BIBLIOMETRIC STUDY OF DOCTORAL DISSERTATIONS IN LIBRARY AND INFORMATION SCIENCE IN NORTH EAST INDIA DURING 2006-2015

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Bibliometric Study of Doctoral Dissertations in Library and Information Science in North East India during 2006-2015

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CERTIFICATE

This is to certify that the thesis entitled '**BIBLIOMETRIC STUDY OF DOCTORAL DISSERTATIONS IN LIBRARY AND INFORMATION SCIENCE IN NORTH EAST INDIA DURING 2006-2015'** submitted by **S.LALREMPUII** for the award of the Degree of Doctor of Philosophy in Library and Information Science is carried out under my supervision and incorporates the students bona-fide research and this has not been submitted for award of any degree in this or any other university or institute of learning.

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Month: September **Year:2020**

DECLARATION

I, **S. Lalrempuii**, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to do the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/Institution.

This is being submitted to the Mizoram University for the degree of Doctor of Philosophy in Library & Information Science.

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PREFACE

A considerable number of research studies have significantly expanded the domain of knowledge in all subjects from the day of inception in Mizoram University. The two paramount activities i.e., (i), study and (ii) research substantially that add value to expand the knowledge horizon usually remain in the department and shape a great power in the socio-economic, scientific, cultural and technological fields if they are properly disseminated and used by the user in time.

The knowledge of social research is essential not only for social science students but also for those who engage in undertaking researches on evaluation for consumer research for the business community as well as government welfare schemes and other researches that have been undertaken today. The publication of research studies in library and information science has got significance in this present day of information world for the students as well as researchers to get the latest information in different kinds of studies.

Bibliometric research in the field of Library and Information Science subject is taken for study, for giving information to the future generation in the subject and for the Librarians, while observing the ever-growing number of bibliographic units like Books, Journals, etc., either in print or electronic form. The utilization of documents, Library staff, Students and Researchers for getting up-to-date information, it is essential to know the importance of the subject and how much the subject has been published so far. The study refers to the contributions made by the Authors, Year, Titles, Subject, Place, Publishers, Journals, Website etc. in the field of Library and Information Science taking the Bibliography used by Ph.D. Scholar in their Dissertation.

The work, therefore, is important in order to trace and highlight the present condition of articles on the Library and Information Science provided by different countries with a different author. Though it may not be up to satisfaction, this thesis may somehow give a clear view of the Library & Information Science Profession, Professionals as well as the material availed. The research study is confined to the field of Library and Information Science during the period of 2006-2015. Data collection is done from the Bibliography of Ph.D. Dissertation during the period of this time. The study is divided into six (6) chapters.

It is hoped that this thesis will prove to be an inclusive study to convey the absorbing conceptual and theoretical knowledge to the students and the researchers to motivate them in using the objective and apply the scientific approach for conducting quality research for obtaining value-based output

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ABBREVIATIONS AND ACRONYMS

Abbreviation	Description
AAPP	Average Author Per Paper
ACA	Author Co-citation Analysis
ACT	Average Citation per Theses
AHCI	Arts & Humanities Citation Index
AICTE	All India Council for Technical Education
AIMA	All India Management Association
AISHE	All India Survey on Higher Education
AIU	Association of Indian Universities
ALA	American Library Association
ALIS	Annals of library and Information Studies
AMU	Aligarh Muslim University
APA	American Psychological Association
APU	Apex Professional University
ARIST	Annual Review of Information Science andTechnology
ASLIB	Association for Special Libraries and InformationBureaux
AU	Assam University
AUS	Arunachal University of Studies
AWU	Assam Women's University
BCI	Bar Council of India
BHU	Banaras Hindu University
BJIR	British Journal of Industrial Relations
BLibSc	Bachelor of Library Science
BLIS	Bachelor of Library and Information Science
BLOG	A truncation of weblog
BMJ	British Medical Journal
CALIBER	Convention on Automation of Libraries in Educationand Research
CAS	Current Awareness Service

CD-ROM	Compact Disc Read-Only Memory
CDC	Curriculum Development Committee
CII	Chartered Insurance Institute
CGM	Consumer Generated Media
CLISObserver	Centre for Library and Information Studies Observer
CLISS	Centre for Library and Information Science Studies
CMJ	Chandra Mohan Jha
CSIC	Consejo Superior de InvestigacionesCientificas
CSIR	Council of Scientific and Industrial Research
DLIS	Department of Library and Information Science
DRTC	Documentation Research and Training Centre
EBSCO	Elton Bryson Stephen Co.
EDIRC	Economics, Departments, Institutes and ResearchCenters
ETS	Educational Technology & Society
FID	Federation Internationale de la Documentation
GS	Google Scholar
HIB	Human Information Behaviour
IASLIC	Indian Association of Special Libraries and Information Centres
IATLIS	Indian Association of Teachers of Library andInformation Scienc
IBM	International Business Machine
ICAL	International Conference on Automation andLogistics
ICT	Information Communication Technology
IDEAS	Interactive Design Engineering Analysis Software
IFLA	International Federation of Library Associations andInstitutions
IGNOU	Indira Gandhi National Open University
IGTAMSU	Indira Gandhi Technological and Medical SciencesUniversity
IIT	Indian Institutes of Technology
IJILIS	Indian Journal of Information Library and Society
IL	Information Literacy
ILA	Indian Library Association

ILM	International Library Movement
INFLIBNET	Information and Library Network
INSDOC	Indian National Scientific Documentation Centre
INTACH - ICCI	Indian National Trust for Art and Cultural Heritage - Indian Council of Conservation Institute
IQS	InstitutQuimic de Sarria
IR	Information Retrieval
ISC	Islamic World Science Citation Database
ISI	Institute of Scientific Information
ISSI	International Society for Scientometrics andInformetrics
JAMA	Journal of American Medical Association
JCR	Journal Citation Reports
JRR	Journal Reference Reports
KELPRO	Kerela Library Professionals Organisation
KIS	Knowledge and Information Science
KKHSOU	Krishna Kant Handique State Open University
LAR	Library Association Record
LICs	Library and Information Centres
LIS	Library and Information Science
LISA	Library and Information Science Abstract
MALA	Madras Library Association
MLibSc	Master of Library Science
MLIS	Master of library and Information Science
MZU	Mizoram University
NACLIN	National Convention on Library and InformationNetworking
NASA	National Aeronautics and Space Administration
NE	North East
NEFTU	North East Frontier Technical University
NEHU	North Eastern Hill University
NER	North East Region
NIH	National Institutes of Health

NISCAIR	National Institute of Science Communication andInformation Resources
NISCOM	National Institute of Science Communication
OA	Open Access
OCLC	Online Computer Library Center
OPAC	Online Public Access Catalogue
PCI	Pharmacy Council of India
PGDLAN	Post Graduate Diploma in Library Automation andNetworking
Ph.D	Doctor of Philosophy
PoP	Publish or Perish
PPA	Productivity Per Author
RCI	Rehabilitation Council of India
RePEc	Research Papers in Economics
RSS	Rich Site Summary / Really Simple Syndication
SCI	Science Citation Index
[SIC]	'sic erat scriptum'
SIU	Sangai International University
SNA	Social Network Analysis
SPSS	Statistical Package for the Social Sciences
SSCI	Social Science Citation Index
SU	Sikkim University
SUNY	States University of New York
TeL	Technology-enhanced Learning
TERI	The Energy and Resources Institute, formerly Tata Energy Research Institute
TT	Total no. of Theses
UGC	University Grants Commission
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and CulturalOrganization
URL	Uniform Resource Locator
USA	United States of America

USTM	University of Science and Technology Meghalaya
VMSU	Vinayaka Missions Sikkim University
VOU	Venkateshwara Open University
WIF	Web Impact Factor
WoS	Web of Science
WWW	World Wide Web

CHAPTER 1: INTRODUCTION

Chapter Plan

CHAPTER 1

INTRODUCTION

1.1 Introduction

Bibliometrics is a recognized component in Library and Information Science research. It commenced at the beginning, a simple mechanism of counting to assess and quantify the growth of the subject which, however, is being used at present as a major component of various science indicators, assessing of scientific output, selection of journals for the libraries, forecasting the research potential of a particular branch of study and so on. To find out the trends and growth of the literature, Bibliometric studies can be applied to every branch of study. The source for collection of data selection is very significant in such studies that are used to recognize the patterns of publication, authorship, and secondary journal coverage to get an intuition into the growth of knowledge on that topic. This helps in developing the organization of information resources which is essential for effective and efficient use. Bibliometrics is sophisticated as well as complicated and has a national, international, and interdisciplinary character. It is a fast-developing area in information science, which is defined as a discipline that examines critically the properties and behaviour of information.

Bibliometrics is the consequential effect of proliferation of literature due to growth of knowledge, spread of liberal education, innumerable research projects, and emergence of inter-disciplinary subjects, democratization of Knowledge, large number of authors, establishment of good number of academic institutions,

development of machine printing and machine-made papers, and Impetus of research that shifted from solo to team.

1.2 LIS Discipline in North East India- A Brief Approach to PhD Programme.

There are altogether 5 Central Universities, 1 State University and 6 State Private University in North East imparting PhD programme in Library and Information Science (LIS) subject. Table-1 below reveals details of the research outputs of the Department of Library and Information Science of various universities offering Ph.D. programme till 2015.

Table-1: Research Output Status of the Department of Library and Information Science in North East India

Sl. No.	Name of the University	State	Location	Status	DLIS	Year of Estd. of the Dept.	No. of Ph.D. Awarded as on 2015
1.	Apex Professional University	Arunachal Pradesh	Pasighat	State Private	✓	2013	-
2.	Arunachal University of Studies	Arunachal Pradesh	Namsai	State Private	✓	2012	-
3.	Assam University	Assam	Silchar	Central	✓	2009	-
4.	C. M. Jha (CMJ) University	Meghalaya	Jorabat	State Private	✓	2009	-
5.	Gauhati University	Assam	Guwahati	State	✓	1966	39
6.	Manipur University	Manipur	Imphal	Central	✓	1986	17

7.	Mizoram University	Mizoram	Aizawl	Central	✓	2002	12
8.	NEHU	Meghalaya	Shillong	Central	✓	1985	15
9.	North East Frontier Technical University	Arunachal Pradesh	Aalo	State Private	✓	2014	-
10.	Sangai International University	Manipur	Churachandpur	State Private	✓	2015	-
11.	Tripura University	Tripura	Agartala	Central	✓	2016	-
12.	University of Science and Technology Meghalaya	Meghalaya	Ri-Bhoi	State Private	✓	2011	-
Total							**83**

(Source: Survey Data)

1.3 Early Approaches to Bibliometrics - A brief Genealogy

In the mid-1600s, the famous correspondence between Pascal and Fermat (De, 2009) gave rise to the mathematical theory of probability which formed the nucleus of inferential statistics. The product of this activity was considered a statistical bibliography and was made achievable by the great availability of abstracting and indexing services developed from the eighteenth century onward to counter the documentary explosion carried about by scientific specialization. Cole and Eales (De, 2009) applied quantitative analysis to the comparative anatomy literature from 1543 through 1860 and use Statistical analysis in their study of The History of Comparative Anatomy Part I in 1917 and the study by declaring objectives were both

descriptive and evaluative in nature and this is considered to be the first bibliometric study. Researchers claim Wyndham Hulme (1922) to be the first to use the expression by changing the name to Statistical Bibliography and the one to describe the use and non-use of information. Statistical Bibliography is also used by Pritchard when he writes Computers, Statistical Bibliography and Abstracting services.

The practical approach to Bibliometrics in library and information services has been visualized by S.R Ranganathan in terms of Librametry who conceived the idea at the Association of Special Libraries and Information Bureaux (ASLIB) conference at Leamington Spa, the United Kingdom on September 1948. The word "Bibliometrics" first appeared in print form in 1969 in Alan Pritchard's article "Statistical Bibliography or Bibliometrics?" in the December issue of Journal of Documentation. He described it as the "application of mathematics and statistical methods to books and other media of communication". In a later, article, Pritchard described Bibliometrics as the "metrology of information transfer process and its purpose is analysis and control of the process" Pritchard (as cited in Hertzel, 2010). Other related terms coming up were, "Scientometrics" the translation of the Russian term "naukometriya" coined by Vassily V.Nalimov and Mulchenko in 1969, "Informetrics" which comes from the German word "Informetrie" by Professor Otto Nacke from West Germany first proposed in 1979 in London, "Webometrics" introduced by Almind and Ingwersen in 1997, and "Cybermetrics" whose origin is not clear;which might probably be attributed to Isidro Aguillo, the editor of the e-journal "Cybermetrics" founded in 1997 (Bar-Ilan, 2010, p.2756). During mid 1990s a range of new terms had emerged in this field coined by various scientists. They are

"Netometrics", "Webometry", "Internetometrics", "Webometrics", and "Web Bibliometry" (Mukherjee, 2011, p.101 cited in Mishra & Lalrempuii, 2015).

1.4 Historical Perspectives of Bibliometrics

Bibliometrics is a method of quantification and assessment of the resources and it has passed through a number of phases depicting various terminologies. Briefly, its genealogy could be explained in the following Table-2:

Table-2: Genealogy of Bibliometrics

Sl. No.	Term/ Concept	Country	Year	Chief Architect	Purpose
1	Statistical Bibliography	London	1922	E.W. Hulme	Application of Statistical methods in Bibliography
2	Librametry	India	1948	Dr. S.R. Ranganathan	Application of Statistical and Mathematical Methods in Librarianship
3	Bibliometrics	Manchester	1969	Alan Pritchard	Application of Mathematics and Statistical methods to books and other media of communications
4	Scientometrics	USSR	1969	Vassily V. Nalimov and Mulchenko	Application of Quantitative Methods to the history of Science
5	Informetrics	Germany	1979	Otto Nacke	Application of Mathematical aspects to information and study of metric aspects of Information Science
6	Citation Analysis	Pennsylvania	1960	Eugene Garfield	Examination of the frequency, patterns, and graphs of citations in documents

(Source: Survey Data)

1.5 Laws of Bibliometrics

In between the 1920s and the 1930s, when three basic bibliometric studies were published namely Lotka's Law, Bradford's Law and Zipf's Law where Lotka's Law works on the distribution of scientific papers among authors while Bradford's Law contribution on the scattering of papers on a given subject in scientific journals and Zipf's Law works on the distribution of words in a text.

a) Lotka's Law of Scientific Productivity

It is concerned with the authors publishing in a certain discipline where the 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". The general formula describes as:

XnY = C, Where X is the number of publications,

Y the relative frequency of authors with X publications and,

n and C are constants depending on the specific field(Potter, 1988; De, 2009, p.75; Hertzel, 2010, p.560-573; Jose, 2012).

b) Bradford's Law of Scattering

It is related to the distribution of publications and serves as a general guideline to librarians in determining 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:

⇨ **The first zone**, where a core of journals on the subject, relatively few in number, that produces approximately one-third of all the articles,

⇨ **The second zone**, containing the same number of articles as the first, but a greater number of journals, and

⇨ **The third zone** contains the same number of articles as the second, but still covers 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 n^2. Bradford expressed this relationship as $1:n:n^2$ (Potter, 1988; De, 2009, p.75; Hertzel, 2010, p.560-573; Jose, 2012).

c) Zipf's Law of Word Occurrence

The law denotes a ranking of Word Frequency which is often used to predict the frequency of its use within a text. The Law 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; De, 2009, p.75; Hertzel, 2010, p.560-573; Jose, 2012).

1.6 Bibliometric Indicator

In addition to the above, Bibliometric Indicator are Impact Factor, Self-citation, co-citation analysis, bibliographic coupling, and co-word analysis.

a) Impact Factor

It signifies the ratio of number of citations received from source items in a particular year to the number of source items published over a fixed period of time in a particular periodical publication (Garfield, 1994 as cited in Sen, 2010).

b) Self-citations

⇨ **Journal self-citation**: It means the citation of the journal-title in the same publication by same or different authors (Schubert & Braun as cited in Glanzel, 2003).

⇨ **Author self-citation**: It means the citation of the bibliographical details of the published article by the author in the subsequent publications (Glanzel, 2003; Cronin, 2002, p.15)

⇨ **Social citation**: The earlier document is written by a friend, colleague, co-author, mentor, or student of the author of the later one, or by an editor or a referee of the journal to which the later document is to be submitted (Borgman & Furner, 2002).

⇨ **Language self-citation**: The earlier document is written in the same language as the later one (Yitzhaki, 1998 as cited in Borgman &Furner, 2002).

⇨ **Nationality self-citation**: The earlier document is written by an author of the same nationality as that of the author of the later one (Herman, 1991 as cited in Borgman & Furner, 2002).

c) Bibliographic coupling

The concept of bibliographic coupling occurs when two articles are having a minimum one common reference (Hirsch, 2005). Bibliographic Coupling links the source documents and gives a trace to an information scientist about the relatedness of two documents. Clustering of literature based on bibliographic coupling gives up meaningful collection of papers within a field and it is of immense value in computerized information retrieval, indexing, and preparation of subject bibliographies (Sharada & Sharma, 1993).

d) Co-Citation

It means that when two documents both appear in the reference list of a third document (Hirsch, 2005). Co-citation analysis involves tracking pairs of papers that are cited together in the source articles indexed in ISI databases. When the same pairs of papers are co-cited with other papers by many authors, a cluster of research begins to form. The co-cited or "core" papers in these clusters tend to share some common theme, theoretical or methodological or both. By examining the titles of the *citing* papers that generate these clusters we get an approximate idea of their cognitive content. That is the citing authors provide the word and phrases to describe what the current research area is all about. The latter is an important distinction, depending on the age of the core papers (Garfield, 1993).

e) Co-word analysis

It is the study of the co-occurrence of the keywords used to index articles and other documents (Ungern, 1995). Co-Word analysis reduces and projects the data into a specific visual representation with the maintenance of essential information containing into the data. It is based on the nature of words, which are the important carrier of scientific concepts, ideas, and knowledge (Van & Tijssen, 1993 as cited in Ding, Chowdhury & Foo, 2001).

1.7 Citation database and commonly used indexing techniques

a) h index

Hirsch's (2005) *h* index depends upon both the number of a scientist's publications and the impact of the papers on the scientist's peers. "A scientist has index *h* if *h* of his or her N_p papers have at least *h* citations each and the other (*Np-h*)

papers have fewer than ≤*h* citations each" (Hirsch, 2005, p. 16569). In other words, it is a way to quantify the productivity and impact of an individual author. Similar to how the Impact Factor is now be used to measure a journal or an author to their scientific field, the h-index has become another measure of the relative impact of scientific publications. While the Impact Factor is derived from the quotient of total citations and total papers in a two-year span, the h-index is simply a count of the largest number of papers (h) from a journal or author that has at least (h) number of citations. For Example, Libri Journal has an h-index of 25 based on Google Scholar, which indicates that the journal has published 25 papers with at least 25 citations (Noruzi, 2016).

b) h(2)-index

It is defined as the highest natural number such that his *h(2)* most-cited papers received each at $[h(2)]^2$. The *h(2)* index can be established by looking at the list of papers of an individual ordered by a number of citations in Thomson Scientific Database. The *h(2)* index is roughly proportional to the cube root of the total number of citations (Kosmulski, 2006).

c) e-index

Using *h-index,* the only citation information that can be inferred is h^2 i.e., at least h2 citations have been received, and additional citations for papers in the h-core are completely ignored. Therefore e-index was defined to complement the h-index for the ignored citations (Zhang, 2009).

d) m-quotient

Hirsch proposed by dividing the *h* index by the number of years of research activity since a scientist's first publication and called this quotient *m* (Bornmann, Mutz & Daniel, 2010, p.3).

e) g-index

The highest number *g*ot papers that together received g^2 or more citations" Egghe (as cited in Bornmann, Mutz & Daniel, 2010, p.3).

f) Original Research Publication Index

An index that gives weight to the originality, productivity, and visibility of the publications is called Original Research Publication Index. It is claimed to negate the influence of self-citation and gift authorship. The index needs to be validated and accepted as a bibliometric indicator by the scientific society (Joshi, 2014).

g) i10 index

A Google-defined metric, the i10 index is a measure of "the number of articles with at least ten citations" (Google, 2010). It is the latest in the line of journal metrics and was introduced by Google Scholar in 2011. It is a simple and straightforward indexing measure found by tallying a journal's total number of published papers with at least 10 citations (Google Scholar Blog, 2011 as cited in Noruzi, 2016 p.3).

1.8. Database

Calculation of indexing techniques for scholars cannot be separated from the citation database that grasps their citation history; therefore, the coverage of

the literature appropriate to the field of study by the databases can affect the accuracy of index scores.

a) Database with special reference to Web of Science

Web of Science is powered by ISI Web of Knowledge and it is a collection of cross-searchable databases including Science Citation Index (SCI), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (AHCI), Conference Proceedings Citation Index – Science and Conference Proceedings Citation Index - Social Science & Humanities.

The Web of Science is particularly good for citation searching, discovering how many times a particular author or article has been cited and by whom, and to locate later works that cite a specific article (Norris & Oppenheim, 2010; Web of Science, 2015).

b) Database with special reference to Scopus

Scopus is a bibliographic database containing abstracts and citations for academic journal articles. It covers nearly 22,000 titles from over 5,000 publishers, of which 20,000 are peer-reviewed journals in the scientific, technical, medical, and social sciences (including arts and humanities). It is owned by Elsevier and is available online by subscription. Searches in Scopus also incorporate searches of patent databases. Since Elsevier is the owner of Scopus and is also one of the main international publishers of scientific journals, an independent and international Scopus Content Selection and Advisory Board was established to prevent a potential conflict of interest in the choice of journals to be included in the database and to maintain an open and transparent content coverage policy, regardless of publisher. The board consists of scientists and subject librarians (Scopus, 2015).

c) Database with special reference to Google Scholar

Google Scholar is a freely accessible web search engine that indexes the full text or metadata of scholarly literature across an array of publishing formats and disciplines. Released in beta in November 2004, the Google Scholar index includes most peer-reviewed online journals of Europe and America's largest scholarly publishers plus scholarly books and other non-peer reviewed journals. While Google does not publish the size of Google Scholar's database, third-party researchers estimated it to contain roughly 160 million documents as of May 2014 and an earlier statistical estimate published in PLOS ONE using a Mark and recapture method estimated approximately 80-90% coverage of all articles published in English (Google Scholar, 2015).

1.9 Journal Citation Reports (JCR)

Journal Citation Reports are primarily meant for information retrieval of scientific information, library science, and research evaluation and are applied at all levels of collections. The Institute of Scientific Information (ISI) located at Philadelphia founded by Eugene Garfield, North America's is the most illustrious activist of citation analysis (Balakrishnan &Paliwal, 2000). Major components of ISI published indexes are highlighted as below:

a) Citation Index

It is arranged alphabetically by cited author and lists all citations made during the current calendar year to an author's works published during any year (Balakrishnan & Paliwal, 2000). The Citation Index, lists by the first author, year of publication, and journal-title and location (volume and pagination) every published

and unpublished work cited in the references of articles published by the SCI's source journals during the year. Under it are listed the bibliographical data needed to identify any paper published during the year that cited the earlier work. Cited articles are listed by the name of the first author only. Then, beneath that, by year, then cited journal, volume, and page number. Multiple articles citing the same paper are listed alphabetically by author's name. "In Press" publications appear before specifically cited papers. "Anonymous" publications are grouped together (Gupta, Jha & Mishra, 2004, p.4).

b) Source Index

The Source Index provides a full bibliographical record for the documents indexed in SCI- the other parts or indexes of SCI refer back to Source Index for complete record identification or information. The bibliographical record or entry in SCI includes the names of first and joint authors, the full title of the article (or an English translation of titles in other languages with a code for the original language), journal title, volume, issue, pagination, number of references, the address of first author, and nature of the item (original article, letter, book review, abstract, correction, etc.). Full entries are given only under the first author's name with cross-references from the other authors. Author names are listed by the last names and initials only. Journal names are highly abbreviated, using ISI's own abbreviations (Gupta, Jha & Mishra, 2004, p.3).

c) Corporate Index

It lists source articles in the first author's institutional problem (Balakrishnan & Paliwal, 2000). The corporate index consists of two sections- Geographic and Organization. The Geographic section is a primary index and it is

arranged by location (country or state and then city) followed by the Institution of the author's organization. Under the organization entry, the name of the first author is listed with the journal-title abbreviation, volume, page and year of the source article published – Full bibliographical information for each article is found in the Source Index under the first author's name (Gupta, Jha & Mishra, 2004, p.3).

d) Permuterm Subject Index

It an offer subject access and implies the annual accumulates fills numerous volumes, with the precise number varying from year to year (Balakrishnan & Paliwal, 2000). It is called a natural language index because it uses current language (terminology) in the form of words from the title of articles listed in the Source Index, as subject headings. If a given term or word appears in several documents, then co-terms from the titles are listed below (as sub-entry) to sub-divide the main subject heading. Very common or uninformative terms may not appear as primary terms but may use as co-terms. Terms, which frequently go together, may be listed as a hyphenated phrase, e.g. amino-acid or magnetic-resonance. Some terms have "see" or "see also" references to related terms. The user matches up main-entry and sub-entry words for quick reference leading to relevant author's first name. Full information may then be obtained from Source Index, as described already (Gupta, Jha & Mishra, 2004, p.3).

1.10 Types of Bibliometrics

Bibliometrics can be categorized into three types as follows.

***a) Descriptive Bibliometrics*:**

It is the study of the number of publications in a given field or productivity of literature in the field for the purpose of comparing the research in different institutions/countries as well different periods (Borgman & Furner, 2002). Quantitatively, it is based on both scientific output and impact measurement which is similar to evaluative Bibliometrics. The fact that differentiates evaluative bibliometrics from descriptive bibliometrics is the degree of validity and reliability of the publication data, underlying a bibliometric analysis (Van, 2004).

***b) Evaluative Bibliometrics*:**

Citation counting is employed as an indicator of research of scientific value in Evaluative Bibliometrics (Borgman & Furner, 2002). Most evaluative bibliometric techniques use citations as their raw data. The theoretical basis for this stems from Robert Merton's (1973 as cited in Thelwall, 2007, p.2) sociology of science which postulates that citations are the way in which scholars acknowledge influential prior work. On this basis, citation counting could be used as an indicator of scientific value because more influential work would tend to be more frequently cited (Thelwall, 2007, p.3).

c) Relational Bibliometrics:

It is used to study relationships within scientific research through the use of ISI data. Journal citation diagrams will illustrate the connections between journals within a field, both central and peripheral (Borgman & Furner, 2002). The basis of this method is that pairs of documents that often appear together in reference lists which is co-cited are likely to be similar in some way. This means that if collections of documents are

arranged according to their co-citation counts then this should produce a pattern reflecting cognitive scientific relationships. Author Co-citation Analysis (ACA) is a similar technique in that it measures the similarity of pairs of authors through the frequency with which their work is co-cited (White & Griffith, 1982 as cited in Thelwall, 2007, p.3). Author Co-citation Analysis operates at a high enough level of aggregation to be a practical tool for mapping the structures of fields (Thelwall, 2007, p.3).

1.11 Web Applications of Bibliometrics

The growth area in Bibliometrics has been in the emerging field of Webometrics and Cybermetrics. Webometrics principally denote quantitative analysis of various attribute of web resources and tried to measure the World Wide Web (WWW) to recognize about the number and the type of hyperlinks, structure of WWW and the usage patterns.

a) Web Impact Factor

It studies a web site's relative importance, especially when we compare it to others in the same field or a country's domains and there is no comparison in a different field (Rao, 2010). Ingwersen (1998) defined three different types of Web Impact Factors: internal Web Impact Factor, where only internal hyperlinks are within a website are used as the denominator, external Web Impact Factor, where all external hyperlinks are used as the denominator and overall Web Impact Factor, where it combines both of these hyperlink counts and uses all in-links (Ingwersen, 1998 as cited in Holmberg, 2010).

b) Web Citation Analysis

It can count how often journal articles are cited and partly to see if the web can generate evidence of wider use of research including informal scholarly communication and for commercial applications as an important amount of webometrics research has also evaluated commercial search engine (Rao, 2010). The Purpose of Web Citation Analysis are to assessing the accuracy and completeness of citations to e-journals, identifying the extent to which scholars publishing in both print and electronic journals citing e-journals and other e-publications, identifying in which researchers actively use scholarly e-journals and analyzing interesting demographic characteristics and access problems of e-journals (Harter & Kim, 1996)

c) Measuring Web 2.0

Various new forms of social content may receive citations, because people may cite YouTube videos, SlideShare slides, or podcasts. On the other hand, various types of Web 2.0 contents include references to either classic publications (e.g. a blog post linking to a journal article) or to other types of social content (e.g. a tweet referencing a blog post (Weller and Peters, 2012). It is to extract patterns such as consumer reactions to products or world events. To deal with these issues, software has been developed by IBM (Web Fountain), Microsoft (Pulse), etc (Rao, 2010).

1.12 Significance and Scope of the Study

It is an emerging area to determine the strength and weaknesses of the literature while using the various sources of information by the students, research scholars and the faculties while preparing their assignments, term papers, projects, theses and dissertations including research publications. It involves an evaluation

process about the use of literature in the process. This also adds substantial value for the libraries to develop the user-oriented collections and weeding out the passive documents. The libraries in the process are able to project the most wanted literature to its patrons.

The study finds its significance further in the areas pertaining to:

i) Forms of documents used by the scholars,

ii) Authors central to publications,

iii) Year of publication, and

(iv) Place of publication.

Substantial numbers of Bibliometric studies have been carried out both at global and national levels in Social Science in general and Library and Information Science in particular, and the results of such studies have been tested with various Bibliometric laws. This is a sporadic attempt of the scholar to carry out Bibliometrics as a research topic of the Ph.D. theses in Library & Information Science of Universities of North East India as no work has yet been done in this area and as such, this is first of its kind. Further, this will bridge the research gap.

It is almost remanded of its virgin field of research by studying the implication of the three laws, i.e., Lotka's Law, Bradford's Law, and Zipf's Law. The present work is limited to the Ph.D. awarded from 2006 to 2015 by Gauhati University, Manipur University, Mizoram University, and North Eastern Hill University in North East. Mention may be made that, a total number of 83 Ph. D has been awarded by different universities having 12,707 citations, were tabulated into 8 different categories for analysis and the retrieved documents comes to 1,01,656 data which is the total population of the study. As the study is limited to the year 2015,

Gauhati University, Manipur University, Mizoram University, and North Eastern Hill University in North East will be covered under study.

The details of the research output leading to Ph.D. in Library and Information Science under different universities from 2006 to 2015 is explicitly discussed year wise in Table-3.

Table-3: Research outputs in Library and Information Science from 2006 to 2015

Sl. No	**Name of the Scholar**	**Title of the Research Topic**	**Name of the Supervisor**	**Year**	**Name of the university**
1	A.Takatemsu Imchen	A study of the public library system as community information centers in Nagaland: Realities and challenges	Prof. N. N Sharma	2006	Gauhati University
2	Anu Hazarika	A study on organization and services of libraries in research and training program in financial institutions of North East India	Prof. Narendra Lahkar	2006	Gauhati University
3	Sanjay Kumar Singh	A study of the impact of Information Technology on the effective management of library operations with special reference to Assam	Prof. A Buragohain	2006	Gauhati University
4	Gurumayum Padma Devi	Women Professionals in Libraries: A Case study of Manipur	Dr. R. Lahiri	2006	Manipur University
5	Mukesh Saikia	Time and cost analysis of Technical Services in Indian Libraries	Prof. A.S. Chandel	2006	NEHU
6	Dhrubajit Das	Document description and their practices in university libraries in northeast India: A study	Prof. Narendra Lahkar	2007	Gauhati University
7	Haricharan Das	Reflection of Rural information in leading Newspapers of Assam: A	Prof. N. N Sharma	2007	Gauhati University

		Critical Study			
8	Hemanta Kumar Barman	Feasibility of library software packages for library automation in Higher Educational Institutions of Assam: A critical study	Prof. A Buragohain	2007	Gauhati University
9	A. Alem W. Longchar	Agricultural information communication and adoption of innovative practices in Nagaland a case study of Dimapur district	Dr. Moses M. Naga	2007	NEHU
10	Medalda Challam	Effectiveness of College Libraries: A Case study of Meghalaya	Prof A.S. Chandel	2007	NEHU
11	Neelam Sharma	Job performance evaluation of library personnel in university library system a study of libraries of Chandigarh, Himachal Pradesh, Haryana and Punjab	Prof. A.S. Chandel	2007	NEHU
12	Bibhuti Choudhuri	Information needs and Information-seeking behavior of users in major science and technology libraries of NE region with special reference to Assam	Prof. R.K Barman	2008	Gauhati University
13	Bikika Laloo	Retrieving information on the socio-economic and socio-cultural conditions of northeast India using different internet search engines	Prof. Narendra Lahkar	2008	Gauhati University
14	Md. Mahtab Hussein	Public Libraries in a multicultural society and their role in promoting solid harmony: A critical study with reference to Assam	Prof. N. N Sharma	2008	Gauhati University
15	Mukut Sarma	Prospects of Application of Information Technology in Academic Libraries in Assam	Prof. A Buragohain	2008	Gauhati University
16	Ramvir Singh Yadav	Impact of Academic Libraries in the development	Prof. A Buragohain	2008	Gauhati University

		of human resources: with special reference to Arunachal Pradesh and Nagaland (colleges and Universities) 1971 to 1999			
17	Smiriti Rekha Baruah	A Critical study of the growth of Tea Literature with special reference to India from 1970-2002	Prof. A Buragohain	2008	Gauhati University
18	Arambam Birajit Singh	Knowledge retrieval methods of Libraries: A study of Manipur	Dr. Th. Madhuri Devi	2008	Manipur University
19	Lairenlakpam Shanta Meitei	Community Information Needs in Rural Manipur	Dr. Th. Purnima Devi	2008	Manipur University
20	Rajkumar Joteen Singh	The Information and Library Network Programme: A Case Study of Manipur	Dr. Th. Madhuri Devi	2008	Manipur University
21	R.K.Ngurtinkhuma	An Assessment of the Role of State and District Libraries for the Socio-Cultural and Educational Development of Mizoram	Prof. Pravakar Rath	2008	Mizoram University
22	George P.V Plathottam	Press and its social responsibility in Northeast India a content analysis	Dr.P. Hangsing, Prof. A.S. Chandel	2008	NEHU
23	Lalremsiami	Role of village Libraries in development: A case study in Mizoram	Dr.P. Hangsing, Prof A.S. Chandel, Joint Supervisor	2008	NEHU
24	Mary A.F.	Television as a medium of information for social change: A study of Meghalaya	Dr.P.Hangsing, Prof A.S. Chandel, Joint Supervisor	2008	NEHU
25	Gyandeep Saikia	Impact of user education on academic libraries in Assam: A study on strategic management of resources and services	Prof. R.K Barman	2009	Gauhati University
26	Nabajyoti Das	Deviance in Academic Libraries: A sociological Study with reference to Assam	Prof. N. N Sharma	2009	Gauhati University
27	S. Kannan	The public library system in Bhutan: A systematic	Prof. Narendra Lahkar	2009	Gauhati University

		approach for future developments			
28	Sanjib Kumar Deka	Search engines and their search performance in retrieving internet resources: An evaluative study	Prof. Narendra Lahkar	2009	Gauhati University
29	Sarita Bhattacharjee	Information seeking behaviour of degree students of general colleges of Barak valley	Prof. N. N Sharma	2009	Gauhati University
30	Chanambam Tanuja Devi	Library Economics in Manipur	Dr. Th. Madhuri Devi	2009	Manipur University
31	Laishram Nandakumar Singh	Sports Information System of Manipur: A Critical Analysis	Dr. Th. Khomdon Singh	2009	Manipur University
32	Sanjeev	Strategic Developmental Plan for Adoption of Information and Communication Technology (ICT) in the College Libraries of Mizoram	Prof. Pravakar Rath	2009	Mizoram University
33	M. Maltesh	Digitization of Buddhist Manuscripts in Arunachal Pradesh	Prof. Narendra Lahkar	2010	Gauhati University
34	Sumana Chakrabarty	Use of Internet Services in the University Libraries of Assam: An Evaluative Study	Prof. A Buragohain	2010	Gauhati University
35	Akhilesh Kumar Singh Yadav	A Study of Curriculum Requirements towards improving IT Skills of Library Professionals	Dr. S.N.Singh	2010	Mizoram University
36	Ajay Kumar	Use of Information Sources by Social Scientists: A Comparative Study of Banaras Hindu University and Mizoram University.	Dr. S.N.Singh	2010	Mizoram University
37	Lalngaizuali	Library and Information Science Education in North East Region: A Critical Study	Prof. Pravakar Rath	2010	Mizoram University
38	Kishor Sarma	Prospects of Library Marketing in North East India: a study	Prof. Narendra Lahkar	2011	Gauhati University
39	Arambam Hileima Devi	A comparative study of staff management in different types of Libraries in Manipur	Dr. Th. Purnima Devi	2011	Manipur University

40	Naorem Vidyavati Devi	Information seeking behavior of Political leaders in Manipur	Dr. Th. Madhuri Devi	2011	Manipur University
41	Lalbiaksanga Hnamte	An Assessment of the Services of College Libraries in the Context of Changing Information Scenario with Special Reference to Mizoram.	Dr. R.N.Mishra	2011	Mizoram University
42	S. Ravi Kumar	Women's Health Information based on Web Resources: An Analysis	Dr. S.N.Singh	2011	Mizoram University
43	Badan Barman	Web Resources in Library and Information Science: a Managerial Approach	Prof. Narendra Lahkar	2012	Gauhati University
44	Dipen Deka	Digital resources management with reference to Indian university libraries	Prof. Narendra Lahkar	2012	Gauhati University
45	Niraj Barua	Prospects of human resource development in the libraries of institutions of higher education in North East India with special reference to library automation a critical study	Prof. R.K Barman	2012	Gauhati University
46	Sanatan Deka	The working and functioning of the Assam Legislative Assembly Library and its use and impact on legislators and administrators: A critical study	Prof. N.N Sharma	2012	Gauhati University
47	Shashilemla Ao	A study on Growth and Development of Literature in Naga Languages	Prof. Narendra Lahkar	2012	Gauhati University
48	Utpal Sarma	Information needs and information-seeking behaviour of urban community and its satisfaction by the public library system	Prof. A Buragohain	2012	Gauhati University
49	Salam Chanu Veenapani	Growth and Development of Libraries in Manipur: A Critical study	Dr. Th. Khomdon Singh	2012	Manipur University
50	Sarangthem Bembem	Information seeking Behavior in Digital Environment: A study of the	Dr. Ch. Ibohal Singh	2012	Manipur University

		social scientist of Manipur			
51	C Lawmzuala	A Study of an Integrated Library Network and Consortium of Central University Libraries in the North East Region	Dr. R.N.Mishra	2012	Mizoram University
52	Mazeal Ampareen Lyngdoh	Influence of media on Public opinion during the period of Social interest: A study of Meghalaya	Dr. Moses M. Naga, Dr. P. Hangsing	2012	NEHU
53	Sanjoy Kumar Barman	Audio-Visual Materials and their Management and Preservation in Television Media Organisations: A Case Study of the Library of Guwahati Doordarshan Kendra.	Prof. A Buragohain	2013	Gauhati University
54	Tarini Goswami	Growth of research output in science and technology institutes in Assam and the role of libraries	Prof. Narendra Lahkar	2013	Gauhati University
55	Utpal Das	A critical study of preservation techniques for Sanchi manuscripts of Assam	Prof. A Buragohain	2013	Gauhati University
56	Lallaisangzuali	A Study on Use of Electronic Resources for Teaching and Research by Faculty Members of Mizoram University	Prof. Pravakar Rath	2013	Mizoram University
57	Lalthanmawii Sailo	Human Resource Development of Central University Libraries in the North East Region: A Study of North-Eastern Hill University (NEHU), Assam University (AU) and Mizoram University (MZU)	Prof. Pravakar Rath	2013	Mizoram University
58	Maya Moyee Narzary	Information Literacy for College Libraries with Special Reference to Lower Assam: A Study	Prof. Pravakar Rath	2013	Mizoram University
59	Rupali Goswami	Information system for Credit Development in Indian Commercial Banks: A	Prof. Moses M. Naga, Prof. N.M. Panda, Joint	2013	NEHU

		case study	Supervisor		
60	Amal Kumar Mondal	Citation pattern of doctoral dissertations in physics submitted to the Gauhati university Guwahati 1993 2000	Prof. R.K Barman	2014	Gauhati University
61	Apurba Jyoti Majumder	Use of web-based resources in engineering college libraries of Assam: An empirical study	Prof. Narendra Lahkar	2014	Gauhati University
62	Bhupendra Nath Samra	Collection development in the libraries of technical institutions in Assam: A study in the context of emerging ICT	Prof. R.K Barman	2014	Gauhati University
63	Gouri Sankar Karmakar	Use of online resources among research scholars in social sciences in university libraries of Assam	Prof. Narendra Lahkar	2014	Gauhati University
64	Pallavi Gogoi	Documentation of Information resources in Women's studies centers of India with reference to North-East India	Prof. N.N Sharma	2014	Gauhati University
65	Ranjanjyoti Sarmah	The role of Library Professionals for effective use of library resources in the present context: A study with reference to the university libraries of Assam	Prof. N.N Sharma	2014	Gauhati University
66	Ayekpam Ithoi Devi	Role of Personal Collections in promoting Intellectual Heritage in Manipur	Dr. Th. Madhuri Devi	2014	Manipur University
67	Bobby Phuritsabam	Library and Information Science Education in Indian Universities	Prof. Th. Purnima Devi	2014	Manipur University
68	Khwairakpam Babita Devi	Influence of Multimedia Technology on Reading Habit in Manipur	Dr. Ch. Ibohal Singh	2014	Manipur University
69	Khwairakpam Surachand Singh	Collection Development: An analytical study of the Academic Libraries in Manipur	Prof. Th. Purnima Devi	2014	Manipur University
70	Lamkhogen Vaiphei	Problems and Prospects of Library Automation in Manipur	Dr. Ch. Ibohal Singh	2014	Manipur University

71	Memori Sagolsem	Knowledge Commission and Public Library Network: A study of Manipur State	Prof. Th. Purnima Devi	2014	Manipur University
72	Zomuana Joute	Resource Generation and Mobilization in College Libraries in Mizoram	Prof. Pravakar Rath	2014	Mizoram University
73	Bobby Goswami Baruah	The relevance of library and information science education in the Indian job market: A study of Indian universities and corporate libraries	Dr. P. Hangsing	2014	NEHU
74	Jacqueline Jeane Thabah	Structuring Competency Model for Library Professionals	Dr.P. Hangsing	2014	NEHU
75	Mangkhollen Singson	Pricing models and usage of e-journal in a consortia environment: A case study of UGC Infonet	Dr. P. Hangsing	2014	NEHU
76	Manoj Rana	Personality traits and job satisfaction: A study of Library Professionals of North- East India	Dr. Moses M. Naga	2014	NEHU
77	Dalimi Devi	Library services in medical and paramedical colleges in Assam analytical study	Prof. N. N Sharma	2015	Gauhati University
78	Nirmal Ranjan Mazumdar	Management of Manuscript collection in Assam in Digital Era: A practical approach using ICT tools	S.K Singh	2015	Gauhati University
79	Prasanta Kumar Deka	Prospects of Coordinating Sarba Shiksha Abhijan and rural libraries for social development in Assam with special reference to Kamrup District	Prof. N. N Sharma	2015	Gauhati University
80	Zabeen Ahmed	LIS education in the Universities of India: A study on the course contents with reference to universities of NE India	Prof. Narendra Lahkar	2015	Gauhati University
81	Sangrang Brahma	Problems and Prospects of Library Automation in Bodoland Territorial Council Area, Assam	Dr. Ch. Ibohal Singh	2015	Manipur University

82	Firstborn Roy Sumer	A comparative study of the standards of selected open Sources Digital Library Software	Dr.P. Hangsing	2015	NEHU
83	Pansngiat Passah	Participation of Library Professionals in Professional Development Activities from 2000 to 2010: A comparative study of the University and IIT Libraries in India	Dr.Bikika Laloo	2015	NEHU

(*Source: Survey Data)*

1.13 Review of Literature

In the present area of systematic inquiry, the scholar made an extensive survey of available literature. Some of the analyses of the literature related to the field of study are reviewed here.

Bibliometric Study

Briganti, Delnevo, Brown, Hastings and Steinberg (2019) studied 4490 e-cigarette publications. Out of 4490, 62.8% were taken from articles. The year 2014 has the largest cigarette publications. During the study period, United States produced 51.6% of publications. They concluded that a strong relationship of NIH funding for tobacco research and e-cigarette publications demonstrates the importance of e-cigarette in tobacco research. **Korkmaz and Cetinkaya** (2019) studies 525 theses. According to them, the majority of master and doctorate theses in logistics and supply chain are written in public universities and the three most studies provinces are Istanbul, Izmir and Ankara. They found out that the highest numbers of theses were written in Istanbul Technical University with 57 theses in supply chain field. In logistics field, the Institute of Social Sciences is the first place followed by the Institute of Natural and Applied and Institute of Defense Science. In supply chain

field, Institute of Natural and applied sciences is the first and the second is Institute of Social Science.

Indexing

Esfani, Tavasoli and Jabbarzadeh (2019) used Scopus databases as a primary search engine and covers 2000 of a highly cited article over the period 2012-2019. They found out that the Unites States have received the highest citations (7348), followed by United Kingdom (588) and China with 543 citations. **Kumar and Kumar** (2019) in their study of 6,363 papers published by 2,719 authors during 2013-2017 in Web of Science (WoS) Database applied Lotka's Inverse Square (n=2) method and general power method (n≠2) to test the applicability of the law. They also added a Chi-Square test and Kolmogorov- Smirnov (K-S) test to measure the viability of the law. The authors deduced that the productivity distribution is inappropriate when Lotka's law was applied in generalized form as well as its original form on the data set. **Qi, Chen, Hu, Song and Wi** (2019) based their studies on SCI-EXPANDED database from 1998 to 2017. They indicated that environmental sciences and ecology was the most productive subject categories followed by engineering. Bioresource Technology was the most prominent journal in the field. They found out that China (146) USA (139) and Spain (76) had the largest amount of Publications. They indicated that USA was a leading position in international cooperation with the highest h-index (67) in 79 countries/territories. **Soheili, Khasseh, and Koranian** (2019) covered 2467 articles which was published in the KIS Journals and indexed in ISC. Statistical packages such as SPSS, BibExcel and UCInet are used for preparing and analyzing data. The study period started in 2006 and ends in 2015. The study period has been divided into two

time period such as 2006-2010 and 2011-2015. The word ‘University’ is the most frequent keyword in both the periods with 82 and 149 occurrences respectively.

Bibliometric Study

Deshmukh and Taksande (2018) studied productivity growth rate Bradford’ Law and Lotka’s Law in their paper. 86 College librarians respond their questionnaire which is their based data for the study. The ratio of Journals Bradford’s Law of Scattering was 6:17:63 and it was fitted with Bradford’s Law of Scattering.

Citation and Co-citation Study

Khasseh, Soheili, and Chelak (2017) examined the intellectual structure of iMetrics through author co-citation analysis and analyses 5,944 records from the Web of Science database in the field of iMetrics that were published between 1978 and 2014. Findings indicated that researchers including “Garfield”, “Egghe”, “Glanzel”, “Leydesdorff” and “Price” have received many co-citations. The author co-citation analysis in iMetrics resulted in eight thematic clusters, including “theoretical foundations and citation analysis”, “sociology of science”, “science mapping and visualization”, “network analysis”, “classic laws of bibliometrics”, “webometrics”, “technometrics”, and “miscellaneous”. “Theoretical foundations and citation analysis” is the biggest cluster which comprises 59 authors. The results suggest the crucial role of Price medalists in shaping the intellectual structure of knowledge in iMetrics.

Indexing

Shihab and Devarajan (2017) in their study used databases like LISA, DOAJ, Google Scholar and Emerald for search techniques and retrieved 134 documents on the topic. They found that maximum number of documents is in the year

2009. Degree of Collaboration is found to be 0.68 and majority of the papers (59.76%) are from developed countries. The Journal "the electronic library" publishes more numbers of the papers and the publication density is 2.63. **Sommer and Wohlrabe** (2017) did the investigation of Moosa (2016) using a much larger data set of almost one million articles listed in Research Papers in Economics and provides new insights into the effects of co-authorship on citation counts and the correlation between quality of papers and quality of the publishing journal. Their evidence is partially in contrast to the results reported in Moosa (2016) and found a positive correlation between the h-index of a journal and the quality of papers measured in terms of citations and this correlation becomes almost perfect using a nonlinear model. In the results, regression of citation counts on the number of authors showed evidence of a positive and significant effect of co-authorship on the quality of a paper when time effects and large sets of top-cited articles are taken into account.

Citation Study

Suguna (2017) studied 2478 Ph.D. theses in Humanities accepted between 1950 and 2012 in five Universities in Kerala. He was surprised by the results that 84.4% of the Theses do not have tables. He found out that more than a quarter of them have 1-3 appendices and no references are found in 22.5% of the Theses. He also found out that chapter end references are seen in 39% and less than 100 entries in bibliography in 37.4% of Theses. With regard to the result almost $3/5^{th}$ of Ph.D. theses used Chicago Style manual.

Indexing

Viana, Vasco Santos, Neiva, Souza, Duarte, Teodoro and Freitas (2017) performed the study to ascertain the characteristic of scientific literature published in a 10-year period (2007–2016) regarding the application of remote sensing data inhuman health. A search was performed on the Scopus database, followed by manual revision using synthesis studies' techniques, requiring the authors to sort through more than 8000 medical concepts to create the query and to manually select relevant papers from over 2000 documents. From the initial 2752 papers identified, 520 articles were selected for analysis, showing that the United States ranked first, with a total of 250 (48.1% of the total) documents, followed by France and the United Kingdom, with 67 (12.9% of the total) and 54 (10.4% of the total) documents, respectively and viewed that, the top three authors were Vounatsou P, Utzinger J and Vignolles C for having 22 articles, 19 articles and 3 articles respectively. Regarding disease-specific keywords, malaria, dengue, and schistosomiasis were the most frequent keywords, occurring 142, 34, and 24 times, respectively. **Vinhas, Antonio and Crespo** (2017) analyses research conducted in Service-Dominant Logic (S-D logic), providing an overview of its intellectual structure. A structured approach was adopted through the implementation of bibliometric methods, used co-citation analysis combined with performance analysis and an integrative science mapping approach, which considered a timeline, a graph, and a distance-based perspective. This permitted the identification of the leading authors and of six clusters of articles based on bibliographic coupling, along with the most prominent research themes clustered in five subdomains of research based on co-occurrence of terms. The networks extracted show the associations between the main articles and concepts treated by the S-D logic

community, unveiling the salient challenges and prospective expansion facing its future theoretical and practical context.

Citation Study

Hutchins, Yuan, Anderson and Santangelo (2016) described an improved method to quantify the influence of a research article by making novel use of its co-citation network to field-normalize the number of citations it has received. Article citation rates are divided by an expected citation rate that is derived from the performance of articles in the same field and benchmarked to a peer comparison group. The resulting Relative Citation Ratio is article level and field-independent and provided an alternative to the invalid practice of using journal impact factors to identify influential papers. They analyzed 88,835 articles published between 2003 and 2010 and found that the National Institutes of Health awardees who authored those papers occupy relatively stable positions of influence across all disciplines and demonstrated that the values generated by the method strongly correlate with the opinions of subject matter experts in biomedical research and suggest that the same approach should be generally applicable to articles published in all areas of science.

Citation Study

Dorta, Dorta and Suarez (2015) in their study of 120 randomly selected highly productive authors from the CSIC Research Centre (Spain) in four different subjects deduced that the ratio between production and impact dimensions is a normalized measure of the citation potential at the level of individual authors. They further viewed that, this ratio decreases the between-group variance in relation to the within-group variance in a higher proportion than the rest of the indicators analyzed

and this result in the selection and promotion process within interdisciplinary institutions as it allows comparisons of authors based on their scientific research. The authors suggested different measures of the citation potential for author based on a proportion of the dimensions. **Jeyasekar and Saravanan** (2015) obtained from PubMed and used the MS-Excel worksheet for data analysis. Their study revealed the exponential growth of forensic literature. In their study the relative growth rate fell from 0.83 in the year 2002 to 0.17 in the year 2013. They found out that the mean collaborative index was 3.5, mean degree of collaboration was 0.89, mean collaborative coefficient was 0.6119 and mean modified collaborative coefficient was 0.6121 during the period of study. They also created Cluster map of co-words. **Pablo and Rafael** (2015) proposed different measures of the citation potential for author based on a proportion of the dimensions. In their study of the set of 120 randomly selected highly productive authors from the CSIC Research Centre (Spain) in four subject areas, shows that the ratio between production and impact dimensions is a normalized measure of the citation potential at the level of individual authors. They also found out that this ratio reduces the between-group variance in relation to the within-group variance in a higher proportion than the rest of the indicators analyzed and these results in the selection and promotion process within interdisciplinary institutions as it allows comparisons of authors based on their particular scientific research.

Indexing

Tsay (2015) analyzed the disciplines and subjects of literature of information science journals during the period from 1998-2010. His studies include Journal of the American Society for Information Science and Technology, Information

Processing and Management, the Journal of Information Science and the Journal of Documentation. He used Ulrich's Periodical Directory, Library of Congress Subject Headings retrieved from WorldCat and LISA database for identifying the main classes, subclasses, and subjects of citing journals. The results included the knowledge flow out of the domain of information science mainly on information science itself and science and technology at a lower percentage. **Uma and Dhanavandan** (2015) studied the published research articles and their citations available in the Indian Citation Index by the authors from University of Madras. In the results, 538 articles include 480 (89.22%) research articles. They also found out that Short Communication includes 19 (3.53%) and Articles each from Review Articles and Case Studies includes 10 (1.86%).They concluded that the highest number of articles and citations are from research type of document.

Bibliometric Study

Haneefa and Jasna (2014) used a checklist and datasheet to collect data on web 2.0 applications in 100 top-ranked online English language newspapers. They found out that Blogs, RSS and Social networking sites i.e. Facebook and Twitter are the most prevalent Web 2.0 applications in the newspapers. The analysis also showed that Upper right side of the homepages of the newspapers is the most preferred location of the Web 2.0 applications. **Kumar** (2014) studied bibliometrics, *h*-index variants, and extensions as bibliometric indicators, Hirsch index, impact factor and citation indices. In the study, various parameters used to characterize the research output of scientists were described. The emergence of *h*-index as a useful pointer was discussed and its proper use was explained.

Indexing/ Bibliometric Study

Kumar (2014) studied by tracing the citation and authorship patterns of selected LIS Journals. He found out that Indian LIS journals have low visibility in Google scholar database. In terms of citations, multiple-authored articles generally got more citations than single-authored articles. He suggested LIS researchers increase collaborations for better visibility of their research. **Singh and Bebi** (2014) studied 260 theses. A total of 52,378 citations were found and main focus was on 9,997 journal articles belonging to 934 journals. They found out that Books contribute the highest number of citations. 9997 journal citations were from journals published from 31 countries. From their studies, Economic & Political Weekly from India is the most-cited journal. **Zervas, Tsitmidelli, Sampson, Chen, and Kinshuk** (2014) used metrics for measuring research collaborative activity include, among others, the co-authored publications (concerned with who works with whom) and the citations (concerned with who cites who). They focus on the co-authorship network of researchers who collaborate in Technology-enhanced Learning (TeL). It is achieved through the example of the Educational Technology & Society (ETS) Journal, where Social Network Analysis (SNA) metrics are applied for analyzing the co-authorship network of the journal. The results provided with evidence that the key authors of ETS Journal co-authorship network have a Taiwanese national background and they have established a strongly connected group that collaborates frequently, diversely and widely. They also found out that both authors and collaborations of the ETS co-authorship network have been polynomial increasing during the past 15 years.

Bibliographic Coupling/ Co-citation Study

Zhao and Strotmann (2014) studied a long history of author co-citation and bibliographic coupling of the intellectual structure of information science into the time period of 2006-2010. They found out that web technologies continue to drive developments, especially at the research front and network science becomes influential as well as full-text analysis methods complement traditional computer science influences. They confirmed a forecast made previously by comparing knowledge-base and research-front findings for IS 2001–2005, which expected both the information retrieval (IR) systems and webometrics specialties to shrink in 2006 to 2010 and also suggested a continuing decline of the IR systems specialty in the near future, but also a considerable (re)growth of the webometrics area after a period of decline from 2001 to 2005 and 2006 to 2010, with the latter due perhaps in part to its contribution to an emerging web of science.

Indexing

Cheng and Zhang (2013) studied 39 rheumatology journals from 1996 to 2010 using the Scopus database and the number of articles, citations, Hirsch indices (h-indices) and international collaborations was determined for countries or regions. 43808 articles were identified and the time trend of the number of articles showed an increase of 2.95-fold between 1996 and 2010. Their results include Western Europe and northern America were the most productive world areas, producing 52.4% and 23.1% of the available literature, respectively. They also found out that USA published the most articles, followed by the UK and Germany and the USA, the UK and the Netherlands had the highest h-indices (169, 137 and 117, respectively) and ranked about the same when total citations were used. The results also include Ireland had the

highest average citations per article (48.33), followed by Denmark (40.19) and the Netherlands (39.86). **Leslie and Chris** (2013) aim for this study was to compare three citation resources with one another for recognizing the citation resource with the most representative South African scholarly environmental sciences citation coverage. The results focus on the content verification process which measured amongst others the citation counts, multiple copies and inconsistencies encountered across the three citation resources ISI Web of Science, Scopus and Google Scholar. They also used a comparative research design method with a purposive, non-probability sample in the first phase. The South African scholarly environmental sciences journals for the year range 2004-2008 (first phase) were extracted from the three citation resources and compared. The total citation counts indicated that ISI Web of Science (WOS) retrieved the most citation results, followed by Google Scholar (GS) and then Scopus. The investigation into multiple copies indicated that WOS and Scopus retrieved no duplicates, while GS retrieved multiple copies.

Bibliometric/ Webometric Study

Shari, Haddowand Genoni (2012) applied Bibliometrics and Webometrics methods to publications and Web sites affiliated with the Malaysian institution. The bibliometric analysis focused on biotechnology-related journal articles indexed in Web of knowledge and Webometrics analysis examined the web sites of top biotechnology institutions generated in the bibliometric analysis. They found out that the advent of e-research has facilitated collaborative research and the near-ubiquitous use of scholarly web sites by both individuals and institutions has made such collaboration increasingly transparent.

Indexing

Yuan and Hua (2011) selected 97 Library and Information Science Open Access journals as a sample and measured their scholarly impact on the basis of citations and links and citation counts done in Web of Science (WoS), coverage in Library and Information Science Abstract (LISA), Web links, WIFs and Page Rank of the journals are retrieved and calculated, and correlations between citation counts, links, pages, WIFs, and PageRank are also analyzed. The findings include that LIS OA journals have become a significant component of the scholarly communication system. The Journal of the Medical Library Association secured the highest citation counts in WoS and D-Lib Magazine, Information Research, Ariadne, Cybermetrics, and First Monday are the six most important LIS OA journals. Bulletin des Bibliothe`ques de France (2151) performs best in with regard to coverage in LISA. Their results also showed that the Page Rank is relatively high, mostly at 6, 7, or 8 and the study found out that correlation between citation-based measurements and link-based measurements tends to be significant.

Bibliometric Study

Kumar (2010) examined the applicability of Lotka's law as a general inverse power ($\alpha \neq 2$) and as inverse square power relationship ($\alpha \neq 2$) to the distribution of the research productivity in CSIR, India. He collected 2 data sets of the research papers (6076 and 17681) contributed by CSIR scientists during the period of 1988-1992 and 2004-2008 from 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 ($\alpha \neq 2$).

Citation study

Thelwall (2010) used citation analysis and a survey of webometricians to assess the extent to which webometrics has found its applications outside of the parent discipline. In the results he suggested that there has been a turn towards applied webometrics with several externally-financed studies being contracted and besides there is a significant amount of citation of webometrics research by disciplines outside information science, including computing, communication science, and health and the potential user base for current webometric techniques is wider still, creating a need for awareness-raising. He concluded that webometrics already has several claims to usefulness, and highlights progress to be made.

Indexing

Yin, Jindra, Aris and Chen (2010) tabulated and combined to provide a simple graphical representation of the journals through the *h*-index and Eigenfactor and values of top and specialized scientific/engineering journals of the same has been found out through the same. They believed that such combination provides a simple, flexible and practical alternative approach for evaluating scientific journals.

Citation Study

Meyer, Lorscheid and Troitzsch (2009) used citation analysis to identify the most influential publications. They verified the characteristics of social simulations such as its multidisciplinary nature. They also performed a co-citation analysis for visualizing the intellectual structure of social simulation and its development. They found out that books represent the dominant publication outlet in

this period. Their findings also included that even at the early stage; social simulation appears to emerge as a multidisciplinary field drawing upon publications from a wide range of disciplines such as economics and evolutionary biology. Ucak and Al (2009), investigated the samples chosen according to layer-sampling techniques from 16 disciplines of 4 basic subject areas namely Social Sciences, Pure Science, Engineering and Arts and Humanities between 1968-2007 using Citation Analysis. The results included the characteristics of citations of the theses differ among academic disciplines. They also found out that the use of books, slow obsolescence rates, and citations to Turkish and single-authored sources are common in arts and humanities use of journals, fast obsolescence rates and citations to English and multiple-authored sources are common in pure sciences and engineering.

Citation Study

Bhat and Kumar (2008) studied a citation analysis of research articles from scholarly electronic journals published in between 2000-2006. Results of the study showed that 81.49% of articles published in selected 9 electronic journals had web references and out of 25,730 references 56.54 % of references are print journal references and 43.52% of them are web references. They found out that the majority of articles having web references are from ARIADANE (93.24%) followed by Cybermetrics: International Journal of Scientometrics, Informetrics, and Bibliometrics (89.47%) and D-LIB Magazine (89.19%).

Bibliometric Study

Saichev, Malevergne and Sornette, (2008) studied the theory of Zipf's law and power laws, driven by the mechanism of proportional growth. They discussed

the origin and conditions of the validity of Zipf's law using the terminology of firm's asset values. The studies also include the intimate connection between Zipf's and Gilbert's laws underlie Zipf's law in diverse scientific areas. **Vallmitjana and Sabate** (2008) studied bibliometric study to ascertain the most frequently used in the research process, the most frequently consulted journals and obsolescence rate of journals. They covered 46 doctoral theses presented at the Institut Quimic de Sarria (IQS) from 1995 to 2003. They covered 4,203 citations and found out that the most frequently used documents were scientific papers which are 79% of the total. They also found out that 33 journals met 50% out of the information needs and the age of 50% of the citations was not older than 9 years.

Bibliometric Study

McMillan and Casey (2007) conducted a bibliometric analysis of the British Journal of Industrial Relations (BJIR), for two time periods, 1986–1995 and 1996–2005. From the late 1980s to the mid-1990s, BJIR's articles relied on the economics literature, while in the later period, it moved to the human resource and management journals, authors and articles.

Bibliometric Study

Schildt, Zahra and Sillanpää (2006) conducted a bibliometric analysis of Scholarly Communities in Entrepreneurship Research: A Co-Citation Analysis. They analyzed co-citation patterns of entrepreneurship-related articles published in the years 2000 to 2004 and identify the 25 most central research streams in entrepreneurship. They described these groups and investigate their mutual

relationships. The United States represents the greatest source of entrepreneurship articles; other countries represent significant sources of research in specific streams.

Indexing

McKechnie, Goodall and Lajoie-Paquette (2005) used the ISI Web of Knowledge for conducting 155 English-language human information behaviour (HIB) articles published from 1993 to 2000 in 6 prominent LIS journals. They identified the bibliometric core of 12 papers. They performed content analysis on papers citing the core (n=377) to determine how the papers were cited. They constructed domain visualization of the citing relationships within the entire corpus. The results included HIB literature is being cited, primarily by LIS authors securing (81.5%). Other than LIS, citing HIB articles include engineering, psychology, education, and medicine.

Link Analysis

Jana and Chatterjee (2004) evaluated the accessibility and feature of a Web site through statistical analysis of the site log files and identify some effective measures of usage and do prediction of future usage using linear trend line approach. The Web tracking program also examined the geographic distribution of users and usage patterns of the Web pages and the peak usage times. Three most common measurements, hits, page views, and user sessions, are used. After a thorough and periodic study of the reports of TERI's Web page activity, it is found that TERI (The Energy and Resources Institute, formerly Tata Energy Research Institute) achieved a unique milestone of one million hits during the month of April 2002.

Link Analysis

Casserly and Bird (2003) studied 500 citations to Internet resources from articles published in library and information science journals in 1999 and 2000 which are profiled and searched on the Web. The majority contained partial bibliographic information and no date viewed. Most URLs pointed to content pages with ".edu" or ".org" domains are excluded. More than half (56.4%) were permanent, 81.4 percent were available on the Web, and searching the Internet Archive increased the availability rate to 89.2 percent. Content, domain, and directory depth were associated with availability.

Indexing

Cronin (2001) highlighted the idea of a unified citation index to the literature of science by Eugene Garfield. He also showed how it becomes the database of choice for citation analysts and evaluative bibliometricians worldwide. He viewed that scientific publication moves to the web and novel approach to scholarly communication, peer review and new methods of citation and link analysis. He concluded that the web affords bibliometricians rich opportunities to apply and adapt their techniques to new contexts and content. **Hawkins** (2001) studied 28 e- journals and ranked by the number of articles on the subject they published. He found out that the publication of information science articles in e-journals began about 1990. The most prolific authors were identified and found that they belong to United States and United Kingdom. He also found out that common topics of e- journal articles in information science include electronic information, electronic publishing, virtual (digital) libraries, information search and retrieval and use of internet.

Citation Study

Tsay (2001) studied citation analysis with different opinions about the nature and the complexities of the citing process. By reviewing many empirical studies here, the article described the development and critique of citation analysis especially focuses on citation classifications, citation functions, citation concepts, and citation motivation.

Webometrics Study

Almind and Ingwersen (1997) introduced the application of informetric methods to the World Wide Web (WWW), also called Webometrics. A workable method for general informetric analyses of the WWW and a number of specific informetric analysis parameters is presented. Their work included a case study of the Danish proportion of the WWW which was compared to those of other Nordic countries. The methodological approach is as good as common bibliometric analyses of the ISI citation databases. Results included that Denmark would fall seriously behind the other Nordic countries with respect to visibility on the Net and compared to its position in scientific databases.

Bibliometric Laws

Chen and Lelmkuhler (1986) studied a common functional relationship among Lotka's law, Bradford's law, and Zipf's law. In the paper, the proof takes explicit account of the sequences of observed values of the variables by means of an index. Their advances resulted in a more realistic and precise formulation of each law.

1.14 Research gap

Having examined all these articles, literature and a few other more, it was found that no scholar has undertaken the research on the Bibliometric studies of doctoral dissertations in Library & Information Science of Private, State Private, State and Central Universities of North East India. Therefore, the present study is an attempt to bridge the gap.

1.15 Statement of the problem

Citation analysis of dissertations and ranking of journals is useful in determining information sources that are vital for students, research scholars, faculties and the library as well in a given subject area. It also helps the library in judicious budget planning for collection of user-centric resources in a crucial budget constraint. This is an intermittent attempt by the scholar to come up with a solution to the ever-increasing literature used by the scholars in library and information science pursuing Ph.D. The problems associated with the present study are mentioned below:

- ⇨ Inappropriate use of Bibliometric indices in the bibliography.
- ⇨ Unscientific arrangement of bibliography in the theses.
- ⇨ Absence of approved style manual.
- ⇨ Inappropriate documenting of bibliography components like author, year, place, publisher, etc.

1.16 Objectives of the study

The objectives of the present study are to:

1. Find out the core list and ranking of journals both print and electronic central to Library and Information Science.
2. Preparing link analysis of the cited electronic journals used by the scholars in their dissertations after confirmation through Web of Science, Scopus and Google Scholar databases.
3. Recognize the core authors and/or group of authors in the Library and Information Science.
4. Ascertain the obsolescence of literature especially in the print domain.
5. Taste the data with Bibliometric laws like Bradford's Law of Scattering, Lotka's Law of Scientific Productivity and Zipf's Law of word occurrence.

1.17 Research Methodology

Data relating to the present study has been collected from a total number of 83 Ph.D. theses during 2006-2015 from the Department of Library and Information Science of 4 Universities (both state and central) of North East India namely, Gauhati University, Manipur University, Mizoram University, and North Eastern Hill University. Other Universities are left out on account of the theses submitted is not available with regard to the period of the study. The bibliographical references cited at the end of each thesis have been taken as the source of data for the study. The present study contains a total sample size of 12707 citations out of 83 Ph.D. theses. The scholar has taken appropriate measures in photocopying all references (bibliographies) appended at the end of each thesis covered under study and were

recorded in the card catalogue measuring 3”x5” for scientific arrangement. The data comprising both print and electronic were scientifically analysed with regard to (i) Forms of documents/literatures such as, Books, Journals, Reports, Conference Proceedings, and Newspapers etc. (ii) Authorship pattern, (iii) Name of the publisher, and (iv) Place of publication of the documents/literatures. Supplemented with graphical representation, the data for each component was tabulated for analysis to draw the inferences. Apart from this, other results were derived which include a) authors central to the publication, b) most preferred form of documents, c) core literature on the subject, d) obsolescence of literature, etc. Further, the data were tested to confirm the various Laws of Bibliometrics such as Lotka’s Law of Productivity, Bradford’s Law of Scattering of Journals and Zipf’s Law of Word Occurrence. The scholar adopts suitable statistical technique to analyze the data to draw inferences.

1.18 Chapterization

The present study is divided into 6 (Six) chapters. The first chapter of the study deals with Introduction, LIS Discipline in North East, India- A Brief approach to PhD programme, Early approaches to Bibliometrics, Historical Perspectives of Bibliometrics, Laws of Bibliometrics, Bibliometric Indicator, Citation database and commonly used indexing techniques, Database, Journal Citation Reports (JCR), Types of Bibliometrics, Web application of Bibliometrics, Significance and Scope of the study, Review of Literature, Research Design and Chapterization. The second chapter is deliberated on Meaning of Research, LIS Education and Research – International Level, LIS Education and Research - A National Glance, and LIS Education and Research in North East Region (NER) with conclusion also have been

dealt with in the chapter. The third chapter of the study is described on Introduction, Historical Development of Citation Analysis, Need of Citation Analysis, Scope and Purpose of Citation Analysis, Importance of Citation Analysis, Key Citation Indexes, Citation Procedures, A range of other measures which complement the impact factor, List of tools for conducting Citation Analysis, Bibliometrics, Scientometrics and Web-Based Metrics including Conclusion have been dealt within the chapter. The fourth chapter of the present study focuses on Introduction; Theoretical outlook of Bibliometric laws, Bibliometric Indicator, Major components of ISI published Indexes, Commonly used Indexing techniques and Conclusion. The fifth chapter deals with Introduction, Establishment of the Department of Library and Information Science in North East India and Research output, Year-wise Research, Cited forms of Documents, Authorship Pattern, Authors Distribution, Author Productivity, Top 10 List of Prolific Authors from all citations, Degree of Collaboration: Single Vs. Multiple Authors, Bibliographical References used in Ph.D. Theses Summary & Average Citation per Thesis, Citation of Website, Website Citation Frequencies, Categorization of Journals, Cited Articles from Journals, Ranking of Journals, Chronological distribution of Documents, Application of Lotka's Law of Scientific productivity, Application of Bradford's Law of Scattering, Application of Zipf's Law of Word Occurrence, Link Analysis, Subject-wise distribution of documents, Categorization of Places, Ranking of top cited places, Ranking of Publishers and Findings. The sixth chapter deals with conclusion and suggestion.

At the end, the scholar has submitted a comprehensive list of bibliography arranged according to APA style manual of 6th edition.

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CHAPTER 2: LIBRARY AND INFORMATION SCIENCE (LIS) RESEARCH

Chapter Plan

CHAPTER 2
LIBRARY AND INFORMATION SCIENCE (LIS) RESEARCH

2.1 Meaning of Research

An inquest of finding solutions to scientific and social problems through objective and systematic analysis is called Research. The research employs original work in answering a question or solving a problem. It unveils the hidden truths where mammoth information is collected from different sources like experience, human beings, books, journals, nature, etc. Research discovers new knowledge which adds substantial contributions to the existing body of knowledge. It is performed with new investigations, experiments, observation, analysis, comparison and reasoning to the given problem of the study (Rajasekar, Philominathan & Chinnathambi, 2013).

2.1.1 Objectives of Research

The major objectives of the research are to:

1. Determine new facts;
2. Confirm and test important facts;
3. Scrutinize an event or process or phenomenon to identify the cause and effect relationship
4. Increase new scientific tools, concepts, and theories to solve and understand scientific and non-scientific problems
5. Discover solutions to scientific, pseudoscientific and social problems, and
6. Overcome or solve the difficulties occurring in our everyday life

(Rajasekar, Philominathan & Chinnathambi, 2013, p.2-3)

2.1.2 Thesis Research- The Need

During the Ph.D. course preferably, one learns the mechanism to pick a research problem and to find out the means to carry out it through intensive searching and extracting the authentic information to give final output. This is followed by publication to make known the scientific community. The thesis or Ph.D. research inherently involves those phases of operations. To complete this process, the textbooks or lecture notes or any other published documents are not adequate enough to find a solution. It is the peak where the values, traditions, and styles of science are transmitted from one generation to another (Beasley & Jones, 1986 as cited in Rajasekar, Philominathan & Chinnathambi, 2013)

2.2 LIS Education and Research - International Level

Melvil Dewey for the first time advocated the need for a library school in the *Library Journal* of 1879 and to materialize it, he submitted his plan for its establishment in 1883 at Colombia College, where he was employed as a librarian (Gayasuddin, Sharma & Mani, 1989, p.37). In 1887, the first library school was set up in New York City, which was, later on, was shifted to Albany in 1889. The growth of library schools in other countries commenced in 1915 when librarian's schools were founded at Leipzig and Barcelona and many others were initiated during World War II. The University of Chicago turns out to be the first library school to offer Master's Degree in Library Science, which is now the standard professional degree and later became the first to offer a Doctoral Degree in the field (Gayasuddin, Sharma & Mani, 1989).

2.3 LIS Education and Research- A National Glance

The beginning of the 20th century has noticed the beginning of LIS education in India. John MacFarlane, the Asst. Librarian of the British Museum, London became the first librarian of the Imperial Library (now National Library, Kolkata) also, shares the credit for training the librarians in the country. In fact, MacFarlane's training programme is the first case of LIS education in India reported in the literature. It took place between 1901 and 1906 in the Imperial Library when training programmes were organized for its staff (Kumar & Sharma, 2010). The first LIS education movement was credited to the Maharaja Sayyaji Rao Gayakwad, the ruler of the erstwhile 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 of such school in LIS education in the world and the first in Asia (Kumar & Sharma, 2010).

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 1937 and in 1938, the 3 months training course was replaced by a one-year full-time postgraduate course, leading to a diploma course in librarianship (Kumar & Sharma, 2010).

The LIS course got an 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 (AISHE, 2016-2017).

In 1947, Dr. S.R Ranganathan moved to the University of Delhi and started the first postgraduate diploma course. Simultaneously, the Ph.D. programme was launched by the university in 1949. The 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 (AISHE, 2016-2017).

The decade of the 1960s saw some very important events taking place affecting LIS education in the country. Ranganathan 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 specialized training programme in documentation. Another parallel institution, Indian National Scientific Documentation Centre (INSDOC) with the merger of National Institute of Science Communication (NISCOM), 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 2002 (http://www.niscair.res.in/). It started a course in Associateship in Documentation in 1964. Prior to this, it organized 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) was established in 1969 which further helped in the growth and development of the discipline. It organized its first seminar in 1970 on teaching methods in library science (AISHE, 2016-2017).

In 1974, the University of Calcutta introduced 2-year MLIS course. There was a need felt to update the 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 2-year integrated MLIS was introduced in the North-Eastern hill University (NEHU) and Madras University in 1986 and 1988 respectively. It was felt that 2 years 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, Ph.D. and PGDLAN (one-year postgraduate diploma) (AISHE, 2016-2017).

There are 864 Universities, 40026 Colleges, and 11669 Stand Alone Institutions listed on All India Survey on Higher Education (AISHE) web portal (http://mhrd.gov.in/sites/upload_files/mhrd/files/statistics/AISHE1617.pdf,) and out of the 795 Universities, 34193 Colleges and 7496 Stand Alone Institutions have responded during the survey. 278 Universities are affiliating i.e. having Colleges. Only 2.6% Colleges run Ph.D. programme and 36.7% Colleges run Post Graduate Level programmes. About 79.4% of the students are enrolled in Undergraduate level programme. 1,41,037 students are enrolled in Ph.D. that is less than 0.4% of the total student enrolment. At Ph.D. level, maximum number of students is enrolled in Science

stream followed by Engineering and Technology. On the other hand at Post Graduate level maximum students are enrolled in Social Science stream and Management comes at number two. The share of Ph.D. students is highest in State Public University (33.6%) followed by Institute of National Importance (21%), Central University (14.3%) and Deemed University-Private (13.4%) (AISHE, 2016-2017).

2.4 LIS Education and Research - North East Region (NER)

North Eastern Region (NER) includes eight (8) states namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. To trace a brief genealogy of the LIS education and research in NER, Library and information science course was first commenced by Gauhati University as an evening course in the year 1966 followed by regular course at North-Eastern Hill University in 1985 and Manipur University in 1986. However, detail descriptions about the Library and Information Science Courses in North East at different levels have been discussed threadbare below.

Out of eight (8) states including Sikkim in North-East Region (NER), the Library and Information Science courses are being offered by 21 universities through Private, State Private, State and Central University. Besides there are three (4) Colleges/Universities namely D.S College, Gangtok, affiliated to Sikkim University and Ram Prasad College affiliated to Tripura University who offered BLIS Course but are discontinued from 2014, Eastern Institute for Integrated learning in Management, Sikkim but discontinued from 2015, and Assam Professional Academy where there is no students admitted in it are excluded under the Table. The following Table-4 depicts

the name of the university who are offering LIS courses and research at M.Phil and Ph.D. level.

Table-4: Lists of University and College offering LIS courses in North Eastern Region

Sl. No	Name of the University	Types of Courses					Duration			
		DIPLOMA PGDLAN CERTIFICATE	BLIS	MLIS	M.Phil	Ph.D	DIPLOMA PGDLAN CERTIFICATE	BLIS	MLIS	M.Phil
1.	Apex Professional University, Pasighat, Arunachal Pradesh.	-	✓	✓	-	✓	-	1 Year	1 Year	-
2.	Arunachal University of Studies, Namsai, Arunachal Pradesh.	-	✓	✓	✓	✓	-	1 Year	1 Year	1 Year
3.	Assam University, Silchar, Assam.	-	-	✓	✓	✓	-	-	2 years	2 years
4.	Assam Women's University, Jorhat, Assam.	-	-	✓	-	-	-	-	2 years	-
5.	C. M Jha (CMJ) University, Jorabat, Meghalaya.	-	✓	✓	✓	✓	1 Year	1 Year	1 Year	-
6.	Dibrugarh University, Dibrugarh, Assam.	-	✓	✓	-	-	-	1 Year	1 Year	-
7.	Gauhati University, Guwahati, Assam.	-	-	✓	✓	✓	-	-	2 years	1 Year

8.	Himalayan University, Itanagar, Arunachal Pradesh.	-	✓	✓	-	-	-	1 Year	1 Year	-
9.	Indira Gandhi Technological and Medical Sciences University, Ziro, Arunachal Pradesh.	-	-	✓	-	-	-	-	2 years	-
10.	Krishna Kant Handique State Open University, Guwahati, Assam	DIPLOMA	-	-	-	-	1 Year	-	-	-
11.	Maharaji Bir Bikram University, Agartala, Tripura.	-	✓	-	-	-	-	1 Year	-	-
12.	Manipur University, Imphal, Manipur.	-	-	✓	-	✓	-	-	2 years	-
13.	Mizoram University, Aizawl, Mizoram	-	-	✓	✓	✓	-	-	2 years	2 years
14.	North-Eastern Hill University, Shillong, Meghalaya.	-	-	✓	-	✓	-	-	2 years	-
15.	North East Frontier Technical University, Aalo, Arunachal Pradesh.	DIPLOMA	✓	✓	✓	✓	1 Year	1 Year	1 Year	1 Year
16.	Sangai International University, Churachandpur, Manipur.	-		✓	✓	✓	-	-	1 Year	2 Years
17.	The Global Open University, Dimapur, Nagaland.	-	✓	✓	-	-	-	1 year	1 year	-

18.	Tripura University, Agartala, Tripura.	-	✓	✓	-	✓	-	1 year	1 year	-
19.	University of Science and Technology Meghalaya, Ri-Bhoi, Meghalaya.	-	-	✓	-	✓	-	-	2 Years	-
20.	Venkateshwara Open University, Naharlagun, Arunachal Pradesh.	**PGDLAN / CERTIFICATE**	✓	✓	-	-	**PGDLAN (1 year) / CERTIFICATE (6 months)**	2 Years	2 Years	-
21.	Vinayaka Missions Sikkim University, Gangtok, Sikkim.	-	✓	✓	-	-	-	1 year	2 Years	-

(Source: Survey Data)

From the above discussions, it could be found that education and research in Library and Information Science (LIS) in North-East India equally gained its importance in various academic departments at the university level.

2.4.1 Library and Information Science- the Indian State of Arunachal Pradesh

a) Himalayan University (State University)

Himalayan University is a university established by Government of Arunachal Pradesh, located in the capital of Arunachal Pradesh i.e. Itanagar and it is a non-profit university recognized by University Grant Commission under section of 2f of UGC act 1956. The university was established in 2013, for the development and strengthening of the economy through higher education to raise the literacy rate of the seven sisters that make up North East India. The University was accredited and

recognized by AICTE, PCI, BCI and RCI and also a member of AIU, AIMA, CII and P.hD Chamber (Himalayan University Website).

The well-resourced department of Library Science of Himalayan University conducts only two very constructive and professional campus-based courses at present i.e. B.Lib and M.Lib with duration 1 Year each. These courses are highly supportive, and well-paying careers in the field of Library Science in India or abroad containing rich curricula, these courses are taught by well-informed and innovative professors and industry experts (Himalayan University Website).

b) Apex Professional University (State Private University)

Apex Professional University (APU) is a non-profit university established by the Government of Arunachal Pradesh located in Itanagar and Apex foundation, Bangalore under the Public Private Partnership (PPP) scheme. The University Grants Commission (UGC) has accorded its recognition to Apex Professional University (APU) as a state private university vides its letter F.No. 8-13/2013(CPP-I/PU) dated 28th June 2013 in accordance with section 2(f) of UGC Act, 1956. As per Ministry of HRD, Government of India, Apex Professional University, Pasighat is empowered to award Degree as specified in section 22 of UGC Act, 1956 (Apex Professional University Website).

The department of Library and Information Science in APU offered Bachelor of Library Science (B.LIB.SCI.) with duration of 1 Year, Master of Library Science (M.LIB.SC.) with duration 1 Year and Doctor of Philosophy (Ph.D.) with duration 3 Years minimum (Apex Professional University Website).

c) Arunachal University of Studies (State Private University)

Arunachal University of Studies (AUS) has been established by Government of Arunachal Pradesh through an Act of State Legislator in 2012. The University is duly recognized by UGC u/s 2(f) and is empowered to award degrees specified u/s 22 of UGC Act 1956. It is a member of Association of Indian Universities (AIU), New Delhi. The certifications issued by the University are globally accepted. It is situated at the serene location of Namsai district in Arunachal Pradesh, which is popular for the famous Buddhist temple and monastery, The Kongmu Kham (Golden Pagoda) (Arunachal University of Studies Website).

The Department of Library and Information Science in AUS offered BLIS, MLIS and M.Phil with duration of 1 Year each and Doctor of Philosophy Ph.D with duration of minimum 3 Years (Arunachal University of Studies Website).

d) North East Frontier Technical University (State Private University)

North East Frontier Technical University (NEFTU) was established in 2014 under 2F of UGC Act 1956 through the North East Frontier Technical University Act, 2014 by the Government of Arunachal Pradesh Legislative, vide notification number LAW/LEGN-9/2014, in the Indian state of Arunachal Pradesh. It is situated in Aalo, formerly Along, a census town and headquarter of the West Siang district of the Indian state of Arunachal Pradesh (North East Frontier Technical University Website).

The Department of Library and Information Science in AUS offered Diploma in Library Science (D.Lib.I.Sc), Bachelor of Library and Information Science (B.LIB.I.SC), Master of Library and Information Science (M.LIB.I.SC) and M.Phil

with duration of 1 Year each and Doctor of Philosophy Ph.D (North East Frontier Technical University Website).

e) *Venkateshwara Open University (State Private University)*

Venkateshwara Open University (VOU) is a state private university located in Lekhi, Naharlahun, Arunachal Pradesh, India. It was established in 2012 by the Venkateshwara Open University Act No.10 of 2012 of the Government of Arunachal Pradesh. VOU is empowered to award degrees by the University Grants Commission (UGC) (Venkateshwara Open University Website).

The school of Library and Information Science strives to be best Schools for information professionals, excelling in teaching, scholarship and professionals service. The University offered Certificate course in Information Communication Technology with duration 6 Months, Post Graduate Diploma in Library Automation and Networking (PGDLAN) with duration 1 Year and B.Lib and M.Lib with duration of 2 Years each (Venkateshwara Open University Website).

f) Indira Gandhi Technological and Medical Sciences University (Private University)

Indira Gandhi Technological and Medical Sciences University (IGTAMSU), Arunachal Pradesh was established in 2012 and it is recognized by UGC as a private university under the section 2(f) of UGC Act 1956. It is located in Ziro, the census town in Lower Subansiri district in the Indian state of Arunachal Pradesh (Indira Gandhi Technological and Medical Sciences University Website).

The Department of Library and Information Science was established in the year 2018 and offered MLIS course with duration of 2 Years. The course covers the principle and practices of Library Science and Library Administration along with the current technologies applied to these processes (Indira Gandhi Technological and Medical Sciences University Website).

2.4.2 Library and Information Science - The Indian State of Assam

a) Assam University (Central University)

Assam University which came into existence through Assam (Central) University Act, 1989 (Established under an Act of Parliament) was established in 1994 situated in Silchar.

The Department of Library and Information Science was established in the year 2009 and offered Masters of Library and Information Science programme (duration 2 Years) primarily to educate students in the principles, practices and ethics of library and information science, imbues them with a sense of service to diverse populations, and prepare them to be lifelong learners and active leaders in a rapidly changing information and knowledge society. The Department of Library and Information Science of Assam University is committed to the University's mission of teaching, learning, research and community services. The Department of Library and Information Science, Assam University also offered M.Phil with duration 2 Years and Ph.D (Assam University Website).

b) Assam Women's University (State University)

Assam Women's University (AWU) has been established by an act XXII of 2013 of State Legislature of Assam as a State University vide Notification

LGL. 149/2011/92 dated 21.08.2013 and is empowered to award degrees as specifies by the UGC under section 22 of the UGC Act 1956 through its own departments. AWU is located in Jorhat, Assam (Assam Women's University Website).

The Department of Library and Information Science was established in the year 2015 under the School of Engineering and Technology with a view to equip the libraries with trained manpower. AWU offered Master of Library and Information Science (M.L.I.S) with duration of 2 years (Assam Women's University Website).

c) Dibrugarh University (State University)

Dibrugarh University, the easternmost University of India was set up in 1965 under the provisions of the Dibrugarh University Act, 1965 enacted by the Assam Legislative Assembly. It is a teaching-cum-affiliating University with limited residential facilities. As the diverse needs of the region, a set of goals and objectives had been laid down in Dibrugarh University Act, 1965. Among them, the most important one is "to secure the advancement, diffusion, and extension of knowledge in all spheres of learning (Dibrugargh University Website).

The Centre for Library and Information Science Studies (CLISS) in Dibrugarh University was established in January, for imparting education and practical training in Library and Information Science. One (1) year BLISc (Annual system with a provision of both internal and external assessment) course was introduced with intake of 24 (including 4 endowment seats). In 2007, One-year MLISc (with two (2) semesters, with a provision of both internal and external assessment) programme was introduced with intake of 20 (15+2 endowment+3 deputation). Both the courses are one (1) year duration. The Centre for Library and Information Science Studies of

Dibrugarh University is developing in proper perspectives producing professionally trained manpower, meeting the needs of the libraries of the region (Dibrugargh University Website).

d) Gauhati University (State University)

The Gauhati University was established in 1948 and the Department of Library Science (then Library Science) was started an evening course in the year 1966.It is the first university and the department as well in the North East Region to offer the course. In 1966-67, one year Bachelor Degree programme leading to Bachelor of Library Science and later in 1978, one year Master degree programme leading to MLibSc were started in the department. The nomenclature of both BLibSc and MLibSc were changed to BLISc and MLISc respectively in 1983 along with renaming of the department as Library and Information Science. From 1984, both BLISc and MLISc courses became regular courses (Gauhati University Website).

The two years integrated Master degree programme leading to MLISc was introduced from the academic session 2001-2002 with a fully revised syllabus accommodating new areas in conformity with the UGC-CDC suggestions in Library and Information Science. The department commenced the Ph.D program in Library and Information Science from 1987. Till today 55 scholars have been awarded Ph.D degree from the department as of 2015. In the year 2016, the department launched M.Phil programme (duration 1 year) and in 2017, M.L.I.Sc, M.Phil and Ph.D syllabus was revised (Gauhati University Website).

e) Krishna Kant Handique State Open University (State University)

Krishna Kant Handique State Open University (KKHSOU) is a state university situated in Guwahati, Assam. It was established by the Assam Legislative Assembly by Act XXXVII of 2005 in 2005. The Act received the assent from the Governor on the same year. It was recognized by the University Grants Commission in 2009 which list 2007 as the year of establishment (Krishna Kant Handique State Open University Website).

The department of Library and Information Science offered Diploma in Library and Information Science with duration of 1 Year which introduce learners to the various areas of Library and Information Science. The Diploma in Library and Information Science comprises of 5 courses including practical works (Krishna Kant Handique State Open University Website).

2.4.3 Library and Information Science - The Indian State of Manipur

a) Manipur University (Central University)

Manipur University which was established in 1980 started the functioning of the Department of Library and Information Science in 1986. The Bachelor of Library and Information Science (BLISc) programme was started in the Department in the year 1986 in response to the demand for training human resources in the field particularly for the state of Manipur. The Department also inducted a one-year Masters of Library and Information Science (MLISc) program in 2004. Both the courses were merged to Two Year Integrated MLISc Course in 2006-2007 academic sessions (Manipur University Website).

The department initiated an effort to carry out research programme leading to Ph.D. in the year 1987. Till today, there are 50 scholars who have been awarded Ph.D Degree (Manipur University Website).

b) Sangai International University (State Private University)

Sangai International University (SIU) was established in 2015 in Churachandpur, Manipur by an Act of State legislature under self finance mode, which received the assent of His Excellency the Governor of Manipur and published in the Manipur gazette with vide. It is the first private university in the state and is affiliated to UGC and has accorded the university as a state private university, in accordance with the provisions contained in the university Grant Commission Act, 1956 and empowered to award degrees in terms of section 2(f) of UGC Act, 1956 (Sangai International University Website).

The department of Library and Information Science offered Master of Library and Information Science (M.Lib.I.Sc) with duration of 1 Year, M.Phil with duration of 2 years and Ph.D with duration of minimum 3 years (Sangai International University Website).

2.4.4 Library and Information Science - The Indian State of Meghalaya

a) North Eastern Hill University (Central University)

North-Eastern Hill University also is known as NEHU, is a Central University established in 1973 by an Act of the Indian Parliament. The University has two campuses i.e., Shillong and Tura in Meghalaya. It was established as a regional university for the states of northeast India, including Meghalaya, Nagaland, Arunachal

Pradesh, and Mizoram, and had given birth to Nagaland University in 1994 and Mizoram in 2001 (North Eastern University Website).

The Department of Library and Information Sciences was established in 1985 with a new approach to Library and Information Science education in the country. The Department introduced for the first time a two-year integrated programme leading to a Master's degree in Library and Information Sciences in the country. The same pattern of education has now been recommended by the UGC under Model Curriculum in Library & Information Science in 2002 (North Eastern University Website). The department also offered Ph.D course which was started from the year 1990 and till today, the total research output in Ph.D program is 45 (Survey Data as on 2015).

b) University of Science and Technology Meghalaya (State Private University)

University of Science and Technology Meghalaya (USTM) was established in 2011 under the provisions of the University of Science & Technology, Meghalaya Act (No.6 of 2008) enacted by the Legislative Assembly of Meghalaya and notified vide Gazette Notification No. LL (B) 87/2008/21, dated 02.12.2008 of the Government of Meghalaya. It is the first private science and technology university in the North-Eastern region of India. The university is empowered by University Grants Commission to award degrees as specified under section 22 of UGC Act, 1956. It is situated in Ri-Bhoi, Meghalaya (University of Science and Technology Meghalaya Website).

The department of Library and Information Science offered Master of Library and Information Science (M.LISc) with duration of 2 Years, and Ph.D with duration of minimum 3 years. The first scholar Ms. Rikumoni Saikia has submitted her thesis in the year 2019 (University of Science and Technology Meghalaya Website).

c) C.M. Jha University (State Private University)

C.M. Jha (CMJ) University was established in the year 2009 by an Act of Meghalaya State Legislature under the CMJ University Act 2009 (Act 4 of 2009) vide Notification No. LL (B) 42/09/80 dated 20th July, 2009. The Chandra Mohan Jha University is notified by UGC (Ministry of HRD, Government of India), New Delhi as state private university under section 2 (f) and empowerment to award Diploma, Bachelor, Master and Doctorate (C.M. Jha University Website).

The department offered Bachelor of Library & Information Science (B.Lib), Master of Library and Information Science (M.Lib) and M.Phil with duration of 1 Year each, and Ph.D with duration of minimum 3 years (C.M. Jha University Website).

2.4.5 Library and Information Science - The Indian State of Mizoram

a) Mizoram University (Central University)

The university is the fruit of the Mizoram Accord between Mizo National Front and Government of India on 30th June 1986. However, it was not created de novo. The North-Eastern Hill University, with its headquarters at Shillong, had already run its Mizoram Campus since 1978. The Mizoram University Act by the Parliament of India officially established the school on 2nd of July, 2001, incorporating all the facilities of the existing Mizoram Campus of NEHU (Mizoram University Website).

Soon after Mizoram become an independent state in the year 1987, the state witnessed a number of economic, social and educational activities including libraries in the state. These libraries include the development of academic libraries (school, college, and university), public libraries and special libraries as well. The Mizoram University introduced Bachelor of Library and Information Science (BLIS) and Master of Library and Information Science courses in the year 2002 and 2003 respectively each with one-year duration course. From 2005 the department switched over to two years integrated Master of Library and Information Science course (Mizoram University Website).

The department introduced the M.Phil programme in Library and Information Science from the year 2007 with the following objectives:

1. To provide the students with an understanding and strong theoretical, practical and innovative base on emerging areas of Library and Information Science.
2. To acquaint and expose the students to different methods, techniques associated with scientific management of Libraries and Information Centres
3. To provide an in-depth exposure to the latest trends and developments of ICT and its application in LICs with special emphasis on Library Automation, Networking, and Digitization.
4. To appraise students the various research methods and tools essential for data collection, analysis, and interpretation (Mizoram University Website).

It is worth mentioning that Mizoram University is the only university in the northeast region to offer M.Phil in Library and Information Science till 2007. Presently 55 candidates have been awarded M.Phil degree (Survey Data as on 2015).

The department introduced Ph.D. in the library and information science since July 2005. Till today, 19 candidates have been awarded Ph.D Degree and Presently 20 numbers of candidates, those who already got their registration, are still going on their research work (Survey Data as on 2015).

2.4.6 Library and Information Science - The Indian State of Nagaland

a) The Global Open University (Private University)

The Global Open University is an Indian university in the state of Nagaland with campuses in Dimapur and Kohima. It was established in 2006. It has been established under the provisions of the Global Open University Act 2006 (Act 3 of 2006) of the Government of Nagaland with a view to introducing vocational, job oriented and employment centric education in the North-East in general and in the State of Nagaland in particular. It is administered by a governing Council and Executive Council. It is provisionally recognized (2008-2009) as a Private University by the University Grants Commission of India. The Association of Indian Universities (AIU) recognizes IGNOU conferred degrees as on par with the degrees conferred by its members. In 2008, it was recognized provisionally by the Distance Education Council for offering distance programmes the same year (The Global Open University Website).

The department of Library and Information Science offered Bachelor of Library & Information Science (B.Lib.I.Sc) and Master of Library and Information Science (M.Lib.I.Sc) with duration of 1 Year each (The Global Open University Website).

2.4.7 Library and Information Science - The Indian State of Sikkim

a) Vinayaka Missions Sikkim University (State Private University)

The Vinayaka Missions Sikkim University (VMSU) was established in the year 2008 by an Act (No. 11 of 2008) of State Assembly passed by Government of Sikkim and was subsequently notified by the Government of Sikkim gazette. It is situated in Gangtok, Sikkim (Vinayaka Missions Sikkim University Website).

The department of Library and Information Science offered Bachelor of Library & Information Science (B.Lib.I.Sc) and Master of Library and Information Science (M.Lib.I.Sc) with duration of 1 Year in Bachelor of Library and Information Science and 2 years in Master of Library and Information Science (Vinayaka Missions Sikkim University Website).

2.4.8 Library and Information Science- Tripura University

a) Tripura University (Central University)

Tripura University was launched in 1987 under Tripura University Act in the Assembly and located at Suryamaninagar, ten (10) kilometres south of Agartala. It is the main Central Government University and provides post-graduate courses in sixteen (16) subjects while the various Departments, Directorate and Centres within it provide 38-degree courses (Tripura University Website).

The Department of Library and Information Science was established in the year 2016 on 29.02.2016 and it was started imparted one year truncated post-graduate diploma program leading to degree of Bachelor of Library and Information Science (BLIS) based on the recommendation by UGC model curriculum in LIS and

also started One (1) Year Master of Library and Information Science functioning from the academic session 2017-2018 to provide advanced knowledge on the subject and equipped libraries in the digital era (Tripura University Website).

b) Maharaja Bir Bikram University (State University)

Maharaja Bir Bikram University was established in 2015 by the Government of Tripura through th Maharaja Bir Bikram University Act, 2015 and it was the first state university in the state of Tripura. It is located at Agartala, Tripura. It has three affiliated colleges namely, Maharaja Bir Bikram College, Bir Bikram Memorial College and Tripura Government Law College (Maharaja Bir Bikram University Website).

The department of Library and Information Science started in the year 2016. The department offered B.Lib with duration of 3 years (Maharaja Bir Bikram University Website).

2.5 Conclusion

Library and Information Science education was established with much effort by the library scientists. Infect, 20th century is remarkable in view of the beginning of the LIS education which commenced its journey with the initiation of Sayyaji Rao Gaekwad as discussed. Contributions of William Alanson Borden and Asa Don Dickinson are remarkable to commence the LIS education in India who initiated its plinth as educators in 1911 to train the librarians of Baroda (Neelameghan, 1974). The journey of LIS education, again, laid a milestone in 1915 when Asa Don Dickinson pioneered in providing education to the librarians at Punjab University, Lahore (earlier part of undivided India) (Krishna Kumar & Sharma, 2010). Further, it

stretched to the various parts of the country with full-fledged courses in the universities and other institutions and now, established as a subject as par with other subjects.

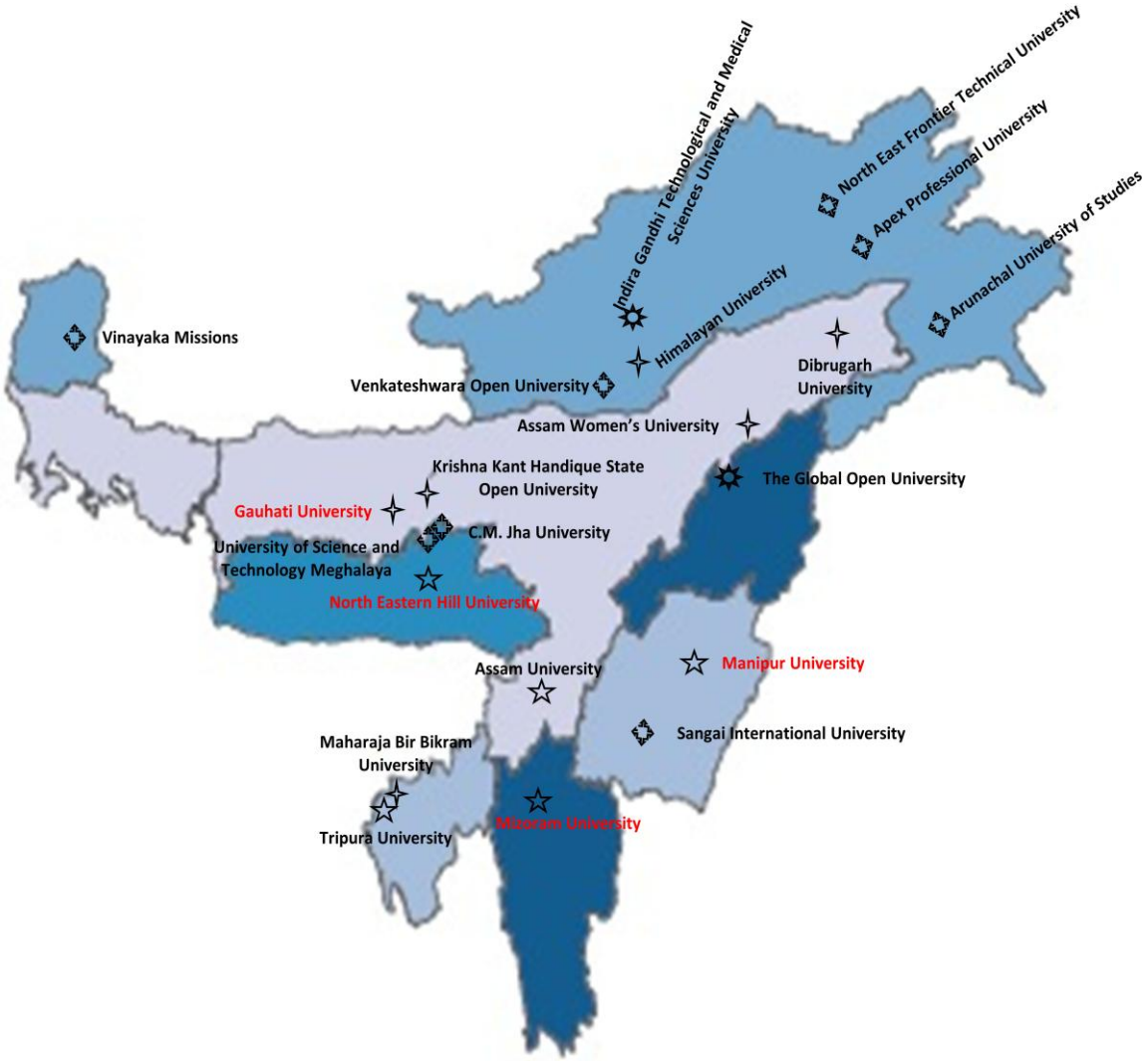

Fig-1: Map of North East India with the location of Universities

Symbol	Type of University
☆	Central University
✦	State University
✸	Private University
✥	State Private University
Note: University marked as ***red fonts*** are the scope of the study	

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CHAPTER 3: CITATION ANALYSIS: CONCEPTS

Chapter Plan

CHAPTER 3
CITATION ANALYSIS: CONCEPTS

3.1 Introduction

Assessment technique like studies based on citations that offers one of the best ways to understand how the referring students could utilize the resources and locate the right information at the right time can be considered as Citation Analysis and they may also be termed as Cito-Analytical Studies. It is an important tool of bibliometric analyses of the scholarly literature for a profound understanding of scholarly activity and performance. Citation analysis studies the citations provided at the end of any scholarly communication and is generally considered as a valuable tool for determining the impact of scholarly works. It scrutinizes the frequency and patterns of citations in journal articles and books. It employs citations in scholarly works to establish links to other works or other researchers. In today's world of the ever-increasing cost of serials, citation analysis is being used in the library to determine the purchase of titles and either to continue or discontinue the subscription of journals.

Citation Analysis is a well-known research tool for bibliometrics study and by itself, it is also a sub-area of bibliometrics study. It has become one of the methods engaged in the identification of core journals in a particular subject field or for a particular scientific community in a geographical area. It is a method of listing of references cited to articles in periodicals and counting the frequency with which kinds of literature are cited. This method highlights that journals are the most desirable ones in a library collection for they are likely to be frequently used by scientists as well as researchers or scholars. Citation Analysis has helped to make out the quality of the

information sources and is a flexible and technique in a university library environment. Citation Analysis deals with such facets as, which are the links among Citations i.e. who cites who, which journal is cited by which journal and what subject fields are more cited in the literature of a precise discipline. Thus, Citations Analysis is very useful to conduct research and find out trends in a subject, authorship pattern, sources, ranking, obsolescence, and chronological distribution.

Though citation-based studies have been going on in the world since long, such studies, on the other hand, did not receive the required impetus till the commencement of citation indexes. The beginning of Science Citation Index in 1963, followed by the Social Science Citation Index in 1973, and the Arts and Humanities Citation Index in 1978 significantly expanded the outlook of citation-based studies and brought forward a mixture of Cito-Analytical products.

3.2 Historical Development of Citation Analysis

Shephard's citations had been used in the legal profession since 1873 before Eugene Garfield developed a method in 1955 for citation indexing in science literature (Garfield 1955, cited in Levin-Clark and Gil, 2009, p.986). Shephard's citation was created by Frank Shephard, who listed each legal case heard by the Illinois Supreme Court that cited previous cases. This citation index grew to cover almost all jurisdictions and became a vital tool in the field of law for case verification. Any lawyer or law librarian still knows what it means to "shephardize" a case (Ballard, et.al, 2006).

The first recorded citation analysis was done by Gross and Gross in 1927 when looking at citation patterns to determine the journals to be subscribed to and back volumes to be acquired for the library of Pomona college, using citation count to rank the periodicals in Chemistry. From the application point of view, citation analysis may be considered as a collaborative peer effort to study and promote the quality of scholarly publications and research (Kumar & Reddy, 2012, p.44).

Early Citation studies were often based on a list of references provided in articles appearing in a limited number of journals. In those studies, Citations had to be transcribed and manipulated by hand to get the results and therefore, it was complicated to grasp a huge amount of data for citation analysis. The introduction of computers has extensively improved the situation and now it is possible to create computer-printed indexes, which include citation data from thousands of documents, and also to get citation data in machine-readable form. That is why Citation Analysis is one of the most attractive fields of study in bibliometrics where Citations play key functions. The growth of Citation Analysis has been marked by the invention of new techniques and measures, the utilization of new tools and the study of different units of analysis. These trends have led to a rapid expansion in the number and types of studies by means of Citation analysis.

Garfield's article on Citation Indexes for Science of 1955 was a turning point in a way information scientist conceptualized the task of bibliographic citations in the knowledge creation process. Garfield (1955) presented Citation Analysis has a predominated and practical technique for studying the trends in Scientific Research and describes it as a systematic tool that uses References Citations of a scientific

paper. Citation Analysis makes use of bibliographic references and their count to recognize what material is related to a particular topic and is worth reading. Besides, it helps in studying how a scientist interacts with other colleagues.

Opponents of the Citation Analysis by Martyn (1976) was that the amount of information cited may differ with the section of the paper in which the citation is made, with each reference cited to research writing not being relevant to the whole topic. A typical research paper contains an Introduction, Methodology, and Analysis where an introductory part is likely to refer to the whole of the cited articles whereas the experimental section makes use of bits of materials from the cited articles. This kind of inconsistent use and scattering is a limitation, obligatory upon the Citation analysis.

Linda Smith (1981) declared that "the easiest techniques to use in a citation count determining how many citations have been received by a given document or set of citing documents". So, Citation Analysis studied most essential for collection development of the library and to identify the core journal. Another critic of citation study is mentioned by Mahapatra (1991) in 'hello citations', where authors deliberately cite to estimate such Citations while ranking the authors on the basis of their citations.

3.3 Need of Citation Analysis

Citation Analysis is essential for measuring the reach, influence, and success of the efforts made by many non-profit and profit companies. An organization's publications (e.g. reports, conference proceedings, authored works, etc) are an excellent starting place where impact can be measured, in organizations where

an information professional is employed; the work is cut out for them. Tracking and measuring the need for organizations' output is a clear-cut way to prove the worth, contribute to department goals and generate useful statistics that will profit the employer.

Many information professionals will be alert of the concept of citation analysis and its application in the activities of scholarly research. Citation Analysis is a method of Bibliometrics that attempts to evaluate the impact of an author's work through the frequency of being cited in other works. The procedure of citing acknowledges previous works, and disputable implies that work is important. Citation Analysis is also recognized (and of greater interest) in academic environments where an author's published research increases their professional profile.

Due to its wide acceptance in academic settings, the tools, available to study citations do not incorporate "non-scholarly" literature (often termed "grey literature") e.g. working papers. As they do not experience the same scholarly publishing process, the majority of grey literature is not indexed in free citation databases, as it is not controlled by commercial publishing and citation analysis is needed (Zack, 2011).

3.4 Scope and Purpose of Citation Analysis

Citation analysis has two major themes such as (i) use of citations as tools for librarians to evaluate the library collection and services and (ii) use of citations as a tool to evaluate research activity. Citation analysis is concerned with the following observable fact:

1. Authors who are most cited;

2. Journals that are most cited;
3. Types of linkages exist between the citing and cited works;
4. Language of documents selected for use as citation; and
5. Subject distributions and how quickly the literature on some subject becomes out-of-date, i.e., obsolescence study. (http://shodhganga.inflibnet.ac.in/bitstream/10603/63873/12/13_chapter%204.pdf)

There are multiple purposes of citation analysis that not only contribute substantially for sustainable research while using the need-based resources by the scholars but effective collection developments. The other various purposes of Citation Analysis are discussed threadbare below:

1. Depicting the basic structure of a discipline's literature;
2. Performance evaluation or ranking or both of authors, academic departments; research institutes, or even nations in terms of research productivity;
3. Demonstrating literature growth, especially in particular disciplines and subject areas;
4. Indicating cross-citation patterns among disciplines, nations, and languages. (i.e. analyzing the proportion of Library and Information Science (LIS) citations to other disciplines versus the proportion of other disciplines citation to LIS);
5. Identifying research fronts;
6. Examining scholarly communication patterns; and
7. Evaluating the effects of funded versus unfunded research (Balakrishnan & Paliwal, 2000).

3.5 Importance of Citation Analysis

Citations analysis has a practical validity in library and information services. The importances of citation analysis are as follows:

1. Recognition of key documents and creation of core list of journals;
2. Study of the coverage of primary journals and other materials in secondary service;
3. Clustering of documents according to common references and citations;
4. Study of attributes of literature as well as growth rate, obsolescence, citation practices;
5. Study of the structure of scientific literature according to language, country of origin, age, subject, form, authorship or any combination of these attributes; and
6. Study of historical and sociological characteristics of scholarly communication in science and technology. (http://shodhganga.inflibnet.ac.in/bitstream/10603/63873/12/13_chapter%204.pdf)

Citation analysis is also applied to derive the following benefits which include:

1. Guiding the readers to further studies in the field;
2. Preparation of bibliographies;
3. Study the use pattern of different types of documents;
4. Discover the relative use of different languages;
5. Study the use of literature from different countries;
6. Find out the scattering of subjects;

7. Choose the obsolescence rate of documents in different subjects;
8. Resolve the interdependence and lineage of subjects;
9. Arrange the rank list of documents;
10. Study the rate of collaborative research; and
11. Analysis of scientific journals like citation rate of a journal, impact factor, self-citing rate, self-cited rate and immediacy index. (http://shodhganga.inflibnet.ac.in/bitstream/10603/63873/12/13_chapter%204.pdf)

3.6 Key Citation Indexes

Citation Index, according to Garfield (1964, p.650) is an ordered list of cited articles each of which is accompanied by a list of citing articles. The citing article is identified by a source citation and the cited article by a reference citation. The index is arranged by reference citations. Any source citation may subsequently become a reference citation. Kent (1987, p.195), however, has categorized indexes into two types such as,

- ➔ An index of all articles published in a selected group of given year is called Source Index; and
- ➔ An index arranged by authors of all articles cited in the articles of a group is known as Citation Index.

The three major citation indexes covering each of the broad areas of human knowledge as major components are explained. It includes,

1) Science Citation Index

Introducing the Science Citation Index (SCI) in 1964, Garfield offered a new dimension to the concept of the evaluation process of scientific articles and index system as a whole. Science Citation Index is considered as one of the most dominant tools for measuring values of information.

The Science Citation Index gives access to current and retrospective bibliographic information, author abstract, and cited references which are found in leading scholarly science and technical journals covering more than 100 disciplines. Garfield considered citation analysis as an effectual tool for tracing scientific information and for journal evaluation as well. Practically, it interlinks scientific papers and, in the process, establishes a network among the scientific papers on identical subjects. It affords methodology to rank scientific journals according to their relative degree of importance (Jose, 2012).

2) Social Science Citation Index

The Social Science Citation Index (SSCI) is a database of scholarly literature and is employed in many important ways. The SSCI is a product of ISI, which is a production of the Thompson Corporation. After building the SCI model, Garfield commenced other index products in 1973 named Social Science Citation Index. The SSCI is an important element in the academic apparatus of rank and prestige. Those who decide which journal are to be included in the SSCI implement an enormous influence over the social sciences (Klein & Chiang, 2004).

3) Arts and Humanities Citation Index

Subsequent to the development of SCI and SSCI models, Garfield further launched the Arts and Humanities Citation Index (AHCI) in the domain of indexing in 1978. According to him, the index covers up a little more than a thousand journals with the ambition to become an imperative tool for researchers in humanities (Leyesdroff, Hammarfelt & Akdag, 2012).

AHCI provides access to diversified disciplines such as Archaeology, Linguistics, Philosophy, Musicology, Literature, and others in the field of art and humanities (Garfield, 1997). The Arts and Humanities Citation Index is not associated with JCR- probably because that journal is less critical in the humanities.

3.7 Citation Procedures

Citation procedures signify the type of literature used in a given field of research. The four citations procedures available in the Journal Citation Report are enumerated below:

1) Total Citation Received

Counting the total citations received by a journal represents the most fundamental citation factor. In fact, the earlier citation studies of journals carried out during the 1920s and 1930s were based on total citation count. In the Journal Citation Report, a journal's "total citations" count consists of the citation received by any issue (current as well as all back runs) during the current year from all other journals in the ISI's database.

The figure counts citations to any kind of item, including articles, book reviews, editorials, letters, etc. However, the total citations exclude books or journals

that are not included in the ISI database (Balakrishnan & Paliwal, 2000, p.258-259). The total citations figure has often been represented as a crude, primitive measure. Its advantages are for both old journals by means of more back runs to be cited and new journals that publish more articles. High citation-count titles may, in fact, be the most important journals in terms of their contribution to scholarly communication over time and the emphasis they deserve in library collection management decisions. It has been used by libraries for serials collection management particularly, the States University of New York (SUNY at Albany and the Louisiana State University libraries).

2) Impact Factor

Impact factor symbolizes the reputation of a journal by the users while using for research and this is primarily due to the embodiments of value-added research articles in the journals. Generally, it is counted in 10-point scale in the international field. The relative importance of a journal is measured with the journals of the subject/ fields. The more the impact factor results in the more status of the journals in the global sphere. The impact factor of the journal is a measurement applied to the average number of citations to articles published in journals, books, patent documents, thesis, project reports, newspapers, conference/ seminar proceedings, documents published in internet, notes and any other approved documents. The Journal Impact factors are calculated in yearly/half-yearly/ Quarterly/Monthly for those journals that are indexed in Journal Reference Reports (JRR) (http://www.jifactor.com/). According to Eugene Garfield:

"Impact factor is the ratio of a number of citations received by source items in a particular year to the number of source items published over a fixed period of time in a particular periodic publication, say a journal".

Source items stated in the definition include original articles, editorials, letters, short communications, reports of meetings, correction, notes and review articles.

The Impact factors provided in Journal Citation Reports are computed bearing in mind the 'fixed period of time' as two years. This particular impact factor, popularly known as Journal Citation Report Impact Factor or SCI (Science Citation Index) impact factor, is naturally used all over the world.

While defining the name "Impact Factor" Garfield did not suggest any symbol for the term. For now, Sen proposed symbol, i.e. I_f has been highlighted.

The impact factor can be represented as:

$$I_{f\,(J)} = \frac{C_1 + C_2}{S_1 + S_2}$$

Where $I_{f\,(J)}$ denotes the impact factor of the Journal J for the year Y;

C_1 denotes the number of citations received by S_1 source items in the year Y;

C_2 denotes the number of citations received by S_2 source items in the year Y;

S_1 denotes the number of source items published in the Journal J in the year Y-1; and

S_2 denotes the number of source items published in Journal J in the year Y-2.

Suppose the Journal J has published 32 and 36 source items in the years 2010 and 2011 respectively. These source items have received respectively 40 and 28 citations in 2012. Now the impact factor of the Journal (J) will be

$$\frac{40+28}{32+36} = 1$$

It may be noted that the 'Journal Citation Report Impact Factor' of a journal cannot be determined till the journal has finished two consecutive calendar years of its life and all its issues are published in time. For a journal that has started publishing in the year 2011, its impact factor will be known only in 2013 provided that the journal has been very regular in publishing its issues i.e., 2012 & 2013.

In the course of the time, impact factor is gaining momentum and finding more and more uses. Some of the users are being highlighted as below:

i) Selection of Journals

While selecting journals for acquisition in a library, the librarians tend to prefer for selection of journals on the basis of Impact Factors as it clearly reveals the global position of the journal in a given subject.

ii) Discontinuation of Journals

Many a time the libraries discontinue some journals because of the shrinking budget allocations along with many related factors such as absence of adequate professionals, changing information needs of the users, lack of administrative support, irregular publications, price hike of the print journals, etc.

iii) Placing a paper

Every researcher after completing the paper desires a reputed journal to place his/her paper so that the paper comes to the notice of the researchers of his field all over the World. In such cases, the list of Journals arranged subject-wise according to the impact factor in Journal Citation Reports verified to be of immense help (Sen, 2010).

iv) Cited half-life

In 1960, Robert E. Burton and R.W Kebler wrote "The half-life of some scientific and technical Literature" in which they evaluated the rate of obsolescence of scientific literature of radioactive substances (Hertzel, 2010). It is defined as the time for the duration of which half the totals use of given literature has been made (De, 2009).A Journal's cited half-life is defined as:

> *"The number of years going back from the current year which accounts for 50% of the total citations received by the cited journal in the current year".*

Cited half-life information can be helpful for serials collection management. It is not evaluative in the sense that a high half-life is tentatively better than a low half-life. However, high-half-life journals will possibly be used for a longer period of time than low-half-life journals, which will become obsolete more rapidly (Balakrishnan & Paliwal, 2000). The three types of Half-Life have been discussed as under:

- **Corrected Half-Life**

The half-life as estimated by removing the growth element from the median citation age.

- **Apparent Half-Life or Median Citation Age**

The time within which half of the citations in a citation study occurs.

- **Item Half-Life**

The time (actual or expected) within which half the total use of an individual item has been, or is expected to be, made (Kawatra, 2008).The symbol of the item may be added within round brackets following *T*. If the item is a book, the symbol will be $T_{(B)}$ (Sen, 1999).

3) Immediacy Index

ISI's definition, of Immediacy Index, is:

> *"A journal [SIC] immediacy index considers citations made during the year in which the cited items were published. Thus, the immediacy index of the Journal X would be calculated by dividing the number of all current citations of current source items published in Journal X by the total number of articles Journal X published that year".*

The calculation of a Journal immediacy index is highlighted as under:

$$\text{2012 Immediacy Index} = \frac{\text{Number of 2012 citations to 2012 items}}{\text{Number of citable Items published in 2012}}$$

Just as impact factor signifies the number of times an average article has been cited, the immediacy index reveals the number of times a hypothetical

average article is cited during the year of its publication. As with cited half-life, a high or low immediacy index is not essentially good or bad, however, some authorities consider it evaluative. For instance, Bert R. Boyce and Janet Sue Pollents term immediacy index as a measure of quality – an expression generally reserved for impact factor.

There was an anticipation of an inverse relationship between a journal's immediacy index and cited half-life. The two measures deal with separate concepts; immediacy index investigates how quickly a journal is cited, and cited half-life indicates how long a journal continues to be cited. The immediacy index is of theoretical interest to information scientists because it indicates how rapidly knowledge is being distributed. A low immediacy index exposes researchers are citing (and thus using) a journal soon after publication and a high immediacy index indicates a time lag between publication and citation.

As we enter the era of electronic publishing, potential practical applications of the immediacy index can simply be imagined. If a library is allowing for an electronic subscription in lieu of the print format or a simultaneous electronic subscription while maintaining the print version, a journal's immediacy index might be considered in the decision. A high immediacy index would involve speedy access to the title is important and thus support the case for an electronic subscription. Searching CD-ROM databases shaped no reported cases of libraries using the immediacy index in collection management decisions (Balakrishnan & Paliwal, 2000).

3.8 A Range of Other Measures have been Developed which Complement the Impact Factor

1) Eigenfactor Metrics

While the impact factor has been famous as one way of measuring journals, it does not measure the quality or influence of a paper. Eigenfactor Centrality is developed by sociologist Philip Bonacin in 1972, quantities an individual's rank in communication networks. This progress is used for Google's PageRank algorithm; examining citation networks and is a foundation of the Eigenfactor^{TM}score and Article Influence^{TM} Score. The Eigenfactor^{TM}score of a journal is based on calculation of the percentage of the time that the model researcher visits that journal in his walk through the library. The measure is a way of rating the significance of a Journal. Journals are rated according to the number of incoming citations, through citations from highly-ranked journals weighted to make a larger contribution to the Eigenfactor than those journals with lower rankings. The Eigenfactor^{TM} score is intended to give a measure of how probably a journal is to be used. (http://admin-apps. webofknowledge.com/JCR/ help/h_ eigenfact.htm).

The Article Influence^{TM} Score processes the influence, per article, of a given journal. Unlike the impact factor, Article Influence^{TM} Score regulates for differences in citation patterns between disciplines. As a result of the improvement of Eigenfactor Metrics, publishers, such as EBSCO and Thomson Reuters are utilizing the advancements in their product development and are promoting the new forms of metrics as a point of differentiation in their marketing campaigns (Thomson Reuters, 2012).

2) Eigenfactor Score

The Eigenfactor Metrics is determined by the *Eigenfactor* Score, the calculation of which is based on the number of times articles from the journal are published in the past five years and have been cited in the Journal Citation Report in the year. It also considers the journals where contributions to these citations have been made so as to influence the network with highly cited journals and it maintains the decreasing sequence. References from one article in a journal to another article from the same journal are removed so that *Eigenfactor* Scores are not influenced by journal self-citation (Thomson Reuters, 2012).

3) Article Influence Score

The a*rticle's influence* determines the average influence of a journal's articles over the first five years after publication. It is calculated by dividing a journal's *Eigenfactor*Score by the number of articles in the journal, normalized as a fraction of all articles in all publications. This measure is roughly analogous to the 5-Year Journal Impact Factor in that it is a ratio of a journal's citation influence to the size of the journal's article contribution over a period of five years (Thomson Reuters, 2012).

The mean *Article Influence* Score is 1.00. A score that is greater than 1.00 indicates that each article in the journal has above-average influence. A score less than 1.00 indicate that each article in the journal has below-average influence. (Thomson Reuters, 2012) (http://admin-apps. webofknowledge.com/JCR/help/h_eigenfact.htm)

3.9 List of Tools for Conducting Citation Analysis

1) Thomson Reuter's Web of Science/ Knowledge:

(http://thomsonreuters.com/products_services/science/science_products/a-z/web_of_science/)

Web of Science (WoS) which requires a subscription is the first citation index and includes an extensive range of very impressive analysis tools. With a high price tag, not every organization will be able to afford this product (and unfortunately, they do not offer a non-profit rate). Thomson Reuters also offers access to "Highly Cited Research" (http://www.highlycited.com), a free resource to identify highly cited authors and works. WoS is extremely useful for tracking cites in academic journals but quite disappointing for measuring citations from grey literature.

2) Elsevier's Scopus: (http://www.scopus.com/home.url/)

The subscription-based Scopus is a little less expensive alternative to Web of Science, and boasts having "the largest abstract and citation database of research literature and quality web sources." Scopus has a free author/organization stare up tool. This will provide an idea of organization's cited works in the Scopus indexed content. Similar to WoS, grey literature is relatively missing from this database.

3) Google Scholar: (http://scholar.google.ca/)

Using the advanced Google Scholar search option, searches can be carried out through author, affiliated organization, etc. to retrieve articles where either are mentioned or cited. This can be complicated, however, as it is not possible to narrow search results to the bibliography or footnotes. Search results might consist of

many unwanted items. That said, Google does a much better job than WoS or Scopus of retrieving unclear and grey literature citation mentions.

4) ***Publish or Perish*****:** (http://www.harzing.com/pop.html)

Public or Perish (PoP) employed Google Scholar citations and runs as standalone software that links to the web. Downloading PoP, and then carry out citation queries to retrieve the analysis of an author or publisher's works. It is less accurate than the fee-based products like Scopus or WoS, but PoP is also quite straightforward about its limitations. PoP achieved much better than Google on the web, and as free software, it is worthwhile and effective.

5) ***CiteSeerX***: (http://www.citeseerx.ist.psu.edu/)

CiteSeerX focuses on (but is not inadequate to) literature in the areas of computer and information science. As an index database, CiteSeerX is unique for adding complex metadata to its contents, which permits a greater capacity for linking documents and locating related materials. Documents are automatically produced from the web, so indexed content is continuously up-to-date.

6) ***Scirus***: (http://www.scirus.com./)

Scirus is a science-specific index database surrounding a very wide range of web pages, government resources, academic articles, and special information sources (e.g. patent data from LexisNexis, technical reports from NASA, institutional digital repositories, etc.).

7) ***RePEc***: (http://repec.org/)

Research Papers in Economics (RePEc) is a database of more than one million items, largely in the social sciences, economics, finance, and computer sciences. The items in RePEc are unpublished papers, non-commercially published

materials, and also pre-published versions of academic articles. RePEc is useful for many types of organizations that produce literature because it supports the free and open dissemination of these materials throughout a variety of outlets. It works by users (e.g. authors of works, or information professionals on behalf of their organization) uploading publications and makes available the metadata and bibliographic information. To carry out citation analyses, RePEc has an embedded system for tracking these uploaded items. Through this, we can quantify how often our publications are downloaded, cited, and shared. RePEc is also a collaborative effort with many other repositories, such as EconLit, EDIRC, and IDEAS.

Although these options may not provide the complete tools for conducting Citation Analysis, however a combination of these tools can produce a rough, but a useful solution. Optimistically, there are ongoing developments in this field, such as Google Scholar Citations (http://scholar.google.ca/intl/en/scholar/citations.html), and Open Grey (www.opengrey.eu), and the maturation of these products will benefit the efforts of citation analysis for grey literature (Zack, 2011).

Table 5: Tools for conducting Citation Analysis

S.No	Citation Analysis Tools	Sub. Status	URL
1	Thomson Reuter's Web of Science/ Knowledge	Priced	http:// thomsonreuters. com/products_services/science/science_products/a-z/web_of_science/
2	Elsevier's Scopus	Priced	http://www.scopus.com/home.url
3	Google Scholar	Free	http://scholar.google.ca/
4	Publish or Perish	Free	http://www.harzing.com/pop.htm
5	CiteSeerX	Free	http://citeseerx.ist.psu.edu/
6	Scirus	Free	http://www.scirus.com/
7	RePEc	Free	http://repec.org/

(Source: Survey Data)

3.10 Bibliometrics, Scientometrics and Informetrics

In order to assess library resources and services more objectively and effectively, Library and Information Science managers have adopted a number of quantitative methods in recent years. This has now appeared as a research front in its own right in Library and Information Science. Different areas of research are explained under the following:

1) Bibliometrics

Alan Pritchard coined Bibliometrics from two roots- 'Biblio' and 'metric'. The term 'Biblio' is derived from the combination of Latin and Greek word 'biblion' equal to 'Bylos' means book, paper which in turn was derived from the word 'Bylos', a city of Phenonicia, a noted city for export trade in paper. The word 'Metrics' on the other hand signifies the science of meter, i.e. measurement and is derived either from Latin or Greek word 'metricus' or 'metricos' respectively each managing measurement.

Bibliometric studies consist of studies of the growth of the literature in some subject, how much literature is contributed by various individuals, groups or organizations or countries, how much exists various languages, how the literature on some subject scattered (e.g. over documentary types, language journals), and how quickly the literature on some subject becomes out of date. Another important group of Bibliometric studies relates to author citing sources and day-by-day this study attaining sophistication and complexity having a national, international and interdisciplinary character.

The backbone of Bibliometrics lies in its sound theoretical basis most successfully laid by some pioneers like Lotka, Gross, Bradford, Zipf. Duck J De Sola Price, Bookstein, Mundelbro, Brooker, Narin, Garfield, Vickery, Moraves, Hulme, Fairthorne, and many others and their techniques are capable of throwing light on various complicated problems faced by information scientists to quantify the process of written communication (Sangam, 2008).

Mamdapur, Govanakoppa & Rajgoli (2011) defined the term Bibliometrics as an important field of information science as it represents a unique set of techniques for the monitoring and analysis of information resources and for the management of knowledge in social and organizational contexts. Babu & Muthusamy (1998) described Bibliometrics that it is the application of mathematical and statistical methods to the published information study and measure the publication patterns of all forms of documents and their authors. Harande (2012) defines by stating that Bibliometrics involves the quantitative analysis of bibliographic data derived from scientific documents. He added that it refers to the study of information materials using relevant statistical and mathematical approaches. Thanuskodi & Venkatalakshmi

(2010) defined the term Bibliometrics as a quantitative study of the literature on a topic and are used to identify patterns of publication, authorship and secondary journal coverage to get an insight into the growth of knowledge on that topic.

2) Scientometrics

Scientometrics is primarily used for the study of all aspects of the literature of science and technology. The term had gained wide appreciation by the foundation in 1978 of the journal 'Scientometrics' by Tibor Braun in Hungary and currently from Amsterdam. According to the subtitle, Scientometrics consist of all quantitative aspects of the science of science, communication in science, and science policy (Hood & Wilson, 2001). As Nalimov and Mul'chenko proposed the term Scientometrics in the former Soviet Union to explain research on the quantitative study of scientific activities, it has been more extensively used in Europe and the former Soviet Union (Wolfram, 2003).

Citation Reports of ISI citation database (Web of Science) and Scopus are two essential tools for Scientometrics (Shahbodaghi & Sajjadi, 2010).Scientometrics used to denote the communication process in science including socio-cultural aspects and appear to be almost synonymous to science of science with more pressure on quantitative aspects. It also used as a generic term for the system of knowledge, which endeavours to study the scientific (and technological) system using a range of approaches within the area of science and technology studies. Thus Scientometrics is a component of sociology of science and has application to science policy-making (Sangam, 2008).

3) Informetrics

When Professor Otto proposed the term "Informetrics" in 1979, he means to describe the area of information science dealing with:

> "*The measurement of information phenomena and the application of mathematical methods to the discipline's problems*" (Wilson, 1999 cited in Wolfram, 2003).

The use of the term informetrics has been rising since early 1990s. It has been recognized by international organizations such as the Federation Internationale de la Documentation (FID) and has been implemented by the International Society for Scientometrics and Informetrics (ISSI) (Wolfram, 2003).The term is also understood to related areas of investigation such as citation analysis and other areas of scholarly communication, which are sometimes treated as distinct from informetrics (Garfield, 1998 cited in Wolfram, 2003).

Informetrics research is carried out by scholars from many disciplines, including library and information science, history of science, computer science, communications, sociology, and linguistics. The different disciplinary outlooks have shaped researcher motivations for undertaking informetric studies and the processes studied. Object studied consist of the document themselves, the creators of documents (authors), document dissemination (publication) and utilization and the document content attributes. These objects are studied within contexts defined by time frames, geography, and the discipline in which the object is employed. In Library and Information Science and Computer Science, applications of informetrics broaden out to information services and system analysis and design (Wolfram, 2003).

4) Web-based Metrics

a) Webometrics

Webometric basically deals with the quantitative analysis of various attributes of web resources. The science of Webometrics attempts to measure the World Wide Web (WWW) to identify the number and the type of hyperlinks, structure of WWW and usage patterns. It is the study of quantitative features of the construction and the use of information resources, structure and technologies on the Web drawing on bibliometric and information approaches.

b) Web Impact Factor

The concept of Web Impact Factor was introduced by Ingwersen (Ingwersen, 1998 cited in Rao, 2010). It is calculated as the number of web pages in a web site receiving links from other web sites, divided by the number of web pages published in the site that are accessible to the crawler. It works well only within a single Country's Webosphere, by means of a single subject field (Noruzi, 2006 cited in Rao, 2010). While analyzing the web impact factor, one can even limit the links to links only (no self-link)

Webometrics in general aims at designing and developing methodologies to measure visibility, such as web impact factors. The web impact factor provides a way to evaluate a web site's relative importance, especially when we compare it to others in the same field or a country's domains (no comparison in different fields). It is computable in relation to a national, sector and larger web segments or top-level domains. It provides a quantitative indicator of web sites' long-

term influence; it simply reflects the ability of web sites and webmasters to attract users. It may provide novel insight into the retrieval process on to web.

c) Web citation analysis

The number of webometric investigations has determined not only on web sites but also academic publications; for example, there are instances of using the web to count how often journal articles are cited. The rationale behind this is partly to give a second opinion for the traditional ISI data and partly to see if the web can generate evidence of wider use of research including informal scholarly communication and for commercial applications as an important amount of webometrics research has also evaluated commercial search engine.

d) Measuring Web 2.0

The current version of the Web has progressed in a relatively new direction which provides an interactive and collaborative environment and has developed the content of the Web through the feedback of its users which is known as Web 2.0 (Singh & Singh, 2013). In Web 2.0, Web sites are mostly determined by consumer content-blogs, Wikipedia and social network sites, particularly in the context of data mining. It should be possible to extract patterns such as consumer reactions to products or world events. To deal with these issues, software has been developed by IBM (Web Fountain), Microsoft (Pulse), etc.

A good example of a research initiative to harness Consumer Generated Media (CGM) is attempt to envisage sales patterns for books based upon the volume of BLOG discussions of them (as compared to reviews) (Rao, 2010).

e) Cybermetrics

Cybermetrics is one of the newly emerged fields in the line of metric studies. It has achieved much popularity since the mid-1990s with the advent of information technology. As it is mainly concerned with the computer science-based approaches, it has outdated all the other metrics studies in the Internet era. Cybermetrics is proposed as the generic term for:

> "*The study of the quantitative aspects of the construction and use of information resources, structures and the technologies on the whole internet drawing on Bibliometric and Informetric approaches"*.

Cybermetrics thus includes statistical studies of discussion groups, mailing lists and other Computer-mediated communication on the internet including WWW. Moreover, covering all the computer-mediated communication using internet applications, this definition of Cybermetrics also covers quantitative measures of internet backbone technology, topology, and traffic. The breadth of coverage of cybernetics implies large overlaps with reproducing computer-science-based approaches in analyses of web content, link structure, and web usage and web technologies (Sangam, 2008). Relationship between the Bibliometrics, Scientometrics, Informetrics, Webometrics, and Cybermetrics has been highlighted under the following diagram:

Where,

A - INFORMETRICS

B - BIBLIOMETRICS

C - SCIENTOMETRICS

D - CYBERMETRICS

E - WEBOMETRICS

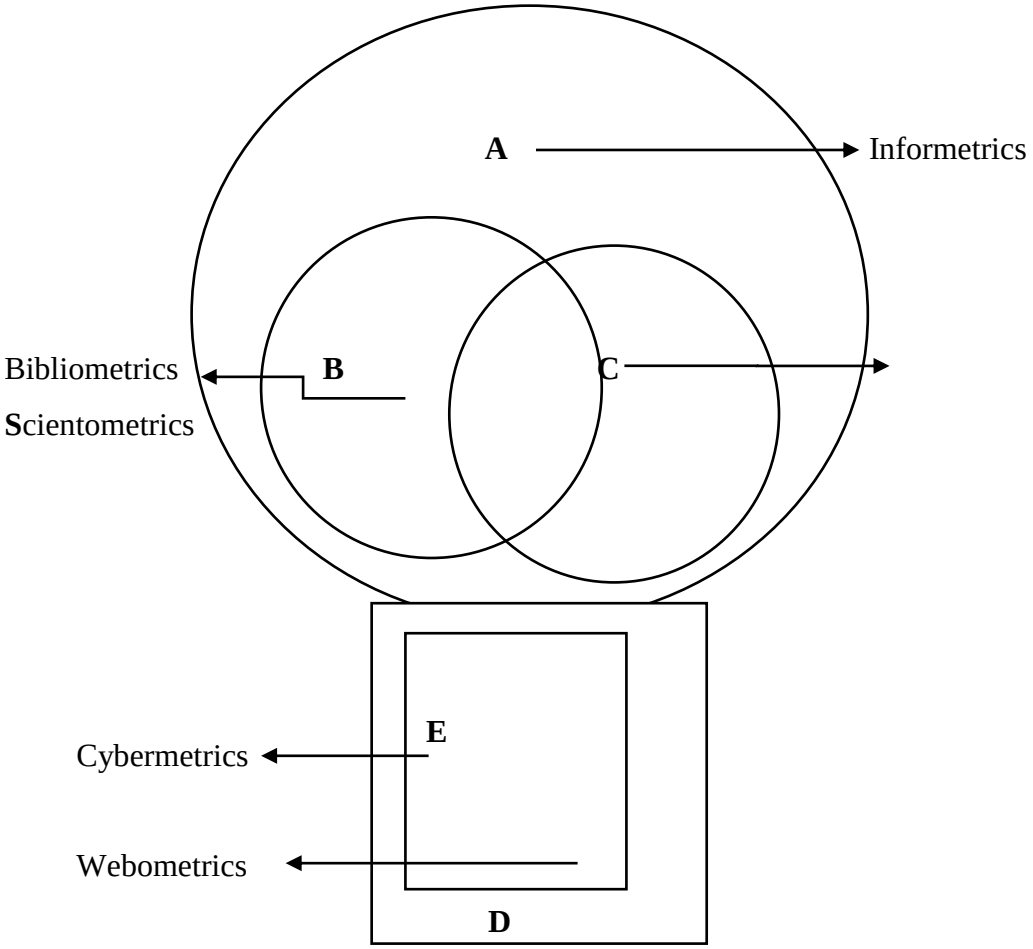

Fig. 2. Relationship between the Bibliometrics, Scientometrics, Informetrics, Webometrics, and Cybermetrics

3.11 Conclusion

It could be observed from the above discussions that multiple parameters are associated to judge the citation analysis. The Citation analysis which reveals the use of literature in the scholarly literature is well described through the different Bibliometric laws and this has become a pragmatic area of research to

ascertain citation which includes journal article, author, etc. The citation measures which include the impact factor indicate the strength of the journal referred by the user in their scholarly output. Like impact factor, other measuring tendencies like Eigenfactor metrics, Eigenfactor Score also equally contribute to deduce the strength of the journal. Moreover, the H-index also reasonably contributes the scientist's productivity in different fields of research. The overall discussion helps the library system in developing user-based collection development to meet the various requirements to promote research and development including facilitating the researchers with multiple resources.

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CHAPTER 4: BIBLIOMETRIC LAWS AND INDEXING

Chapter Plan

CHAPTER 4
BIBLIOMETRIC LAWS AND INDEXING

4.1 Introduction

Research field and Information technology development are incessant progress in the Science and Technology of any nation. Amenities should be made available to Scientists engaged in carrying out their scientific activities. The substantial growth of literature in the field of Library and Information Science has excited the Scientist in the field to have intensive studies. The growth of literature in a subject desires a quantitative analysis for its better production. The research output of these scientists can be seen in the form of experiments they bear out and results have arrived in their experiments. Research productions are available in the form of research articles published in Journals, International and National Periodicals and Papers presented in various Symposia, International and National Conferences. Assessing published or semi published literature, Bibliometric studies are carried out as it is referring to the science of measurement relating to the books.

In the process, the bibliometricians have approved certain empirical laws and models out of which, quite a few of them are mere speculation than anything else. When Hulme in 1923, used the term Statistical Bibliography, he used to mean the enlightenment of the process of Science and Technology by means of counting documents. There are two types of Bibliometric studies namely, Qualitative and Quantitative. The Qualitative Studies are based on the three basic laws which are identified as Bradford's Law of Scattering, Zipf's Law of Frequency of Words and Lotka's Law of Productivity of Authors. The other study i.e. Quantitative Study is

based on the citation analysis and employs to quantify the literature published during a particular time (Sinha & Dhiman, 2001).

The Bibliometric laws assist in understanding some of the information phenomena and help in proper planning of library activities, as they specify certain basic patterns and relationships that govern information items and activities.

Abraham Bookstein (1977, cited in Hertzel, 2010) has set stipulations for laws,

> *"When a new law is proposed, it may be reasonable to demand of it, on intuitive grounds, that it remain true under a variety of circumstances differing from those in which it was discovered. Should it satisfy these demands, we may increase the validity of the law; if it does not, and yet we still wish to maintain the validity of the law, we ought to feel an obligation to explain the discrepancy".*

The laws of nature have two basic outlines such as,

1) Universal

Law, which is universally provided is found together with certain other conditions; and

2) Probabilistic

Probabilistic affirms the average if, a stated fraction of cases displaying a given condition reveals certain other conditions as well. In either case, a law may be valid even though it gets hold of only under special circumstances or as a convenient approximation. Besides, a law of nature has no logical requirement; rather, it rests directly or indirectly upon the evidence of experience (Ralte, 2012, p.34-35).

Contrasting to the Laws of nature, Bibliometric laws are empirical laws and employed simple mathematical statements and graphical devices to express the empirical relation between sources and the items they turn out in three areas: authors producing papers, journals producing papers on a given subject, and texts producing words with a given frequency. Their common denominator is a striking inequality in the pattern of the information processes under surveillance: a few authors turn out to be responsible for the largest portion of scientific literature in a specified research field; a few scientific journals seem to focus the literature required to satisfy their needs; and a relatively small number of recurring word units preside over their (and not only their) linguistic habits (De, 2009).

The objectives of such empirical studies other than the description of the empirical phenomena are recognized through laws and theories, general principles by which empirical phenomena can be better elucidated. An empirical law engaged at least two variables representing a minimum of 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 assessable in the same scale, otherwise, a and bx cannot be added together (Rao, 1988, p. BBL24, cited in Ralte, 2012).

4.2 Theoretical Outlook of Bibliometric Laws

The inconvenience of the present library and Information Centres are the short of adequate space, insufficient budget provision, and increase in the rate of production of a variety of documents and the unprecedented hike in prices of documents. As a result, the quality of the library collection is gradually deteriorating and ultimately affecting the services of the library. However, the librarians have to play an immense responsibility in this context. They have to adopt some determined

policy of choosing the best documents so that the most important and up to date information can be brought to the notice of their clientele with their limited library budgets. The librarians have to develop appropriate collection development policies so that they can administer the situation.

The application of the bibliometric techniques in selecting the most relevant documents on any field is a well-established device. Pritchard first used the term Bibliometrics and described it as all studies which try to find out to quantify the process of written communication. Bibliometrics has instructed the concentration of numerous individuals in the library and information science. The measurement of bibliographic information presents the promise of providing a theory that will determine many practical problems. It is affirmed that patterns of author productivity, literature growth rates, and related statistical distributions can be used to assess authors and disciplines as well as managing collections.

Organizing and counting scientists, books, papers, and citations, as early statistical bibliographers set out to do, remain a fairly extemporary activity as long as data sustained to be examined outside a mathematical framework that would let them reveal meaningful patterns in the documentation process. The turning point, or at least the introduction to a turning point, occurred between the 1920s and the 1930s when three basic bibliometric studies were published namely Lotka's Law, Bradford's Law and Zipf's Law where,

Lotka's Law works on the distribution of scientific papers among authors, Bradford's Law contribution on the scattering of papers on a given subject in scientific journals and Zipf's Law works on the distribution of words in a text (De, 2009, p.75).

Bibliometric Laws usually quantifies the use of documents in a library or in an information Centre. They can be used as a device to study the library problems and its results can be used for making a variety of library policies and management studies. Bibliometric Laws are mathematically correlated to each other, not unlike the very relationships each law seeks to find out. Like Physical Laws, they seek out to explain the functioning of a system by mathematical means. Besides, all these laws can be applied to World Wide Web content and in ascertaining patterns of Web usage.

There are three (3) basic laws of Bibliometrics namely Bradford's Law, Lotka's Law and Zipf's Law which are enumerated below:-

4.2.1 Bradford's Law of Scattering

Samuel Clement Bradford was a very strong-minded and dedicated person who is very evident in his writing. His thinking was definitely influenced by Paul Otlet and Henry La Fontaine, who organized the First International Conference on Bibliography held in Brussels in 1895. The topic of the conference was the need for international cooperation to develop a universal index which would identify the requirement of a standard subject classification to be backed by a central universal library. The idea was loyally supported by Bradford, as shown in the following.

In 1927 "Bibliography by Cooperation" emerges in Library Association Record (LAR). Here Bradford points out his concern for the speed up the accumulation of "useful scientific and technical literature" and repeats the need for "bibliographical work. . . [to] be brought together" by the use of one system of classification "as an index to all the papers that relate to a particular subject of study,

no matter when they were written". Because "Every bureau indexes or abstracts papers that are done by other bureaux, and only a portion of the literature is covered," he assumed a universal classification system would get rid of repetition or classifying the same articles, use items, not catalogue, and thereby save time, information, and money, and provides better service.

He integrated with his paper a list of science subjects and the number of bibliographic references for each to alert the readers as to what the Science Library, to develop into an "information service covering the whole field of Science and Technology". At that time, Bradford declared the number of references assembled, covering many aspects of science and technology, as 1, 212,700.

This article was followed by Bradford's "The Necessity for the Standardisation of Bibliographical Methods" in which Bradford explained the Science Library's method of classification and again stressed the requirement for cooperation. By the time of the introduction of the paper, a form of interlibrary loan already had been practiced for 2 years by the Science Library, with requests having arrived from a number of other countries.

In 1934, Bradford's an article enclosing his law was printed. Again he wrote about the number of articles abstracting and indexing journals showing his continuous concern about wasted money and skills brought about by duplication of effort. He stated that "although the 300 abstracting and indexing journals notice 759,000 articles each year...only 250,000 different articles are dealt with and 500,000 are missed". His anxiety was shared by Ernest Lancaster-Jones, assistant keeper in the Science Museum. As a result, "A statistical analysis was made of the references in two quarterly bibliographies compiled in the science Library, i.e. the *Current Bibliography*

of Applied Geophysics and the *Quarterly Bibliography of Lubrication"* by Lancaster-Jones, a qualified mathematician who also "had received recognition as an expert in applied geophysics". Bradford, using the data, developed gradually his "law" (Hertzel, 2010).

The process Bradford used was this: For every two subjects, geophysics and lubrication, a table was made, listing "number of journals producing a corresponding given a number of references" and each growth. It seems that such a list of subjects and the number of references for each, plus a very limited budget and a heartfelt desire to give exceptionally good library service would cause an active and curious mind, such as Bradford's, to wonder about the actual number of journals needed for coverage.

One of Bradford's hypotheses was that

> *"References are scattered throughout all periodicals with a frequency approximately related inversely to the scope. On this hypothesis, the aggregate of periodicals can be subject concerned, but the more remote classes will, in the aggregate, produce as many references as the more related classes"* (Hertzel, 2010).

Observations of the tables showed three "rough" zones or grouping which Bradford graded as:

1. Those producing more than 4 references a year.
2. Those producing more than 1 and not more than 4 a year.
3. Those producing 1 or less a year.

Bradford found:

> *"The groups thus produce about the same proportion of references in each case, and the number of constituents increases from group to group, by a multiplier which, though by no means constant, approximates fairly closely to the number 5, especially for the two larger groups"* (Hertzel, 2010).

From his data, Bradford put up two graphs, plotting the logarithms of the cumulated number of journals in relation to the cumulated number of references for each, geophysics and lubrication. He renowned that "the later portion of each curve is remarkably close to a straight line", and observed that

> *"The aggregate of references in a given subject, apart from those produced by the first group of large producers, is proportional to the logarithm of a number of sources concerned, when these are arranged in order of productivity"* (Hertzel, 2010).

With this surveillance in mind, Bradford constructed a second graph or diagram. In this diagram, he used to develop an algebraic relation, but only for the "straight" part of the curve noted originally. From his he assumed his "law":

> *"Therefore, the law of distribution of papers on a given subject in scientific periodicals may thus be stated: if scientific journals are arranged in order of decreasing productivity of articles on a given subject they may be divided into nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the numbers of periodicals in the nucleus and succeeding zones will be as* $1:n:n^2...$ *"* (Hertzel, 2010).

This was the first announcement of what was later to be called the verbal part of Bradford's Law. This usually referred to as Bradford's Law of Distribution of Scattering, "sometimes this regularity is also called the law of dispersal of publications".

Bradford came to the conclusion that

> *"A standard classification must be adopted, so that references to the same subject would be brought together by the classification, irrespective of source or abstracting bureau, when, without an increase of labour, a complete index to scientific literature would be achieved"* (Hertzel, 2010).

In a paper on abstracting and indexing periodicals, presented in 1937 at the ASLIB Proceedings 14th Conference, Bradford told that the information of the analysis "to determine the extent to which scientific papers are scattered in periodicals devoted to other subjects", published in *Engineering* in 1934, were reprinted "in publication No. 1 of the British Society for International Bibliography, 1934" and added, "Only the results need be quoted here".

> *"The law of scattering may thus be stated. If periodicals containing articles on the given subject are arranged in decreasing order of the number of such articles they contain and divided into nucleus of journals more specifically devoted to the subject and zones of periodicals containing the same number of special articles as the nucleus, the numbers of journals in the nucleus and succeeding zones are as 1:N:N^2...where N is about 5 or 6* (Hertzel, 2010).

In his first article Bradford employed the value of 5. In the discussion which pursued his presentation, Bradford admitted:

> *"The whole object of the elaborate statistical investigations reported in this paper is to prove beyond any question that quantities of important scientific papers are neither abstracted nor indexed. This is one of the main reasons why so much time and expense is being wasted in duplicating previous work. The other main reason is the adoption of archaic alphabetical methods of indexing, which hide the information and prevent it from being found. The adoption of standard methods would go far to remove both these defects"* (Hertzel, 2010).

The International Federation for Documentation in 1946 published Bradford's "Complete Documentation in Science and Technology" which Bradford presented at Paris in the 16th Conference. Bradford presented another time the statistics he used in "Sources of Information on Specific Subjects". He repeated his explanation on the "law of distribution" as given in his previous papers and again holds up the use of the Universal Decimal Classification. A synopsis of this paper was moreover printed in the *Nature* of January 1947.

Two more of his publications are simply mentioned here: "Complete Documentation" presented at the 1946 Royal Society Empire Scientific Conference while Bradford was president of the British Society for International Bibliography, and his book *Documentation* first published in 1948. In both cases, Bradford utilized the same statistics he had used in his paper which first offered his law. The statistics were principally used to support his ideas about the cooperative, universal classification; the law was a natural outcome of Bradford's wish to give added proof and credibility to his reliable conviction (Hertzel, 2010).

The study of the Bradford law has until now been concerned with theoretical models that are too static, too deterministic and too physical. All Bradford

data are derived by examining the *activities* of a set of sources over some appropriate period and by noting these activities, as calculated in terms of the numbers of items each source accounts for at that time.

Thus, the Bradford law is concerned with:

- A finite set of active sources (an ensemble) whose activities are made manifest by the generation or consumption of a specified type of item.
- Observation of those activities over a specific sampling period.
- Items of some homogenous kind those are discrete and countable.

One of the points that have so far escaped analysis is the fact that the statistical distributions of such collection of activity must depend on relationships between the number of active sources, the range, and intensity of their activities, and the period of observation which offered the sample data. All Bradford distributions are samples of some ongoing activity but, all too often, the sample data have been observed as constituting a total population (Hertzel, 2010).

4.2.2 Lotka's Law of Scientific Productivity

Alfred J. Lotka was a mathematician and supervisor of mathematical research from 1924 to 1933 in the Statistical Bureau of the Metropolitan Life Insurance Company. It was during this time, 1926, that his definitive work, later called Lotka's law was formed. His inquiry was a productivity analysis. Counting names and the number of publications listed for each, the exposure was for only A and B names in *Chemical Abstracts* for 1907 to 1916 and for Auerbach's *Geschichtstafeln der Physik* from its beginning through 1900. The data were tabulated and plotted, from

which Lotka build up a "general formula for the relation . . . between the frequency *y* of persons making *x* contributions" as $x^n y = const$".

Finding the value of the constant when $n = 2$, he scrutinized that:

> *"The number of persons making 2 contributions is about one-fourth of those making one; the number making 3 contributions is about one-ninth, etc.; the number 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"* (Hertzel, 2010).

Observing that Lotka's observation deals with the least number of productions

> *"Since the publication of Lotka's original article in 1926, much research has been done on author productivity in various subject fields. The publications arising from this research have come to be associated with Lotka's work and are often cited as proving or supporting his findings. However, a review of this literature reveals that Lotka's article was not cited until 1941, that his distribution was not termed 'Lotka's Law' until 1949, and that no attempts were made to test the applicability of Lotka's law to other disciplines until 1973"*(Hertzel, 2010).

Based on his data, he proposed an inverse square law of scientific productivity:

$$Y_x = \frac{ß}{x^a / n^2}$$

$a > 0$

$x = 1, 2, 3 \ldots$

where, Yx is the relative frequency of authors publishing *x* papers; the value of *a* is found to be 1.89 for chemist and 2 for physicist.

If N is the total number of authors, NY_1 in Lotka's equation gives the number of authors who have published a single paper each. Thus, Lotka's equation is influential in its general form by three parameters:

1) The number of a scientist with minimal productivity (authors with single paper each...NY_1)
2) The maximal productivity of a scientist (X_{max})
3) The characteristic exponent (Kumar, 2002, p.932).

Lotka's equation can also be written in the following type:

$$Yx = \frac{k}{x}$$

$x = 1, 2, 3, 4. . .$

$$k = \frac{6}{n^2} \qquad \text{for } a = 2$$

Thus, Lotka's equation proposes that the portion of single authors [*k*] is a function of *a*, that is:

$$K[a] = \left(\sum_{x=1}^{X_{max}} \frac{1}{X^a} \right)^{-1}$$

This implies that the increase of *a* is accompanied by the increase of low productive scientists. This entailed that forgiven N and for a large value of *a,* the position of highly productive scientists will decrease. Therefore, one can dispute that the large the parameter, the greater is the gap between the productivity of individual groups of scientists. In this sense, it is regarded as a measure of inequality in the distribution of scientific papers (Kumar, 2002, p.933).

4.2.3 Zipf's Law of Word Occurrence

The most influential, wide-ranging law of bibliometrics is Zipf's Law. In his book *Human Behaviour & The Principle of Least Effort*, George Kingsley Zipf describes the essence of what became known as his law, called The Principle of Least effort, as "the primary principle that governs our entire individual and collective behaviour or all sorts, including the behaviour of our language and preconceptions" (Zipf, 1949 cited in Chao, Detlor & Turnbull, 2001, p.139). Zipf is saying that the main forecaster of human behaviour is that we always endeavour to minimize our effort. Therefore, Zipf's work applies to almost any field where human production is concerned. He notes that his principle proves that a person will

> *"Expand in solving both his immediate problems and his probable future problems which in turn means that the person will strive to minimize the probable average rate of his work-experience (over time) and thus, minimizes the effort. Least effort, therefore, according to him is a variant of least work"* (Zipf, 1949, p.1, cited in Chao, Detlor & Turnbull, 2001, p.139).

He also found that,

> *"The distribution of words in English approximates with remarkable precision a harmonic series . . . an unmistakable progression according to the inverse square, valid for well over 95% of all the different words used in the sample"* (Zipf, 1935, cited in Hertzel, 2010, p.567).

Zipf wrote a number of books "On the theory and application of his principle of relative frequency in the structure and development of language". In his first thesis, *Relative Frequency: A determinant of Phonetic Change*, available in the Harvard Studies in Classical Philology in 1920, Zipf wrote:

> "*Observing the speech of many hundreds of millions of people, we have demonstrated, in part actually, in part by induction, that the conspicuousness or intensity of any element of language is inversely proportionate to its frequency. Using X for frequency, and Y for conspicuousness (rank) we can express our thesis".*
>
> Thus: $Y/X = n$ or $XY = n$
>
> where, *n* is some constant, the actual size or value of which needs to be our immediate concern (Zipf, 1929, cited in Hertzel, 2010, p.568).

Zipf also functionalized his principle to other aspects of communication, from the distribution of population sizes among towns and cities to the number of newspapers and to the balance of types of equipment and work.

Originally, Zipf's law basically envisages the phenomenon that familiar words with high frequency. In order to minimize attempt in remembering or alternating similar word use, we tend to keep using the same words and phrases continually in a document. Particularly, for a distribution applied to word frequency in a text, a word's rank *r* occurs *f* times (frequency) where *c* is the constant for the text examined. This provides us the formula which is

$r \times f = c$.

Pro analysis can be functionalized by counting all the words in a document with the most frequent occurrences representing the subject matter of the document. We could also employ relative frequency as a replacement for an absolute frequency to determine when a new word is entering a vocabulary.

But, what makes Zipf's law so outstanding is its use in other fields as well. In fact, the common applicability of Zipf's Law can paradoxically be used to prove itself. Being so extensively known, it is widely used, possibly, so much so in

meaningful, that is becoming the bibliometric law used and referred through the highest frequency by far. Zipf points out

"That individuals will at times try to minimize effort, then it follows that the reason for their buying and reading newspapers is that such conduct is an economical method of learning of those events in their environment that may be of positive or negative value for their particular economies . . . in order to lure these potential buyers into the paper's reader population for the sake of increasing the circulation, the editor must increase the diversity of his news items".

This can be relevant to more than just newspapers and it could be any information source. The World Wide Web is truly spread out and not limited by page size (as Zipf was concerned through print), but financial resources limit the amount of any one organization can publish. For example, Huberman et. al. (1998) indicates that an empirical study of Web use that there are Zipf-like distributions in path lengths (i.e. the number of characters in the Web page's URL) and page visits to sites on the World Wide Web (Chao, Detlor & Turnbull, 2001, p.140).

4.3 Bibliometric Indicator

Bibliometric Indicator like Self-citation, co-citation analysis, bibliographic coupling, and co-word analysis have been discussed under the following: -

4.3.1 Self-citations

a) Journal self-citation

It means the citation of the journal-title in the same publication by the same or different authors (Schubert & Braun as cited in Glanzel, 2003). "Journal self-citations are citations of previous papers in the same journal. Since the cited object in

journal self-citations in the paper, not the author, journal self-citations are different from other kinds of self-citations, which are related to the author's country, affiliation or research team. The characteristics and patterns of journal self-citation may completely differ from those of author self-citation. An author may never cite their own previously published papers, and yet still cite others' papers published in the same journal, creating an incidence of journal self-citing without author self-citation" (Huang & Cathy, 2012).

b) Author-self citations

It means the citation of the bibliographical details of the published article by the author in the subsequent publications (Glanzel, 2003; Cronin, 2001, p.15).Author self-citation refers to citing one's previous publications in a new publication. Author self-citation exists when the citing and cited papers have at least one author in common. Although authors may have good reasons to cite their own works, these citations do not necessarily reflect the importance of their work or its impact on the rest of the scientific community (Fowler & Aksnes, 2006 cited in Davarpanah & Amel, 2009).Author self-citations may misrepresent the importance of individual articles, skew the calculation of journal impact factors, and bias perceptions of the importance of a publication (Davarpanah & Amel, 2009); Mohammad, R. D. 2009).

c) Social citation

The earlier document is written by a friend, colleague, co-author, mentor, or student of the author of the later one, or by an editor or a referee of the journal to which the later document is to be submitted (Borgman & Furner, 2002).

In other words, Social citations refer to storing, sorting, classifying, sharing and searching through a collection of internet-based bookmarked links of citable sources such as e-journals, news articles, academic studies, and interviews. Social citations function similarly to social bookmarking sites but are intended to be used for the collection of academic and citable resources. Social citation sites function by using an application or website to bookmark a piece of information and store it on the internet for personal use, to share with a friend or group, or for public viewing. These citations can be tagged and organized into predefined categories or into a new category as defined by the user. The tags of all users are compiled together in order to create a searchable folksonomy of information within the social citation site. This allows academics researching or interested in similar areas to connect and share resources.

Some popular social citation applications and websites include:

- BibSonomy
- Citeline
- CiteULike
- EasyBib
- Endnote
- Mendeley(http://citt.ufl.edu/tools/social-citations/, 2018)

d) Language self-citation

The earlier document is written in the same language as the later one (Yitzhaki, 1998 as cited in Borgman & Furner, 2002).

e) Nationality self-citation

The earlier document is written by an author of the same nationality as that of the author of the later one (Herman, 1991as cited in Borgman & Furner, 2002).

4.3.2 Bibliographic coupling

The concept of bibliographic coupling occurs when two articles are having a minimum one common reference (Hirsch, 2005). Bibliographic Coupling links the source documents and gives a trace to an information scientist about the relatedness of two documents. Clustering of literature based on bibliographic coupling gives up a meaningful collection of papers within a field and it is of immense value in computerized information retrieval, indexing, and preparation of subject bibliographies (Sharada & Sharma, 1993).

4.3.3 Co-Citation

It means that when two documents both appear in the reference list of a third document (Hirsch, 2005). Co-citation analysis involves tracking pairs of papers that are cited together in the source articles indexed in ISI databases. When the same pairs of papers are co-cited with other papers by many authors, the cluster of research begins to form. The co-cited or "core" papers in these clusters tend to share some common theme, theoretical or methodological or both. By examining the titles of the *citing* papers that generate these clusters we get an approximate idea of their cognitive content. That is the citing authors provide the word and phrases to describe what the current research area is all about. The latter is an important distinction, depending on the age of the core papers (Garfield, 1993).

4.3.4 Co-word analysis

It is the study of the co-occurrence of the keywords used to index articles and other documents (Ungern, 1995). Co-Word analysis reduces and projects the data into a specific visual representation with the maintenance of essential information containing into the data. It is based on the nature of words, which are the important carrier of scientific concepts, ideas, and knowledge (Van Raan & Tijssen, 1993 as cited in Ding, Chowdhury & Foo, 2001).

4.4 Major Components of ISI Published Indexes

4.4.1 Citation Index

It is arranged alphabetically by cited author and lists all citations made during the current calendar year to an author's works published during any year (Balakrishnan & Paliwal, 2000). The Citation Index, lists by the first author, year of publication, and journal-title and location (volume and pagination) every published and unpublished work cited in the references of articles published by the SCI's source journals during the year. Under it are listed the bibliographical data needed to identify any paper published during the year that cited the earlier work. Cited articles are listed by the name of the first author only. Then, beneath that, by year, then cited journal, volume, and page number. Multiple articles citing the same paper are listed alphabetically by author's name. "In Press" publications appear before specifically cited papers. "Anonymous" publications are grouped together (Gupta, Jha & Mishra, 2004).

4.4.2 Source Index

The Source Index provides full bibliographical record for the documents indexed in SCI- the other parts or indexes of SCI refer back to Source Index for complete record identification or information. The bibliographical record or entry in SCI includes the names of first and joint authors, the full title of the article (or an English translation of titles in other languages with a code for the original language), journal title, volume, issue, pagination, number of references, the address of first author, and nature of the item (original article, letter, book review, abstract, correction, etc.). Full entries are given only under the first author's name with cross-references from the other authors. Author names are listed by the last names and initials only. Journal names are highly abbreviated, using ISI's own abbreviations (Gupta, Jha & Mishra, 2004, p.3).

4.4.3 Corporate Index

It lists source articles in the first author's institutional problem (Balakrishnan & Paliwal, 2000). The corporate index consists of two sections- Geographic and Organization. The Geographic section is a primary index and it is arranged by location (country or state and then city) followed by the Institution of the author's organization. Under the organization entry, the name of the first author is listed with the journal-title abbreviation, volume, page and year of the source article published – Full bibliographical information for each article is found in the Source Index under the first author's name (Gupta, Jha & Mishra, 2004, p.3).

4.4.4 Permuterm Subject Index

It offers subject access and imply the annual accumulates fill numerous volumes, with the precise number varying from year to year (Balakrishnan & Paliwal,

2000). It is called a natural language index because it uses current language (terminology) in the form of words from the title of articles listed in the Source Index, as subject headings. If a given term or word appears in several documents, then co-terms from the titles are listed below (as sub-entry) to sub-divide the main subject heading. Very common or uninformative terms may not appear as primary terms but may use as co-terms. Terms, which frequently go together, may be listed as a hyphenated phrase, e.g. amino-acid or magnetic-resonance. Some terms have "see" or "see also" references to related terms. The user matches up main-entry and sub-entry words for quick reference leading to relevant author's first name. Full information may then be obtained from Source Index, as described already (Gupta, Jha & Mishra, 2004, p.3).

4.5 Commonly used Indexing Techniques

4.5.1 h index

Hirsch's (2005) *h* index depends upon both the number of a scientist's publications and the impact of the papers on the scientist's peers. "A scientist has index *h* if *h* of his or her N_p papers have at least *h* citations each and the other (*Np-h*) papers have fewer than $\leq h$ citations each" (Hirsch, 2005, p. 16569). In other words, it is a way to quantify the productivity and impact of an individual author. Similar to how the Impact Factor is now be used to measure a journal or an author to their scientific field, the h-index has become another measure of the relative impact of scientific publications. While the Impact Factor is derived from the quotient of total citations and total papers in a two-year span, the h-index is simply a count of the largest number of papers (h) from a journal or author that has at least (h) number of citations. For Example, Libri Journal has an h-index of 25 based on Google Scholar,

which indicates that the journal has published 25 papers with at least 25 citations (Noruzi, 2016).

4.5.2 h(2)-index

It is defined as the highest natural number such that his *h(2)* most-cited papers received each at $[h(2)]^2$. The *h(2)* index can be established by looking at the list of papers of an individual ordered by a number of citations in Thomson Scientific Database. The *h(2)* index is roughly proportional to the cube root of the total number of citations (Kosmulski, 2006).

4.5.3 b-index

A novel and simple way of correcting h-index values to remove self-citations have been proposed. This is referred to as the b-index. This method avoids the laborious process of removing self-citations from individual publications. The b-index for an author is simply equal to the integer value of the author's external citation rate to the power three quarters, multiplied by their h-index. While this method provides a useful and efficient shortcut, it is hoped in the future that the ISI Web of Science database will provide h-indices without self-citations as an extra functionality – the Scopus database (Scopus, 2009) already offers an h-index without self-citations (Brown, 2009).

4.5.4 e-index

Using *h-index,* the only citation information that can be inferred is h^2 i.e., at least h2 citations have been received, and additional citations for papers in the h-core are completely ignored. Therefore e-index was defined to complement the h-index for the ignored citations (Zhang, 2009).

4.5.5 m quotient

Hirsch proposed by dividing the *h* index by a number of years of research activity since a scientist's first publication and called this quotient *m* (Bornmann, Mutz & Daniel, 2010, p.3).

4.5.6 g index

The highest number *g*ot papers that together received g^2 or more citations" Egghe (as cited in Bornmann, Mutz & Daniel, 2010, p.3).

4.5.7 Original Research Publication Index

An index that gives weight to the originality, productivity, and visibility of the publications is called Original Research Publication Index. It is claimed to negate the influence of self-citation and gift authorship. The index needs to be validated and accepted as a bibliometric indicator by the scientific society (Joshi, 2014).

4.5.8 i10 index

A Google-defined metric, the i10 index is a measure of "the number of articles with at least ten citations" (Google, 2010). The i10-index indicates how many items in the result list were cited at least ten times, which is a new "hint" for getting a feel about the productivity and citedness of the author (Jacso, 2012). It is the latest in the line of journal metrics and was introduced by Google Scholar in 2011. It is simple and straightforward indexing measure found by tallying a journal's total number of published papers with at least 10 citations (Google Scholar Blog, 2011 as cited in Noruzi, 2016 p.3).

4.6 Conclusion

Various Bibliometric laws have been promulgated by the scientists to measure the bibliography which establishes scientific communications to the future researchers. The laws specify their implications such as measuring the scattering of journals, scientific productivity, and word of occurrence. The laws extend the strength of productivity of the journals which also can be well applied to measure the use of web through statistical measures. Regularly in the history of science, the pursuit of certainty and sound theoretical foundations are satisfied by the decreasing of a complex matter to a small set of basic principles from which specific statements are subsequently derived through logic or mathematical reasoning. This occurred constantly from the 1970s onward, bibliometricians hunted to reveal that, under certain conditions, the laws of Lotka, Bradford, and Zipf are mathematically equivalent, that an exact relation between the corresponding parameters can be given, and that, in the last analysis, they can be described in a mathematical sense on the basis of more basic principles, whether in a stochastic or a deterministic fashion. Further frequently than not, such descriptions rely on real numbers and real analysis techniques, remarkably integration and differentiation, which provide a mathematical approximation to the distinct reality of informetric data which is authors' ranks are natural numbers, and so are productivity and citation scores.

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CHAPTER 5: DATA ANALYSIS AND FINDINGS

Chapter Plan

CHAPTER 5
DATA ANALYSIS AND FINDINGS

5.1 Introduction

Analysis of data is the concluding step in the research process which links between raw data and momentous results leading to conclusions.

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 institution. All the bibliographies appended in the 83 number of theses covered under study were photocopied which comprise a total number of 12707 citations. All the citations i.e., 12,707 were tabulated into 8 different categories for analysis and the retrieved documents comes to 1, 01,656 data. The Microsoft-excel was used to draw the statistical inferences of the data.

Data collected from all the 83 Ph.D. theses during 2006-2015 were classified, tabulated and analyzed to:

- ⇨ Find out the core list and ranking of journals both print and electronic central to Library and Information Science.
- ⇨ Preparing link analysis of the cited electronic journals used by the scholars in their theses after confirmation through Web of Science, Scopus and Google Scholar databases.
- ⇨ Recognize the core authors and/or group of authors in the Library and Information Science.
- ⇨ Ascertain the obsolescence of literature especially in the print domain.

⇨ Test the data with Bibliometric laws like Bradford's Law of Scattering, Lotka's Law of Scientific Productivity and Zipf's Law of word occurrence.

5.2 Establishment of the Department of Library & Information Science in North-East India & Research Output

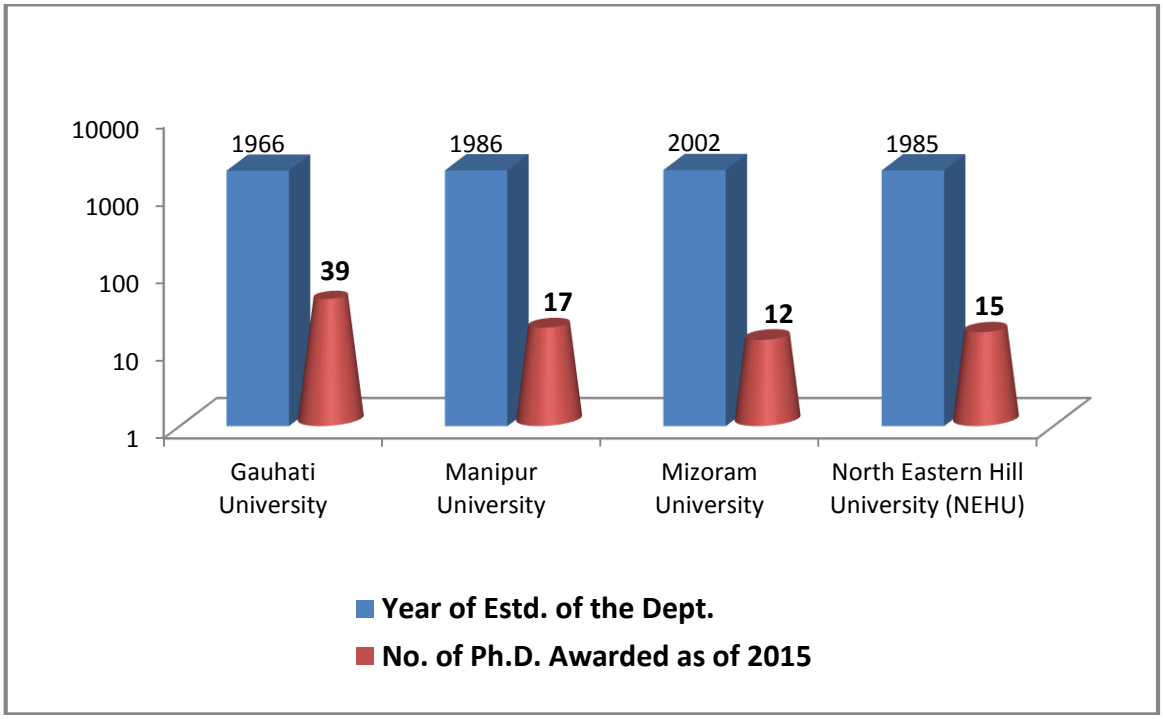
The establishment of every institution results in the quality as well as quantity of research output and therefore, a scientific approach relevant to the study has been highlighted about the establishment of the department of library and information science in North East India along with the award of Ph.D. in the discipline in Table-6. Table-6 not only reveals the alphabetical presentation of the establishment of the Department and its establishment year but also the number of Ph.D. awardees till 2015 and it is supported with Graph 1 for better visualization.

Table-6: Establishment of the Department and institution wise Research Output

Sl.No	Name of the University	Year of Estd. of the Dept.	No. of Ph.D. Awarded as of 2015	% *
1.	Gauhati University	1966	39	46.99 or 47
2.	Manipur University	1986	17	20.48 or 20
3.	Mizoram University	2002	12	14.46 or 14
4	North-Eastern Hill University (NEHU)	1985	15	18.07 or 18
		Total	**83**	**100**

(Source: Survey data)

* >.5 has been rounded to the next digit, <.5 has been rounded to the previous digit



Graph-1: Establishment and Institution-wise Research Output

Table-6 reflects the alphabetical establishment of the department of library and information science where, the table further reflects that, the total numbers of Ph.D. awardees from various universities.Table-6 on analysis found that Gauhati University is the first university to commence the Department of Library and Information Science in 1966 followed by North Eastern Hill University (NEHU) in 1985, Manipur University in 1986, Mizoram University in 2002,and Assam University in 2009. The table, on institution-wise contribution of research leading to Ph.D. during the period under coverage further visualized that, Gauhati University stands at the apex i.e., 39 (47%) in conferring Ph.D. degree out of 83 in total followed by Manipur University 17(20%), North-Eastern Hill University (NEHU) 15(18%) and Mizoram University 12 (14%). Though Assam University got its establishment in 2009, it does not contribute any research output leading to a Ph.D. as of 2015.

5.3 Year-Wise Research Output

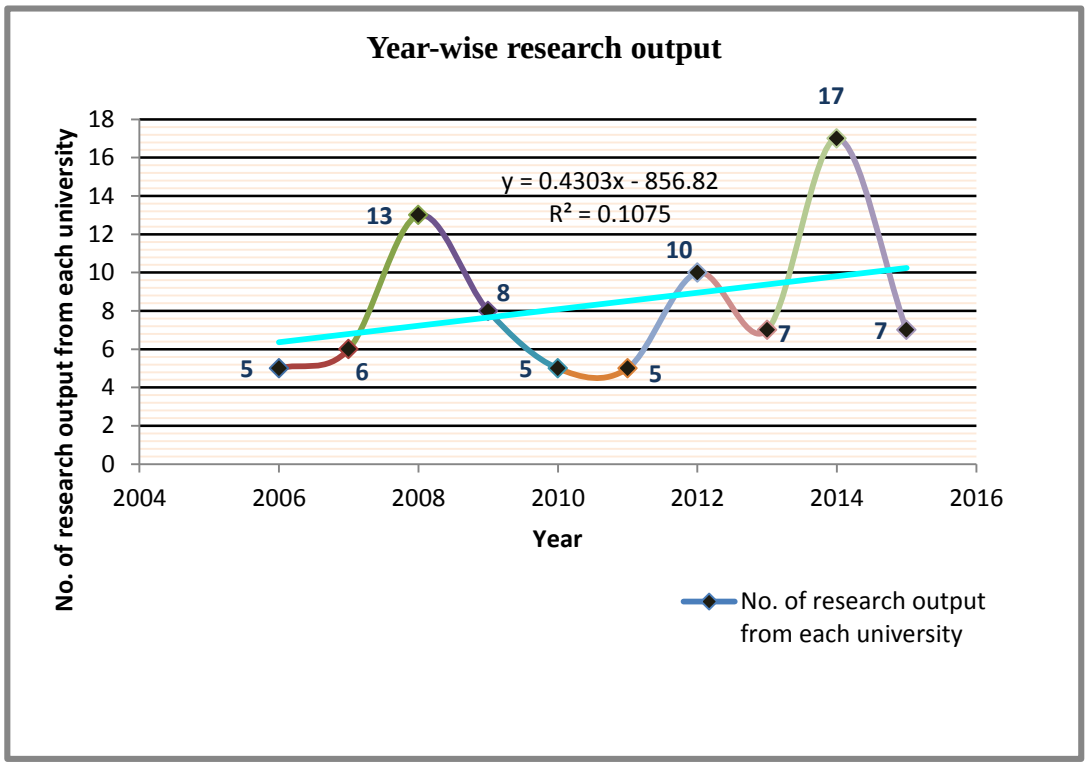
It is pertinent to discuss the year-wise research output of all the 4 (Four) universities covered under the study. Data relating to the year-wise research output of all four universities covered under study is placed chronologically in Table-7 which is supplemented with Graph-2 for a clear understanding of the table.

Table-7: Year-wise Research Output

S/N	**Year**	**No. of research output from each university**	**%***
1.	2006	5	6.02 or 6
2.	2007	6	7.23 or 7
3.	2008	13	15.66 or 16
4.	2009	8	9.64 or 10
5.	2010	5	6.02 or 6
6.	2011	5	6.02 or 6
7.	2012	10	12.05 or 12
8.	2013	7	8.43 or 8
9.	2014	17	20.5 or 21
10	2015	7	8.43 or 8
Total	**10**	**83**	**100**

(Source: Survey data)

Note: * >.5 has been rounded to the next digit, <.5 has been rounded to the previous digit



Graph-2: Year-wise research output

It was found from the Table-7 that a maximum number of theses 17(21%) out of 83 were submitted in the year 2014, followed by 13(16%) submitted in the year 2008, 10 (12%) in the year 2012. The table further reflected that less number of theses i.e.8 (10%) in 2009, 7 (8%) each in 2013 and 2015, 5(6%) each were submitted in the year 2006, 2010, and 2011 respectively. This shows an inconsistency in research output in the departments of the universities under study.

5.4 Cited Forms of Documents

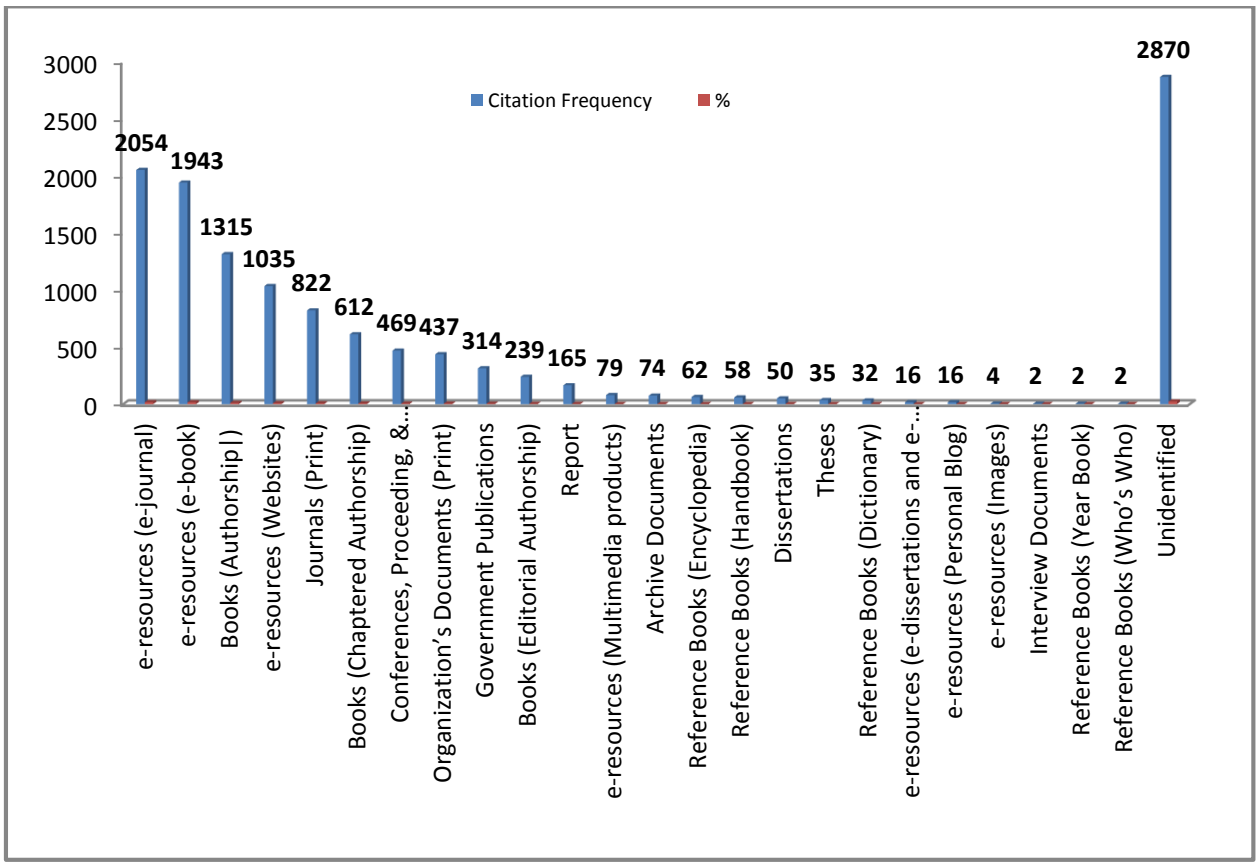
Multiple forms of documents support the researchers, and the students as well to elicit information in the field of their research and or study. Due to the availability of wide information sources, the scholars come across extensive options for choosing the right, reliable and authentic source of information ranging from prints to e-books, e-journal, and the Web. Information regarding most cited forms of documents i.e., 12,707 by the Ph.D. scholars in Library and Information Science of the universities covered under study are placed below in Table-8 and the same is

supported with Graph-3 for clear understanding. The cited documents of the scholars have been classified into 25 categories showing the citation frequency against each category.

Table-8: Cited Form of Documents

Sl. No	Cited Forms of Documents	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	e-resources (e-journal)	2054	16.16	2054	16.16
2.	e-resources (e-book)	1943	15.3	3997	31.46
3.	Books (Authorship|)	1315	10.35	5312	41.81
4.	e-resources (Websites)	1035	8.14	6347	49.95
5.	Journals (Print)	822	6.47	7169	56.42
6.	Books (Chaptered Authorship)	612	4.81	7781	61.23
7.	Conferences, Proceeding, & Workshop Documents	469	3.7	8250	64.93
8.	Organization's Documents (Print)	437	3.44	8687	68.37
9.	Government Publications	314	2.47	9001	70.84
10.	Books (Editorial Authorship)	239	1.9	9240	72.74
11.	Report	165	1.3	9405	74.04
12.	e-resources (Multimedia products)	79	0.62	9484	74.66
13.	Archive Documents	74	0.58	9558	75.24
14.	Reference Books (Encyclopedia)	62	0.5	9620	75.74
15.	Reference Books (Handbook)	58	0.46	9678	76.2
16.	Dissertations	50	0.4	9728	76.6
17.	Theses	35	0.27	9763	76.87
18.	Reference Books (Dictionary)	32	0.25	9795	77.12
19.	e-resources (e-dissertations and e-theses)	16	0.12	9811	77.24
20.	e-resources (Personal Blog)	16	0.12	9827	77.36
21.	e-resources (Images)	4	0.03	9831	77.39
22.	Interview Documents	2	0.01	9833	77.4
23.	Reference Books (Year Book)	2	0.01	9835	77.41
24.	Reference Books (Who's Who)	2	0.01	9837	77.42
25.	Unidentified	2870	22.58	12707	100
	Total	**12707**	**100**		

(Source: Survey data)



Graph-3: Cited Forms of Documents

Multiple forms of documents cater information to the researcher, educationist, and students for research, teaching and study respectively. The students particularly access various forms of documents for different academic purposes. Likewise, the Ph.D. scholars of the departments understudy also access versatile forms of documents as reflected in Table-8 above. While analyzing the forms of documents placed in Table-8, it was revealed that the citation of e-journals which comes to 2054 (16.16%) is the highest followed by e-books with 1943 (15.3%) citations and Print Books with 1315 (10.35%) citations. Thus, in order of ranking, e-journals, e-books, and printed Books are ranked with 1st, 2^{nd,} and 3rd respectively. However, other forms of documents equally contributed significantly as a source of information for their research work. The analysis further found that scholars are more prone to e-journals

due to their latest contents and research output in different fields of their works and this shaped to the most preferred documents.

5.5 Authorship Pattern

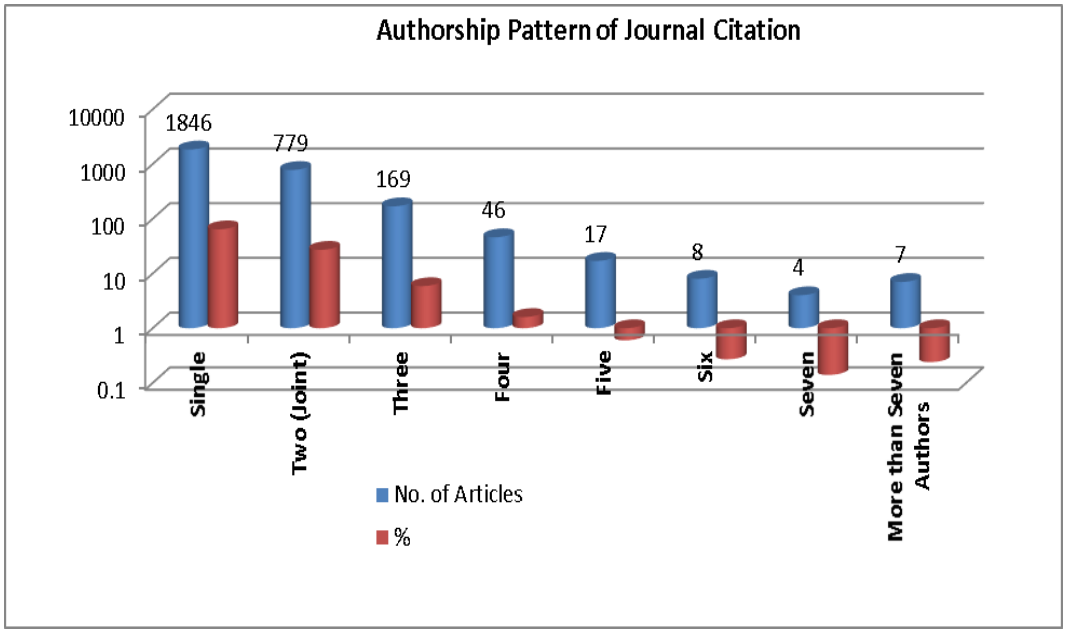
Authors contribute potentially in the domain of research and other academic writings through articles that are available in both print and electronic form. The author, either may be single or joint and or triple or may be more. Data relating to all 2876 citations from 404 Journals appended in all 83 theses covered under study is placed in Table-9 showing the number of articles contributed by the author(s) and its percentage including its cumulative frequencies and the percentage thereto. The Table is also supported with Graph-4 for a clear understanding of the authorship pattern.

Table-9: Authorship Pattern of Journal Citation

Sl No	Description of Author(s)	No. of Articles	%	Cumulative Frequencies	Cumulative %
1	Single	1846	64.20	1846	64.2
2	Two (Joint)	779	27.08	2625	91.28
3	Three	169	5.87	2794	97.15
4	Four	46	1.60	2840	98.75
5	Five	17	0.60	2857	99.35
6	Six	8	0.27	2865	99.62
7	Seven	4	0.14	2869	99.76
8	More than Seven Authors	7	0.24	2876	100
	Total	**2876**	**100**		

(Source: Survey data)

Note: * >.5 has been rounded to the next digit, <.5 has been rounded to the previous digit



Graph-4: Authorship Pattern of Journal Citation

While analyzing the data placed in Table-9 of the authorship pattern, it was revealed that the contribution of articles by a Single author is significantly more which comes to 1846 (64.2%) out of 2876 followed by Two (Joint) authors 779 which forms 27.08% and 169 by three authors that constitute 5.87%. The analysis, further revealed that, among 8 groups, single author, Two (joint) authors, and three authors rank First, Second and Third position respectively while four authors, five authors, six authors, seven authors and more than seven authors are insignificant. This may be due to the fact that the contribution of article by many authors is difficult.

Further, the scholar made a study of the authorship pattern i.e., contribution of all documents to ascertain whether, the authors are single, joint, three etc. While evaluating all 12,707 citations appended in all 83 theses covered under study, the scholar identified 9835 (77.39%) authors while 2870 (22.58%) were unidentified. The total numbers of 9835 authors are categorized into Single author, Two (Joint) authors, three authors, etc. without author (links only) and organization as

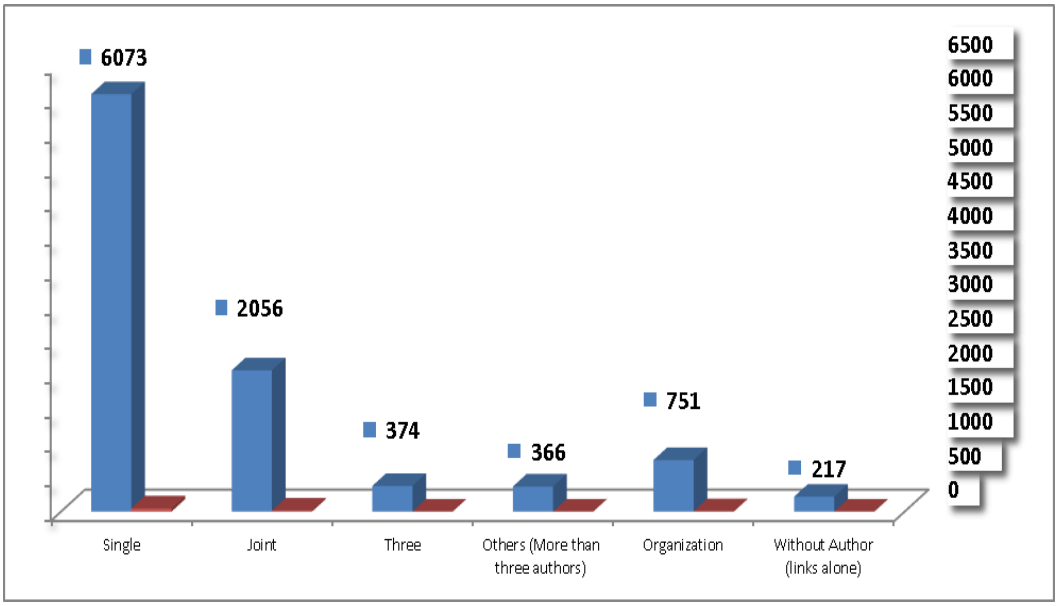
an author and the data of the same is placed in Table-9A. The Table is also supported with Graph- 4A for a clear understanding of the authorship pattern.

Table-9A: Authorship Pattern of all documents

Sl No	Description of Author(s)	Frequency	%	Cumulative Frequencies	Cumulative %
1	Single	6073	48	6073	48
2	Two (Joint)	2056	16	8129	64
3	Three	374	3	8503	67
4	Others (More than three authors)	366	3	8869	70
5	Organization	751	6	9620	76
6	Without Author (links alone)	217	2	9837	78
7	Unidentified	2870	22	12707	100
	Total	**12707**	**100**		

(Source: Survey data)

Note: * >.5 has been rounded to the next digit, <.5 has been rounded to the previous digit



Graph-4A: Authorship Pattern of all documents

While analyzing the authorship pattern placed in Table-9A, it was revealed that the contribution of documents by a Single author is significantly more which comes to 6073 (48%) out of 12707 followed by Two (Joint) authors 2056 which forms 16%, 751 number of organizations as an author that constitute 6%. The analysis further revealed that, among 6 groups, single author, Two (joint) authors, and organizations as an author rank First, Second and Third position respectively while three authors and more than three authors and without author (links alone) are insignificant. This may be due to the fact that the contribution of documents by many authors is lacking in bringing out their research publications.

5.6 Author Distribution

5.6.1 Author Distribution with Special Reference to Journal's Article

The study of the author distribution is one of the prime components of the citation study. Data relating to all 2876 citations from 404 Journals appended in all 83 theses covered under study. A total of 1846 single authors were cited by Ph. D scholars among the list of Journal's articles. The single author position is significant in author distribution, the details of which have been shown with their rank in Table-10 along with Graph-5 for clear understanding.

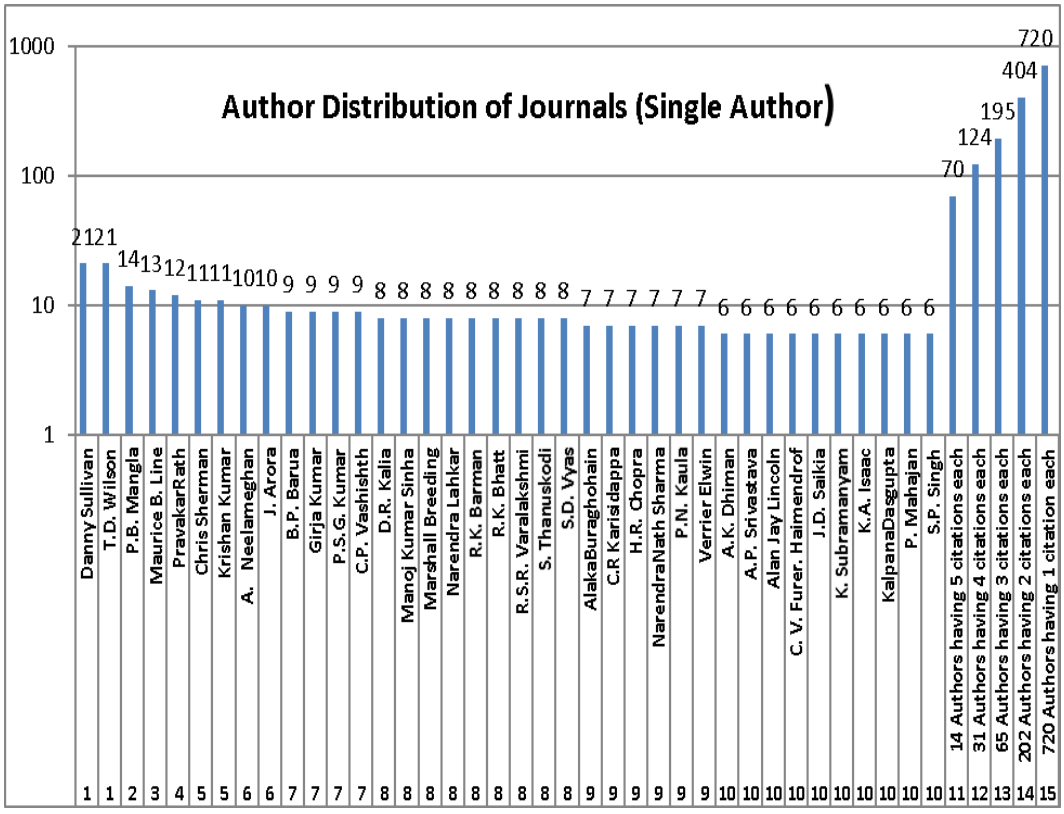
Table-10: Author Distribution of Journal's Article (One Author)

Sl.No	Rank	Name of Author	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1	1	Danny Sullivan	21	1.14	21	1.14
2	=1	T.D. Wilson	21	1.14	42	2.28
3	2	P.B. Mangla	14	0.76	56	3.04
4	3	Maurice B. Line	13	0.7	69	3.74
5	4	PravakarRath	12	0.65	81	4.39
6	5	Chris Sherman	11	0.6	92	4.99
7	=5	Krishan Kumar	11	0.6	103	5.59
8	6	A. Neelameghan	10	0.54	113	6.13
9	=6	J. Arora	10	0.54	123	6.67
10	7	B.P. Barua	9	0.49	132	7.16
11	=7	Girja Kumar	9	0.49	141	7.65
12	=7	P.S.G. Kumar	9	0.49	150	8.14
13	=7	C.P. Vashishth	9	0.49	159	8.63
14	8	D.R. Kalia	8	0.43	167	9.06
15	=8	Manoj Kumar Sinha	8	0.43	175	9.49
16	=8	Marshall Breeding	8	0.43	183	9.92
17	=8	Narendra Lahkar	8	0.43	191	10.35
18	=8	R.K. Barman	8	0.43	199	10.78
19	=8	R.K. Bhatt	8	0.43	207	11.21
20	=8	R.S.R. Varalakshmi	8	0.43	215	11.64

21	=8	S. Thanuskodi	8	0.43	223	12.07
22	=8	S.D. Vyas	8	0.43	231	12.5
23	9	AlakaBuraghohain	7	0.38	238	12.88
24	=9	C.R Karisidappa	7	0.38	245	13.26
25	=9	H.R. Chopra	7	0.38	252	13.64
26	=9	NarendraNath Sharma	7	0.38	259	14.02
27	=9	P.N. Kaula	7	0.38	266	14.4
28	=9	Verrier Elwin	7	0.38	273	14.78
29	10	A.K. Dhiman	6	0.32	279	15.1
30	=10	A.P. Srivastava	6	0.32	285	15.42
31	=10	Alan Jay Lincoln	6	0.32	291	15.74
32	=10	C. V. Furer. Haimendrof	6	0.32	297	16.06
33	=10	J.D. Saikia	6	0.32	303	16.38
34	=10	K. Subramanyam	6	0.32	309	16.7
35	=10	K.A. Isaac	6	0.32	315	17.02
36	=10	KalpanaDasgupta	6	0.32	321	17.34
37	=10	P. Mahajan	6	0.32	327	17.66
38	=10	S.P. Singh	6	0.32	333	17.98
39	11	14 Authors having 5 citations each	70	3.79 (0.27 each)	403	21.77
40	12	31 Authors having 4	124	6.71 (0.21	527	28.48

		citations each		each)		
41	13	65 Authors having 3 citations each	195	10.56 (0.16 each)	722	39.04
42	14	202 Authors having 2 citations each	404	21.88 (0.1 each)	1126	60.92
43	15	720 Authors having 1 citation each	720	39 (0.05 each)	1846	99.92 or 100
		Total	**1846**	**99.92 or 100**		

(Source: Survey data)



Graph-5: Author Distribution of Journal's Article (One Author)

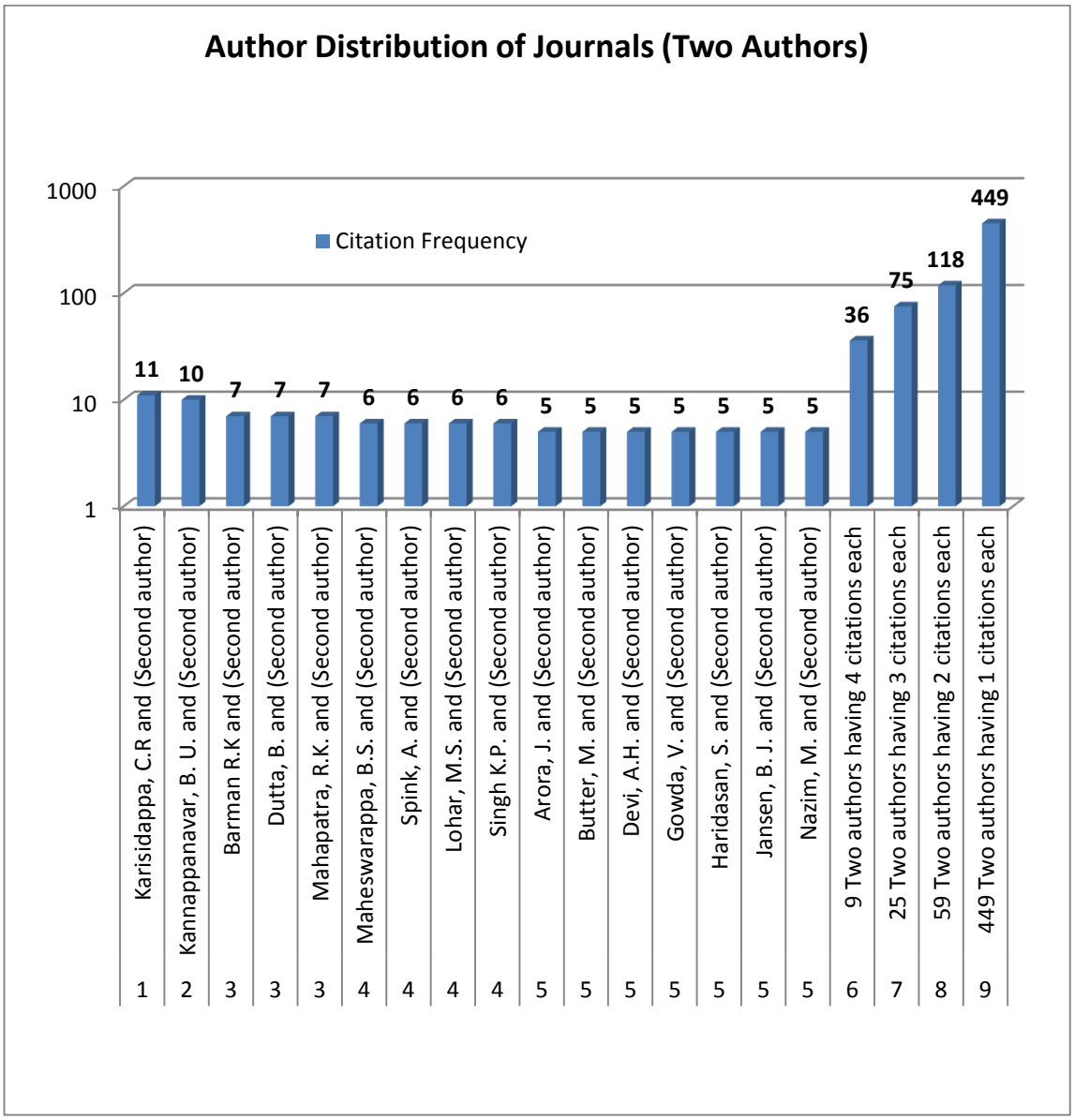
While analyzing the cited author distribution placed in Table-10 revealed that there are a total number of 1846 single authors and in the ranking order placed in detail up to 10, the authors Danny Sullivan and T.D. Wilson is cited maximum number of times i.e. 21 times (1.14%) out of 1846 followed by P.B. Mangla 14 times (0.76%) and Maurice B. Line 13 (0.7%) and thus, they are placed 1st, 2nd and 3rd in the ranking order respectively. Further, the authors who have been cited up to 6 times are reflected in the Table as well in the Graph-5 to make it clearer. Again, the table reflected that 14 authors having 5 citations each (0.27% each) constitute 70 (3.79%), 34 authors having 4 citations each (0.21 % each) are 124 (6.71%), 65 Authors having 3 citations each (0.16% each) form 195 (10.56%), 202 Authors having 2 citations each (0.1% each) constitute 404 (21.88%) and 720 Authors having 1 citation each (0.05% each) comprise 720 (39%). The author's citation depends upon the research output of the authors where the scholars access concerning their research work.

Further, the two authors which constitute of One-time Citation Frequency, Two-times Citation Frequency, Three-times Citation Frequency, Four-times Citation Frequency, Five-times Citation Frequency, Six-times Citation Frequency, Seven-times Citation Frequency, Ten-times Citation Frequency, and Eleven-times Citation Frequency is placed in Table-10A showing their ranking. The two authors' distribution is taken according to the first author names. This is supported with Graph-5A.

Table-10A: Author Distribution of Journal's Article (Two Authors)

S/N	Rank	Authors Cited	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Karisidappa, C.R and (Second author)	11	1.41	11	1.41
2.	2	Kannappanavar, B. U. and (Second author)	10	1.28	21	2.69
3.	3	Barman R.K and (Second author)	7	0.9	28	3.59
4.	=3	Dutta, B. and (Second author)	7	0.9	35	4.49
5.	=3	Mahapatra, R.K. and (Second author)	7	0.9	42	5.39
6.	4	Maheswarappa, B.S. and (Second author)	6	0.77	48	6.16
7.	=4	Spink, A. and (Second author)	6	0.77	54	6.93
8.	=4	Lohar, M.S. and (Second author)	6	0.77	60	7.7
9.	=4	Singh K.P. and (Second author)	6	0.77	66	8.47
10.	5	Arora, J. and (Second author)	5	0.64	71	9.11
11.	=5	Butter, M. and (Second author)	5	0.64	76	9.75
12.	=5	Devi, A.H. and (Second author)	5	0.64	81	10.39
13.	=5	Gowda, V. and (Second author)	5	0.64	86	11.03
14.	=5	Haridasan, S. and (Second author)	5	0.64	91	11.67
15.	=5	Jansen, B. J. and (Second author)	5	0.64	96	12.31
16.	=5	Nazim, M. and (Second author)	5	0.64	101	12.95
17.	6	9 Two authors having 4 citations each	36	4.62 (0.51 each)	137	17.57
18.	7	25 Two authors having 3 citations each	75	9.62 (0.38 each)	212	27.19
19.	8	59 Two authors having 2 citations each	118	15.14 (0.25 each)	330	42.33
20.	9	449 Two authors having 1 citation each	449	57.63 (0.12 each)	779	99.96 or 100
		Total	**779**	**99.96 or 100**		

(Source: Survey data)



Graph-5A: Author Distribution of Journal's Article (Two Authors)

The analysis of Table-10A unveils that there are a total number of 779 Two authors and the ranking has been mentioned in detail up to 5 where Karisidappa, C.R and (Second author) is cited maximum 11 times (1.41%) out of 779 followed by Kannappanavar, B. U. and (Second author) 10 times (1.28%) and Barman R.K and (Second author), Dutta, B. and (Second author), and Mahapatra, R.K. and (Second author) 7 times (0.9%) each and thus, they rank 1st, 2nd, and 3rd respectively. Further,

the authors who have been cited up to 5 times are reflected in the table as well as the Graph-5A to make it more visible. The Table also reflected that, 9 Two authors having 4 citations each constitute 36 citation frequency 4.62% (0.51% each), 25 Two authors having 3 citations each constitute 75 citation frequency 9.62% (0.38% each), 59 Two authors having 2 citations each constitute 118 citation frequency 15.14% (0.25% each) and 449 Two authors having 1 citations each constitutes 449 citation frequency 57.63 (0.12 each).

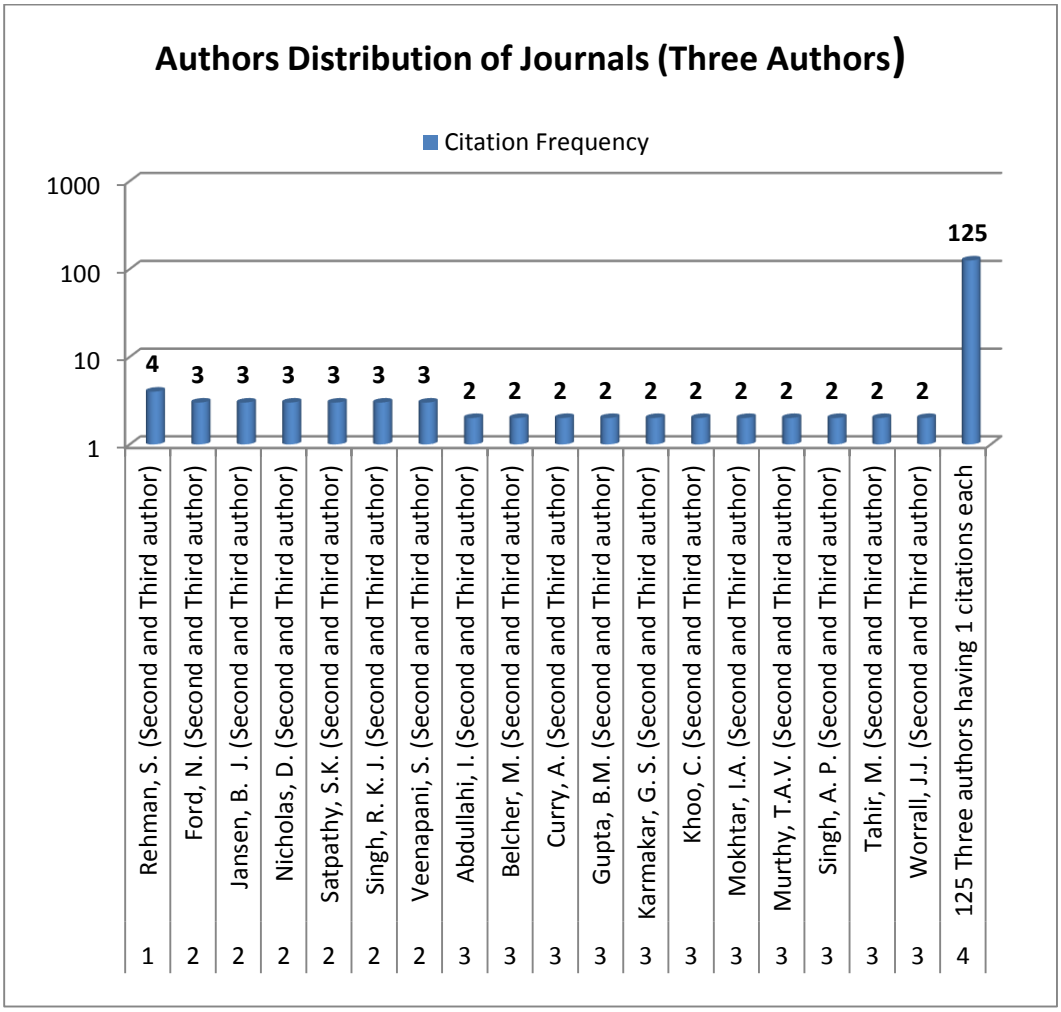
Again, the three authors that constitute One-time Citation Frequency, Two-times Citation Frequency, Three-times Citation Frequency, and Four-times Citation Frequency are placed in Table-10B which also shows the ranking order of the author. Here, the three author's distribution is taken according to the first author names. This is supported with Graph-5B.

Table-10B: Author Distribution of Journal's Article (Three Authors)

S/N	Rank	Authors Cited	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Rehman, S. (Second and Third author)	4	2.37	4	2.37
2.	2	Ford, N. (Second and Third author)	3	1.77	7	4.14
3.	=2	Jansen, B. J. (Second and Third author)	3	1.77	10	5.91
4.	=2	Nicholas, D. (Second and Third author)	3	1.77	13	7.68
5.	=2	Satpathy, S.K. (Second and Third author)	3	1.77	16	9.45
6.	=2	Singh, R. K. J. (Second and Third author)	3	1.77	19	11.22

7.	=2	Veenapani, S. (Second and Third author)	3	1.77	22	12.99
8.	3	Abdullahi, I. (Second and Third author)	2	1.18	24	14.17
9.	=3	Belcher, M. (Second and Third author)	2	1.18	26	15.35
10.	=3	Curry, A. (Second and Third author)	2	1.18	28	16.53
11.	=3	Gupta, B.M. (Second and Third author)	2	1.18	30	17.71
12.	=3	Karmakar, G. S. (Second and Third author)	2	1.18	32	18.89
13.	=3	Khoo, C. (Second and Third author)	2	1.18	34	20.07
14.	=3	Mokhtar, I.A. (Second and Third author)	2	1.18	36	21.25
15.	=3	Murthy, T.A.V. (Second and Third author)	2	1.18	38	22.43
16.	=3	Singh, A. P. (Second and Third author)	2	1.18	40	23.61
17.	=3	Tahir, M. (Second and Third author)	2	1.18	42	24.79
18.	=3	Worrall, J.J. (Second and Third author)	2	1.18	44	25.97
19.	4	125 Three authors having 1 citations each	125	73.96 (0.59 each)	169	99.93 or 100
		Total	**169**	**99.99 or 100**		

(Source: Survey data)



Graph-5B: Author Distribution of Journal's Article (Three Authors)

The analysis of Table-10B disclosed that, there are a total number of 169 Three authors and the ranking has been mentioned in detail up to 3 where Rehman, S. (Second and Third author) is cited maximum 4 times (2.37%) while, Ford, N. (Second and Third author), Jansen, B. J. (Second and Third author), Nicholas, D. (Second and Third author), Satpathy, S.K. (Second and Third author), Singh, R. K. J. (Second and Third author), Veenapani, S. (Second and Third author), are cited 3 times (1.77%) each and Abdullahi, I. (Second and Third author), Belcher, M. (Second and Third author), Curry, A. (Second and Third author), Gupta, B.M. (Second and Third author), Karmakar, G. S. (Second and Third author), Khoo, C. (Second and Third

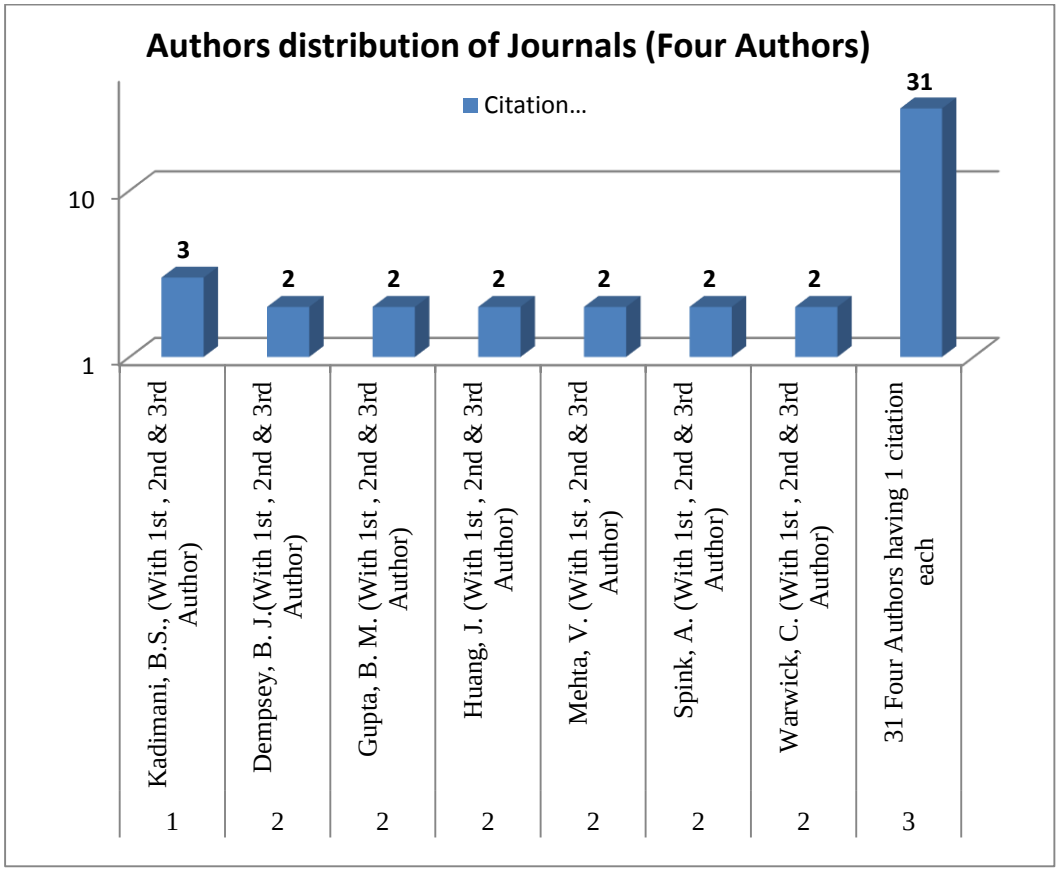
author), Mokhtar, I.A. (Second and Third author), Murthy, T.A.V. (Second and Third author), Singh, A. P. (Second and Third author), Tahir, M. (Second and Third author) and Worrall, J.J. (Second and Third author) are cited 2 times (1.18%) each. Thus, it ranks 1st, 2nd, and 3rd respectively. Further, the Table also reflects 125 Authors (With Second and Third author) having 1 citation each constitutes 125 citation frequencies 73.96% (0.59% each).

Four Authors which constitute One-time Citation Frequency, Two-times Citation Frequency and Three-times Citation Frequency has been shown in Table- 10C. Here, Four Authors distribution is taken according to the first author names. This is supported with Graph-5C.

Table-10C: Author Distribution of Journal's Article (Four Authors)

S/N	Rank	Authors Cited	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Kadimani, B.S., (With 1st , 2nd& 3rd Author)	3	6.52	3	6.52
2.	2	Dempsey, B. J.(With 1st , 2nd& 3rd Author)	2	4.35	5	10.87
3.	=2	Gupta, B. M. (With 1st , 2nd& 3rd Author)	2	4.35	7	15.22
4.	=2	Huang, J. (With 1st , 2nd& 3rd Author)	2	4.35	9	19.57
5.	=2	Mehta, V. (With 1st , 2nd& 3rd Author)	2	4.35	11	23.92
6.	=2	Spink, A. (With 1st , 2nd& 3rd Author)	2	4.35	13	28.27
7.	=2	Warwick, C. (With 1st , 2nd& 3rd Author)	2	4.35	15	32.62
8.	3	31 Four authors having 1 citation each	31	67.39 (2.17 each)	46	100.01 or 100
		Total	**46**	**100**		

(Source: Survey data)



Graph-5C: Author Distribution of Journal's Article (Four Authors)

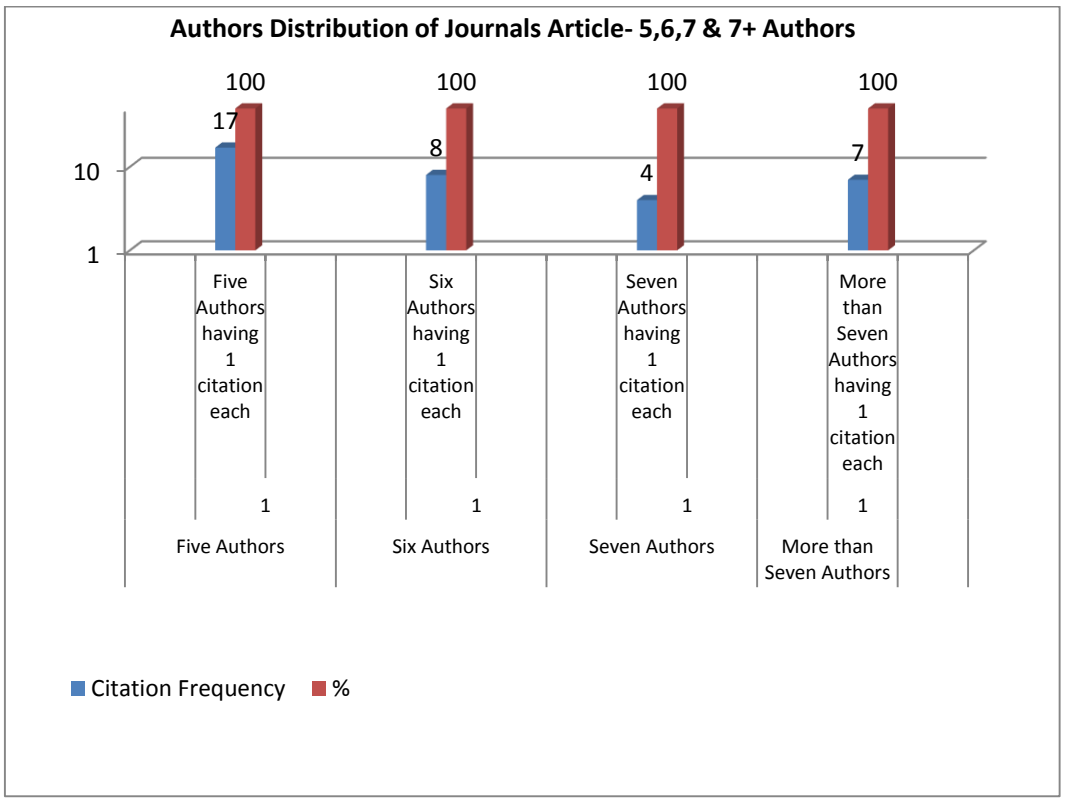
Table-10C on analysis found that there are a total number of 46 Four authors and the ranking has been placed in detail up to 2 where Kadimani, B.S., (With 1st , 2nd& 3rd Author) is cited maximum 3 times (6.52%) out of 46 while, Dempsey, B. J.(With 1st , 2nd& 3rd Author), Gupta, B. M. (With 1st , 2nd& 3rd Author), Huang, J. (With 1st , 2nd& 3rd Author), Mehta, V. (With 1st , 2nd& 3rd Author), Spink, A. (With 1st, 2nd& 3rd Author) and Warwick, C. (With 1st, 2nd& 3rd Author) are cited 2 times (4.35%) each and thus, it ranks 1st and 2nd respectively. Further, the Table also reflected that 31 Four authors having 1 citation each constitute 31 citation frequencies [67.39% (2.17% each)].

The Five, Six, Seven and More than Seven authors have been placed in Table-10D to have a detailed study about the citations made by the scholars in their theses. The table reflects the ranking position of all types of authors as discussed. The data is reflected in Table-10D which has also been supported with Graph-5D for clear understanding.

Table-10D: Author Distribution of Journal's Article (Five, Six, Seven and More than Seven Authors)

S/N	Rank	Authors Cited	Citation Frequency	%
		Five Authors		
1	1	Five Authors having 1 citation each	17	100 (5.88% each)
		Total	**17**	**100**
		Six Authors		
1.	1	Six Authors having 1 citation each	8	100 (12.5% each)
		Total	**8**	**100**
		Seven Authors		
1.	1	Seven Authors having 1 citation each	4	100 (25% each)
		Total	**4**	**100**
		More than Seven Authors		
1.	1	More than Seven Authors having 1 citation each	7	100 (14.28% each)
		Total	**7**	**100**

(Source: Survey data)



Graph-5D: Author Distribution of Journal's Article (Five, Six, Seven and More than Seven Authors)

The analysis of Table-10D brings out that, with regard to five authors, there are 17 different Five authors combine i.e. 17 citation frequencies which is placed in one criterion 100% (5.88% each). There are 8 different Six authors combine i.e. 8 citation frequencies which is placed in one criterion 100% (12.5% each). There are 4 different Seven authors combine i.e. 4 citation frequencies which is placed in one criterion 100% (25% each). Likewise, there are 7 different 7+ (more than seven) authors combine i.e. 7 citation frequencies which is placed in one criterion 100% (14.28% each).

5.6.2 Authors Distribution of Documents

Authorship distribution is studied from the forms of documents cited by the Ph.D. scholars of all 83 numbers of theses. Among the list of documents cited, a total of 6073 single authors were cited by Ph. D scholars in their theses. The single author position is significant in cited forms of documents, the details of which have been shown with their rank in Table-10E along with Graph-5E for clear understanding.

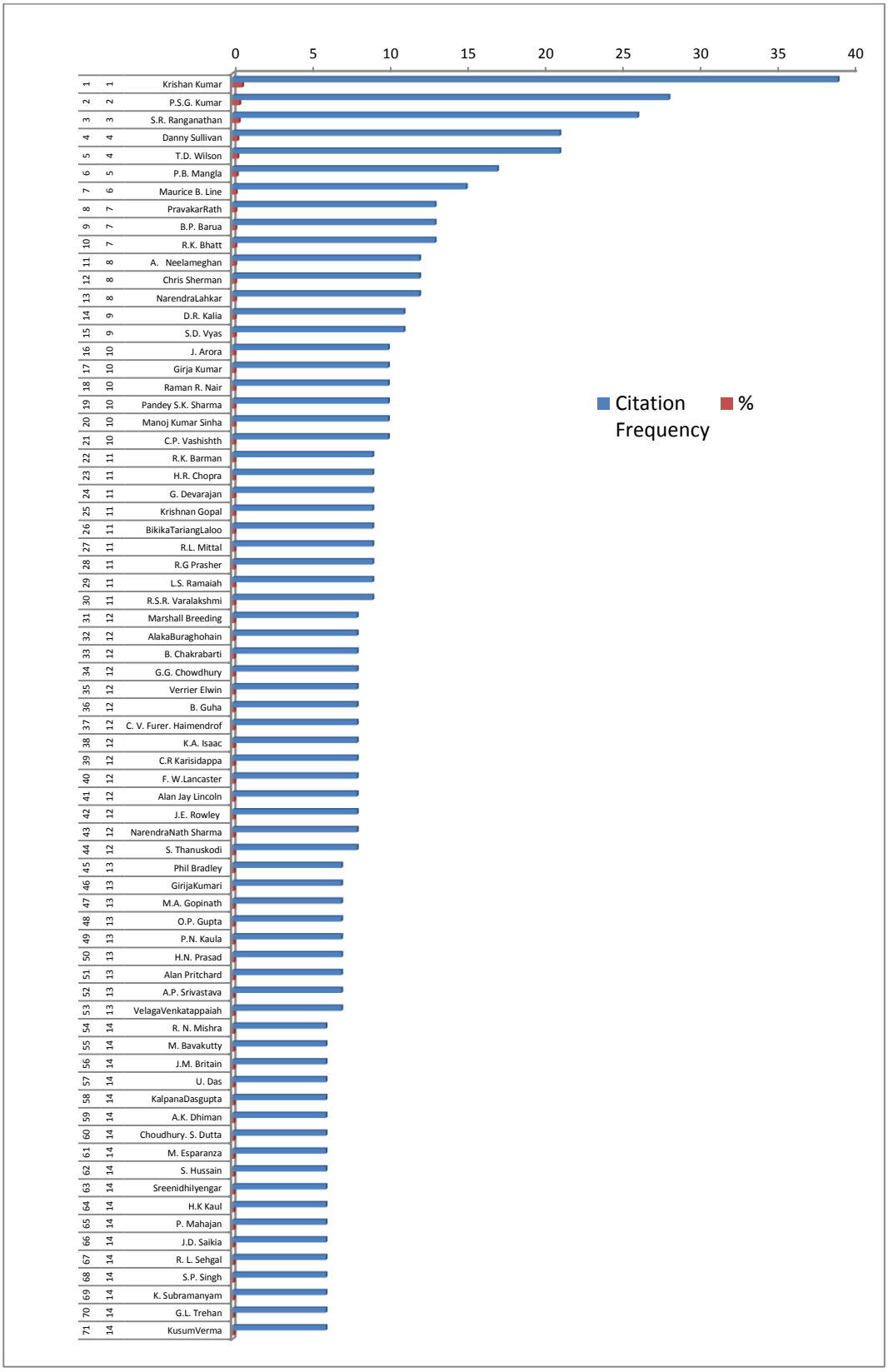
Table-10E: Author's Distribution (Single Author)

Sl.No	Rank	Name of Author	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Krishan Kumar	39	0.64	39	0.64
2.	2	P.S.G. Kumar	28	0.46	67	1.1
3.	3	S.R. Ranganathan	26	0.43	93	1.53
4.	4	Danny Sullivan	21	0.34	114	1.87
5.	=4	T.D. Wilson	21	0.34	135	2.21
6.	5	P.B. Mangla	17	0.30	152	2.51
7.	6	Maurice B. Line	15	0.24	167	2.75
8.	7	PravakarRath	13	0.21	180	2.96
9.	=7	B.P. Barua	13	0.21	193	3.17
10.	=7	R.K. Bhatt	13	0.21	206	3.38
11.	8	A. Neelameghan	12	0.20	218	3.58
12.	=8	Chris Sherman	12	0.20	230	3.78
13.	=8	NarendraLahkar	12	0.20	242	3.98
14.	9	D.R. Kalia	11	0.18	253	4.16
15.	=9	S.D. Vyas	11	0.18	264	4.34
16.	10	J. Arora	10	0.16	274	4.5
17.	=10	Girja Kumar	10	0.16	284	4.66
18.	=10	Raman R. Nair	10	0.16	294	4.82
19.	=10	Pandey S.K. Sharma	10	0.16	304	4.98
20.	=10	Manoj Kumar Sinha	10	0.16	314	5.14
21.	=10	C.P. Vashishth	10	0.16	324	5.3
22.	11	R.K. Barman	9	0.15	333	5.45
23.	=11	H.R. Chopra	9	0.15	342	5.6
24.	=11	G. Devarajan	9	0.15	351	5.75
25.	=11	Krishnan Gopal	9	0.15	360	5.9
26.	=11	BikikaTariangLalo	9	0.15	369	6.05

		o				
27.	=11	R.L. Mittal	9	0.15	378	6.2
28.	=11	R.G Prasher	9	0.15	387	6.35
29.	=11	L.S. Ramaiah	9	0.15	396	6.5
30.	=11	R.S.R. Varalakshmi	9	0.15	405	6.65
31.	12	Marshall Breeding	8	0.13	413	6.78
32.	=12	AlakaBuraghohain	8	0.13	421	6.91
33.	=12	B. Chakrabarti	8	0.13	429	7.04
34.	=12	G.G. Chowdhury	8	0.13	437	7.17
35.	=12	Verrier Elwin	8	0.13	445	7.3
36.	=12	B. Guha	8	0.13	453	7.43
37.	=12	C. V. Furer. Haimendrof	8	0.13	461	7.56
38.	=12	K.A. Isaac	8	0.13	469	7.69
39.	=12	C.R Karisidappa	8	0.13	477	7.82
40.	=12	F. W.Lancaster	8	0.13	485	7.95
41.	=12	Alan Jay Lincoln	8	0.13	493	8.08
42.	=12	J.E. Rowley	8	0.13	501	8.21
43.	=12	NarendraNath Sharma	8	0.13	509	8.34
44.	=12	S. Thanuskodi	8	0.13	517	8.47
45.	13	Phil Bradley	7	0.11	524	8.58
46.	=13	GirijaKumari	7	0.11	531	8.69
47.	=13	M.A. Gopinath	7	0.11	538	8.8
48.	=13	O.P. Gupta	7	0.11	545	8.91
49.	=13	P.N. Kaula	7	0.11	552	9.02
50.	=13	H.N. Prasad	7	0.11	559	9.13
51.	=13	Alan Pritchard	7	0.11	566	9.24
52.	=13	A.P. Srivastava	7	0.11	573	9.35
53.	=13	VelagaVenkatappaiah	7	0.11	580	9.46
54.	14	R. N. Mishra	6	0.10	586	9.56
55.	=14	M. Bavakutty	6	0.10	592	9.66
56.	=14	J.M. Britain	6	0.10	598	9.76
57.	=14	U. Das	6	0.10	604	9.86
58.	=14	KalpanaDasgupta	6	0.10	610	9.96
59.	=14	A.K. Dhiman	6	0.10	616	10.06
60.	=14	Choudhury. S. Dutta	6	0.10	622	10.16
61.	=14	M. Esparanza	6	0.10	628	10.26
62.	=14	S. Hussain	6	0.10	634	10.36
63.	14	SreenidhiIyengar	6	0.10	640	10.46
64.	=14	H.K Kaul	6	0.10	646	10.56
65.	=14	P. Mahajan	6	0.10	652	10.66
66.	=14	J.D. Saikia	6	0.10	658	10.76

67.	=14	R. L. Sehgal	6	0.10	664	10.86
68.	=14	S.P. Singh	6	0.10	670	10.96
69.	=14	K. Subramanyam	6	0.10	676	11.06
70.	=14	G.L. Trehan	6	0.10	682	11.16
71.	=14	KusumVerma	6	0.10	688	11.26
72.	15	23 Authors having 5 citations each	115 (1.9%)	0.082 each	803	13.16
73.	16	58 Authors having 4 citations each	232 (3.82%)	0.065 each	1035	16.98
74.	17	121 Authors having 3 citations each	363 (6%)	0.049 each	1398	22.98
75.	18	399 Authors having 2 citations each	798 (13.14%)	0.032 each	2196	36.12
76.	19	3877 Authors having 1 citation each	3877 (63.84%)	0.016 each	6073	99.96 or 100
		Total	**6073**	**99.96 or 100**		

(Source: Survey data)



Graph-5E: Author's Distribution

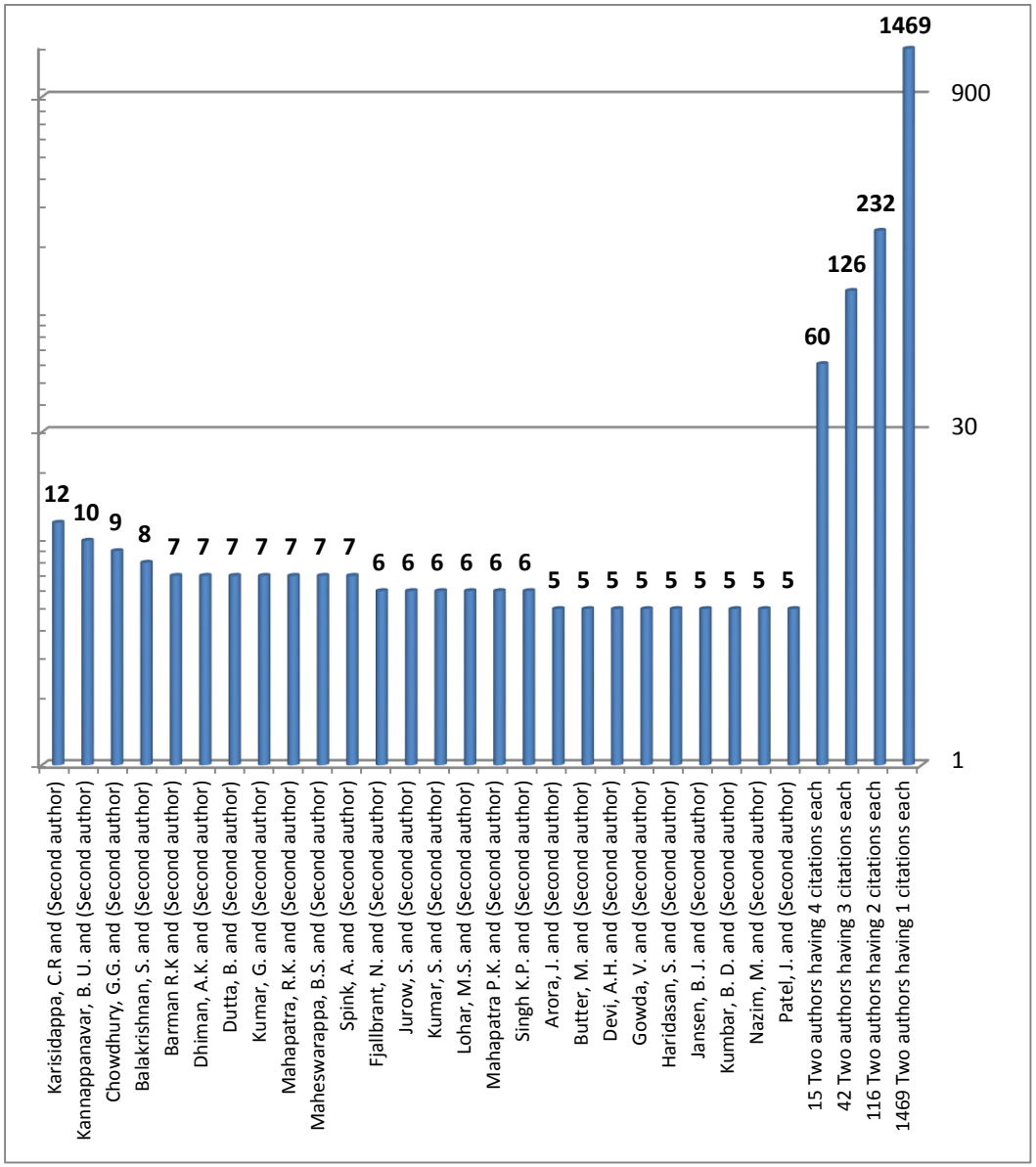
While analyzing the cited author distribution placed in Table-10E revealed that there are a total number of 6073 single authors and in the ranking order placed in detail up to 14, the author Krishan Kumar is cited maximum number of times i.e. 39 times (0.64%) out of 6073 followed by P.S.G Kumar 28 times (0.46%) and S.R Ranganathan 26 (0.43%) and thus, they are placed 1st, 2nd and 3rd in the ranking order respectively. Further, the authors who have been cited up to 6 times are reflected in the Table as well in the Graph-5E to make it clearer. Again, the table reflected that 23 authors having 5 citations each (0.082% each) constitute 115 (1.89%), 58 authors having 4 citations each (0.065 % each) are 232 (3.82%), 121 authors having 3 citations each (0.049% each) form 363 (5.97%), 399 authors having 2 citations each (0.032% each) constitute 798 (13.14%) and 3877 having 1 citation (0.016% each) comprise 3877 (63.83%). The author's citation depends upon the research output of the authors where the scholars access concerning their research work.

Further, the two authors which constitute of One-time Citation Frequency, Two-times Citation Frequency, Three-times Citation Frequency, Four-times Citation Frequency, Five-times Citation Frequency, Six-times Citation Frequency, Seven-times Citation Frequency, Eight-times Citation Frequency, Nine-times Citation Frequency, Ten-times Citation Frequency, and Twelve-times Citation Frequency is placed in Table-10F showing their ranking. The two authors' distribution is taken according to the first author names.

Table-10F: Author's Distribution (Two Authors)

S/N	Rank	Authors Cited	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Karisidappa, C.R and (Second author)	12	0.58	12	0.58
2.	2	Kannappanavar, B. U. and (Second author)	10	0.5	22	1.08
3.	3	Chowdhury, G.G. and (Second author)	9	0.44	31	1.52
4.	4	Balakrishnan, S. and (Second author)	8	0.4	39	1.92
5.	5	Barman R.K and (Second author)	7	0.34	46	2.26
6.	=5	Dhiman, A.K. and (Second author)	7	0.34	53	2.6
7.	=5	Dutta, B. and (Second author)	7	0.34	60	2.94
8.	=5	Kumar, G. and (Second author)	7	0.34	67	3.28
9.	=5	Mahapatra, R.K. and (Second author)	7	0.34	74	3.62
10.	5	Maheswarappa, B.S. and (Second author)	7	0.34	81	3.96
11.	=5	Spink, A. and (Second author)	7	0.34	88	4.3
12.	6	Fjallbrant, N. and (Second author)	6	0.29	94	4.59
13.	=6	Jurow, S. and (Second author)	6	0.29	100	4.88
14.	=6	Kumar, S. and (Second author)	6	0.29	106	5.17
15.	=6	Lohar, M.S. and (Second author)	6	0.29	112	5.46
16.	=6	Mahapatra P.K. and (Second author)	6	0.29	118	5.75
17.	=6	Singh K.P. and (Second author)	6	0.29	124	6.04
18.	7	Arora, J. and (Second author)	5	0.24	129	6.28
19.	=7	Butter, M. and (Second author)	5	0.24	134	6.52
20.	=7	Devi, A.H. and (Second author)	5	0.24	139	6.76
21.	=7	Gowda, V. and	5	0.24	144	7

		(Second author)				
22.	=7	Haridasan, S. and (Second author)	5	0.24	149	7.24
23.	=7	Jansen, B. J. and (Second author)	5	0.24	154	7.48
24.	=7	Kumbar, B. D. and (Second author)	5	0.24	159	7.72
25.	=7	Nazim, M. and (Second author)	5	0.24	164	7.96
26.	=7	Patel, J. and (Second author)	5	0.24	169	8.2
27.	8	15 Two authors having 4 citations each	60	2.92 (0.2 each)	229	11.12
28.	9	42 Two authors having 3 citations each	126	6.13 (0.14 each)	355	17.25
29.	10	116 Two authors having 2 citations each	232	11.3 (0.1 each)	587	28.55
30.	11	1469 Two authors having 1 citations each	1469	71.45 (0.04 each)	2056	100
		Total	**2056**	**100**	*(Source: Survey data)*	



Graph-5F: Author's Distribution (Two Authors)

The analysis of Table-10Funveils that there are a total number of 2056 Two authors and the ranking has been mentioned in detail up to 7 where Karisidappa, C.R and (Second author) is cited maximum 12 times (0.58%) out of 2056 followed by Kannappanavar, B. U. and (Second author) 10 times (0.5%) and Chowdhury, G.G. and (Second author) 9 times (0.44%) and thus, they rank 1st, 2nd, and 3rd respectively.

Further, the authors who have been cited up to 5 times are reflected in the table as well as the Graph-5F to make it more visible. The Table also reflected that, 15 Authors (With Second Author) having 4 citations each constitute 60 citation frequency (2.92%) i.e. 0.2% each, 42 Authors (With Second Author) having 3 citations each constitute 126 citation frequency (6.13%) i.e. 0.14% each, 116 Authors (With Second Author) having 2 citations each constitute 232 citation frequency (11.3%) i.e. 0.1% each and 1469 Authors (With Second Author) having 1 citation each constitutes 1469 citation frequency (71.45%) i.e. 0.04% each.

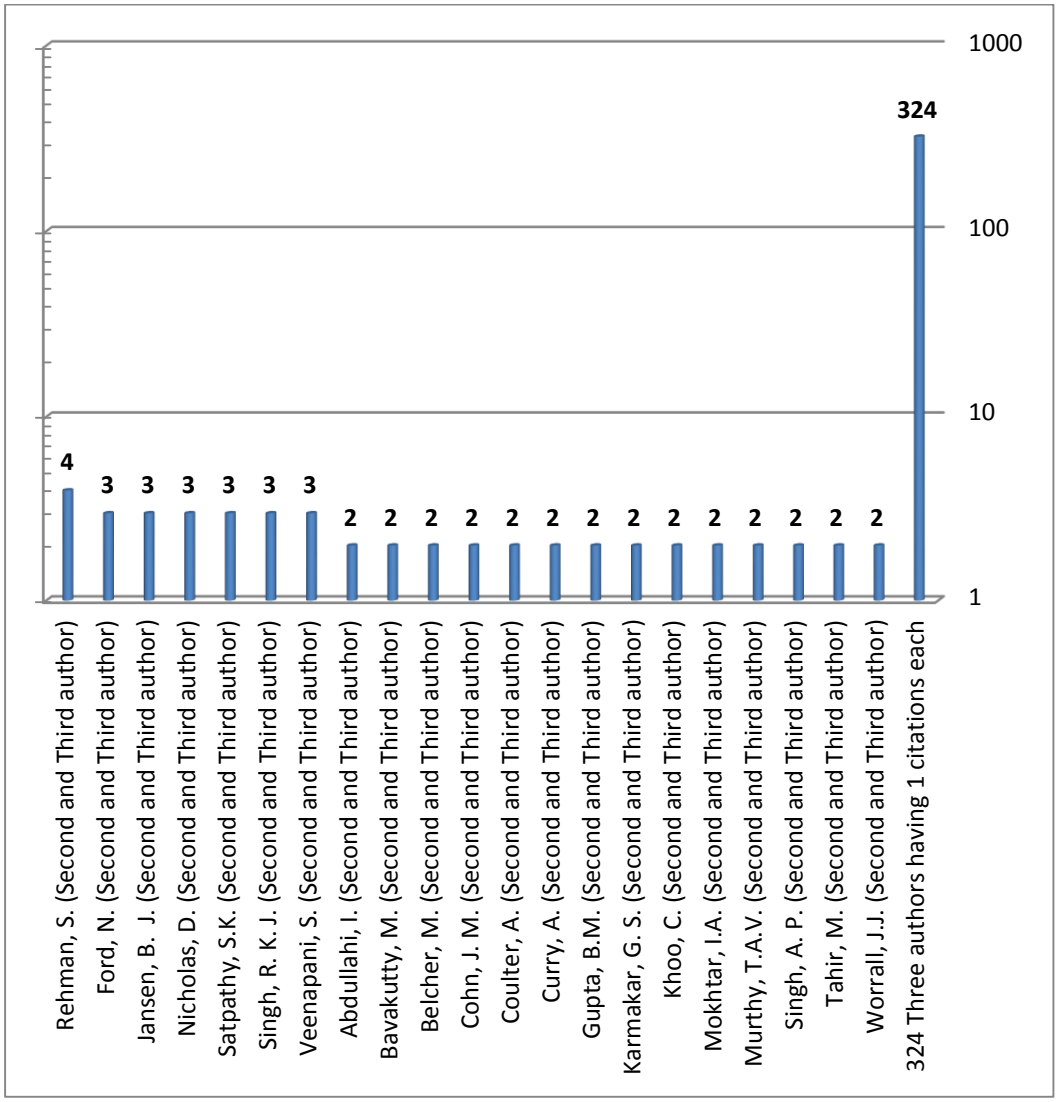
Again, the three authors that constitute One-time Citation Frequency, Two-times Citation Frequency, Three-times Citation Frequency, and Four-times Citation Frequency are placed in Table-10G which also shows the ranking order of the author. Here, the three authors' distribution is taken according to the first author names.

Table-10G: Author's Distribution (Three Authors)

S/N	Rank	Authors Cited	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Rehman, S. (Second and Third author)	4	1.07	4	1.07
2.	2	Ford, N. (Second and Third author)	3	0.8	7	1.87
3.	=2	Jansen, B. J. (Second and Third author)	3	0.8	10	2.67
4.	=2	Nicholas, D. (Second and Third author)	3	0.8	13	3.47
5.	=2	Satpathy, S.K. (Second and Third author)	3	0.8	16	4.27
6.	=2	Singh, R. K. J. (Second and Third author)	3	0.8	19	5.07
7.	=2	Veenapani, S. (Second and Third author)	3	0.8	22	5.87
8.	3	Abdullahi, I. (Second and Third author)	2	0.53	24	6.4

9.	=3	Bavakutty, M. (Second and Third author)	2	0.53	26	6.93
10.	=3	Belcher, M. (Second and Third author)	2	0.53	28	7.46
11.	=3	Cohn, J. M. (Second and Third author)	2	0.53	30	7.99
12.	=3	Coulter, A. (Second and Third author)	2	0.53	32	8.52
13.	=3	Curry, A. (Second and Third author)	2	0.53	34	9.05
14.	=3	Gupta, B.M. (Second and Third author)	2	0.53	36	9.58
15.	=3	Karmakar, G. S. (Second and Third author)	2	0.53	38	10.11
16.	=3	Khoo, C. (Second and Third author)	2	0.53	40	10.64
17.	=3	Mokhtar, I.A. (Second and Third author)	2	0.53	42	11.17
18.	=3	Murthy, T.A.V. (Second and Third author)	2	0.53	44	11.7
19.	=3	Singh, A. P. (Second and Third author)	2	0.53	46	12.23
20.	=3	Tahir, M. (Second and Third author)	2	0.53	48	12.76
21.	=3	Worrall, J.J. (Second and Third author)	2	0.53	50	13.29
22.	4	324 Three authors having 1 citations each	324	86.7 (0.26 each)	374	99.99
		Total	**374**	**99.99 or 100**		

(Source: Survey data)



Graph-5G: Author's Distribution (Three Authors)

The analysis of Table-10G disclosed that, there are a total number of 374 Three authors and the ranking has been mentioned in detail up to 3 where Rehman, S. (Second and Third author) is cited maximum 4 times (1.07%) while,Ford, N. (Second and Third author), Jansen, B. J. (Second and Third author),Nicholas, D. (Second and Third author), Satpathy, S.K. (Second and Third author), Singh, R. K. J. (Second and Third author), and Veenapani, S. (Second and Third author) are cited 3 times (0.8%) each and Abdullahi, I. (Second and Third author), Bavakutty, M. (Second and Third author), Belcher, M. (Second and Third author), Cohn, J. M.

(Second and Third author), Coulter, A. (Second and Third author), Curry, A. (Second and Third author), Gupta, B.M. (Second and Third author), Karmakar, G. S. (Second and Third author), Khoo, C. (Second and Third author), Mokhtar, I.A. (Second and Third author), Murthy, T.A.V.(Second and Third author), Singh, A. P. (Second and Third author), Tahir, M. (Second and Third author) and Worrall, J.J. (Second and Third author) are cited 2 times (0.53%) each. Thus, it ranks 1st, 2nd, and 3rd respectively. Further, the Table also reflects 324 Authors (With Second and Third author) having 1 citation each constitutes324 citation frequencies (86.7%) i.e. 0.26% each.

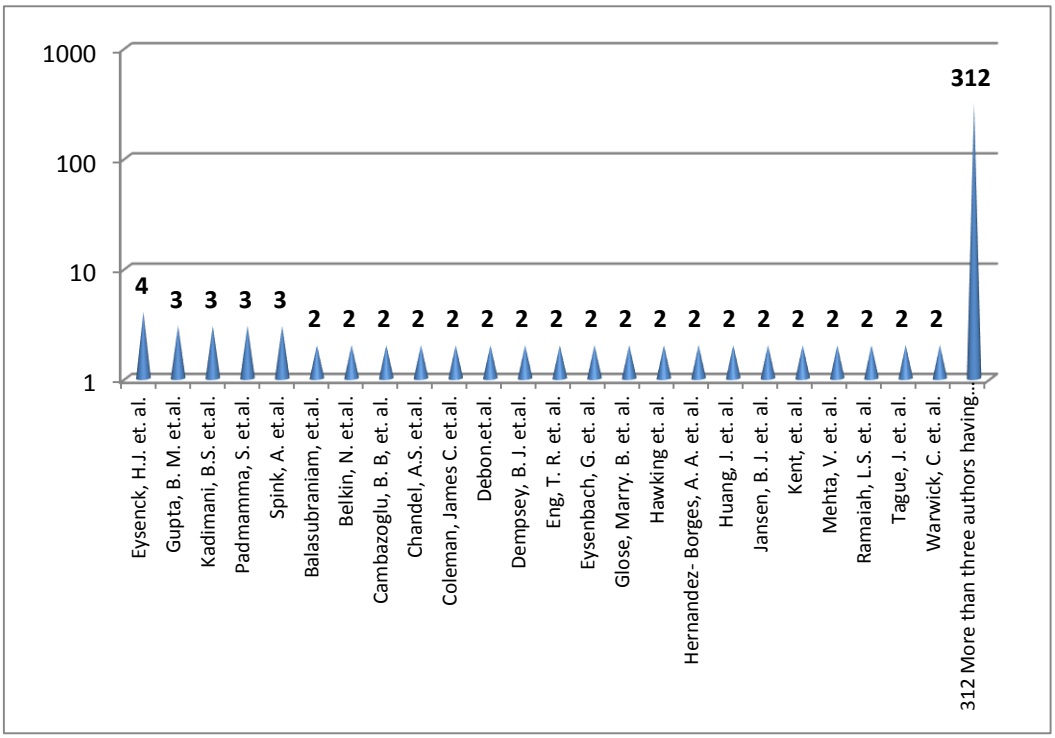
Once again, more than three authors which constitute One-time Citation Frequency, Two-times Citation Frequency, Three-times Citation Frequency, and Four-times Citation Frequency has been shown in Table- 10H. Here, more than three authors distribution is taken according to the first author names.

Table-10H: Author's Distribution (More than three Authors)

S/N	Rank	Authors Cited	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Eysenck, H.J. et. al.	4	1.09	4	1.09
2.	2	Gupta, B. M. et.al.	3	0.81	7	1.9
3.	=2	Kadimani, B.S. et.al.	3	0.81	10	2.71
4.	=2	Padmamma, S. et.al.	3	0.81	13	3.52
5.	=2	Spink, A. et.al.	3	0.81	16	4.33
6.	3	Balasubraniam, et.al.	2	0.55	18	4.88
7.	=3	Belkin, N. et.al.	2	0.55	20	5.43
8.	=3	Cambazoglu, B. B, et. al.	2	0.55	22	5.98
9.	=3	Chandel, A.S. et.al.	2	0.55	24	6.53
10.	=3	Coleman, James C. et.al.	2	0.55	26	7.08
11.	=3	Debon.et.al.	2	0.55	28	7.63
12.	=3	Dempsey, B. J. et.al.	2	0.55	30	8.18
13.	=3	Eng, T. R. et. al.	2	0.55	32	8.73
14.	=3	Eysenbach, G. et. al.	2	0.55	34	9.28
15.	=3	Glose, Marry. B. et. al.	2	0.55	36	9.83
16.	=3	Hawking et. al.	2	0.55	38	10.38
17.	=3	Hernandez- Borges, A.	2	0.55	40	10.93

		A. et. al.				
18.	=3	Huang, J. et. al.	2	0.55	42	11.48
19.	=3	Jansen, B. J. et. al.	2	0.55	44	12.03
20.	=3	Kent, et. al.	2	0.55	46	12.58
21.	=3	Mehta, V. et. al.	2	0.55	48	13.13
22.	=3	Ramaiah, L.S. et. al.	2	0.55	50	13.68
23.	=3	Tague, J. et. al.	2	0.55	52	14.23
24.	=3	Warwick, C. et. al.	2	0.55	54	14.78
25.	4	312 More than three authors having 1 citation each	312	85.24 (0.27 each)	366	100.02
		Total	**366**	**100.02 or 100**		

(Source: Survey data)



Graph-5H: Author's Distribution (More than three Authors)

Table-10H on analysis found that there are a total number of 366 More than three authors and the ranking has been placed in detail up to 3 where Eysenck, H.J. et. al. is cited maximum 4 times (1.09%) out of 366 while, Gupta, B. M. et.al., Kadimani, B.S. et.al., Padmamma, S. et.al. and Spink, A. et.al. 3 times (0.81%) each

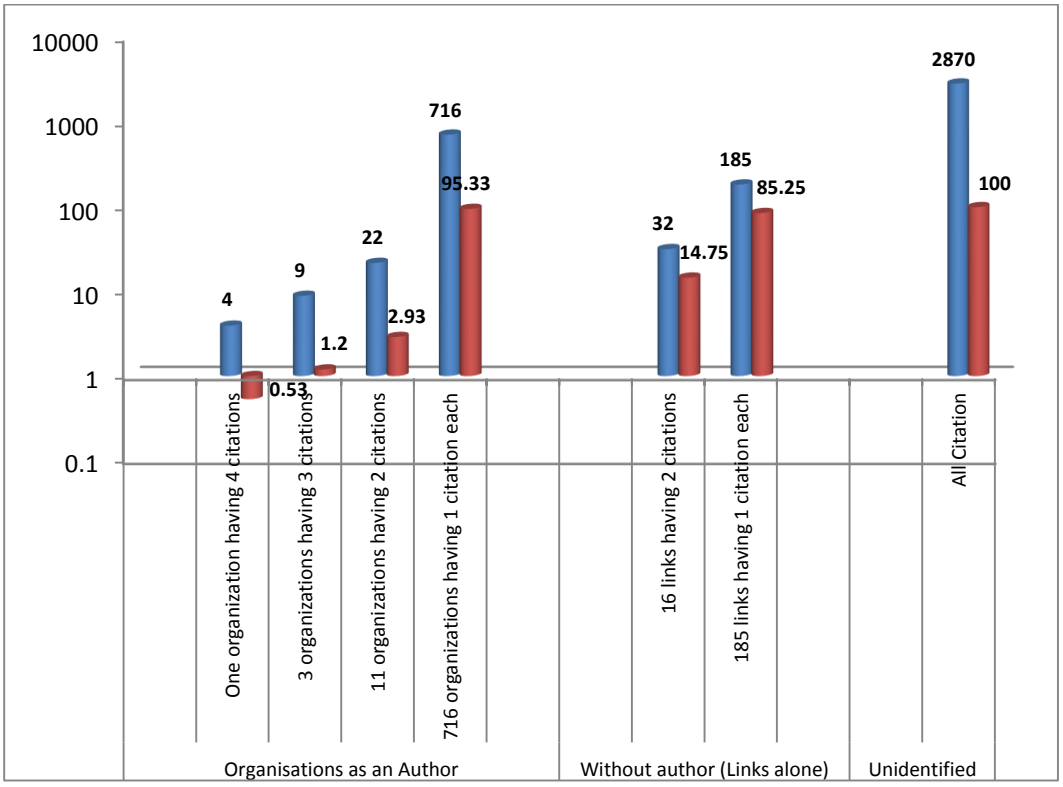
and Balasubraniam, et.al., Belkin, N. et.al., Cambazoglu, B. B, et. al., Coleman, James C. et.al., Chandel, A.S. et.al., Debon.et.al., Dempsey, B. J. et.al., Eng, T. R. et. al., Glose, Marry. B. et. al., Eysenbach, G. et. al., Hawking et. al., Hernandez- Borges, A. A. et. al., Huang, J. et. al., Jansen, B. J. et. al., Kent, et. al., Mehta, V. et. al., Ramaiah, L.S. et. al., Tague, J. et. al. and Warwick, C. et. al. are cited 2 times (0.55%) each and thus, it ranks 1st, 2nd, and 3rd respectively. Further, the Table also reflected that 312 authors with more than three authors having 1 citation each constitute 312 citation frequencies (85.24%) i.e. 0.27% each.

The authors which constitute Organizations as an author, without author (Links alone) and Unidentified has been placed in Table-10**I** to have a detailed study about the citations made by the scholars in their theses. The table reflects the ranking position of all types of authors as discussed. The data is reflected in Table-10**I** which has also been supported with Graph-5**I** for clear understanding.

Table-10**I**: Other Author's Distribution

S/N	Rank	Authors Cited	Citation Frequency	%
		Organizations as an Author		
1.	1	One organization having 4 citations	4	0.53
2.	2	3 organizations having 3 citations	9	1.2 (0.4 each)
3.	3	11 organizations having 2 citations	22	2.93 (0.26 each)
4.	4	716 organizations having 1 citation	716	95.33 (0.13 each)
		Total	**751**	**99.99 or 100**
		Without Author (Links alone)		
1.	1	16 links having 2 citations each	32	14.75 (0.92 each)
2.	2	185 links having 1 citation each	185	85.25 (0.51 each)
		Total	**217**	**100**
		Unidentified		
1.	1	All Citations	2870	100
		Total	**2870**	**100**

(Source: Survey data)



Graph-5I: Other Authors Distribution

The analysis of Table-10Ibrings out that, with regard to Organizations as an author, there are a total number of 751 citation frequencies and the ranking order has been mentioned in detail up to 4. One organization having 4 citations is cited maximum 4 times (0.53%) while, Three organizations having 3 citations 3 times (0.4%) each is cited and Eleven organization having 2 citations 2 times (0.26%) each is cited. Further analysis of the Table reflected that 716 Organization as an Author having 1 citation each constitute 716 citation frequencies (95.33%) i.e. 0.13% each.

Likewise, while discussing without author (Links alone), the table again revealed that 16 links are having 2 citations each with a citation frequency 32 (14.75%) i.e. 0.92% each in total out of 217 followed by 185 links are having 1 citation each (85.25%) i.e. 0.51% each. Further, the analysis for unidentified citations shows that 22% of the total number of authors could not be identified; this 22%, the

percentage is calculated from the total number of authors' i.e. 12,707. Here in Table-10**I**, the unidentified citation is not classified due to difficulties in identification for classification. All unidentified citations are placed in one criterion, and therefore, all citations from unidentified authors cited forms 2870 (100%).

5.7 Author Productivity

Yoshikane,et. al. (2009) gave a formula to calculate Average Author Per Paper (AAPP) and Productivity Per Author (PPA). Mathematically, the formula is represented as below. Data pertaining to author productivity and average author per paper is placed in Table-11. Author productivity with regard to all documents and journal is calculated separately.

5.7.1 Average Author Per Paper

→ **With regard to all documents:-**

Average Author Per Paper = No. of Authors/No. of Papers

Average Author Per Paper = $\frac{6898}{8869}$

Therefore, Average Author Per Paper = **0.78**

→ **With regard to Journals:-**

Average Author Per Paper = No. of Authors/No. of Papers

Average Author Per Paper = $\frac{1845}{2876}$

Therefore, Average Author Per Paper = **0.64**

5.7.2 Productivity Per Author

- **With regard to all documents:-**

Productivity Per Author = No. of Papers/No. of Authors

Productivity Per Author = $\frac{8869}{6898}$

Therefore, Productivity Per Author = **1.28**

- **With regard to Journals:-**

Productivity Per Author = No. of Papers/No. of Authors

Productivity Per Author = $\frac{2876}{1845}$

Therefore, Productivity Per Author = **1.56**

Table -11: Author Productivity

Author Productivity of All Documents Authors available					
Sl.No	**Year**	**Total Number of Papers (Documents)**	**Total Number of Authors**	**AAPP**	**Productivity per Author**
1.	1807-2015	8869 (excluding organization, links and unidentified)	6898	0.78	1.28
Author Productivity with regard to Journal's Author					
Sl.No	**Year**	**Total Number of Papers**	**Total Number of Authors**	**AAPP**	**Productivity per Author**
1.	1839-2015	2876	1845	0.64	1.56

(Source: Survey data)

While analyzing the table, it could be found that, the total number of papers (Documents) is 8869 and the total number of Authors is 6898. With regard to AAPP of all documents (6898/8869) is 0.78 during 1807-2015 and productivity per author is 1.28 i.e., (8869/6898). Author Productivity of Journal's Author alone is

calculated and AAPP is 0.64 i.e., (1845/2876) and productivity per author is 1.56 i.e. (2876/1845).

5.8 Top 10 List of Prolific Authors from all citations

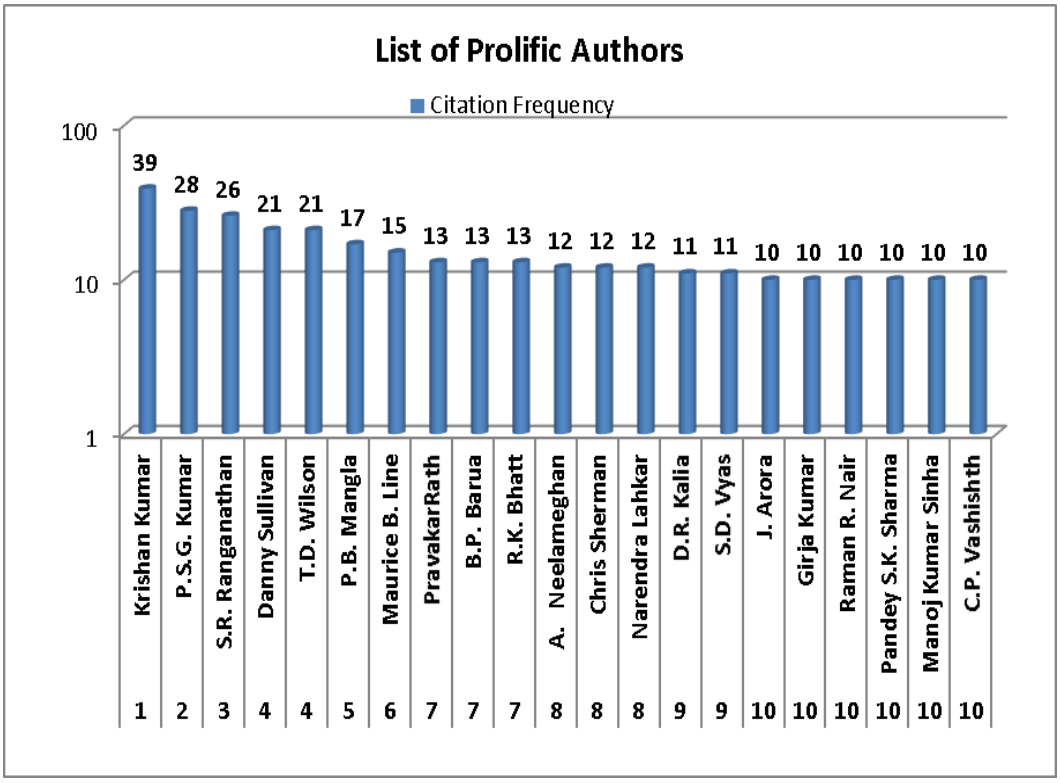
Table-12 depicts the top 10 list of 21 prolific authors who have contributed at least 10 articles during the study period. There are 6898 authors (from all citations) during the period 2006-2015 of the Bibliography of Doctoral Theses. This is supported by Graph-6 for clear visualization.

Table -12: Top 10 List of Prolific Authors from all citations

Sl.No	Rank	Name of Author	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Krishan Kumar	39	0.64	39	0.64
2.	2	P.S.G. Kumar	28	0.46	67	1.1
3.	3	S.R. Ranganathan	26	0.43	93	1.53
4.	4	Danny Sullivan	21	0.34	114	1.87
5.	=4	T.D. Wilson	21	0.34	135	2.21
6.	5	P.B. Mangla	17	0.30	152	2.51
7.	6	Maurice B. Line	15	0.24	167	2.75
8.	7	PravakarRath	13	0.21	180	2.96
9.	=7	B.P. Barua	13	0.21	193	3.17
10.	=7	R.K. Bhatt	13	0.21	206	3.38
11.	8	A. Neelameghan	12	0.20	218	3.58
12.	=8	Chris Sherman	12	0.20	230	3.78
13.	=8	Narendra Lahkar	12	0.20	242	3.98
14.	9	D.R. Kalia	11	0.18	253	4.16
15.	=9	S.D. Vyas	11	0.18	264	4.34
16.	10	J. Arora	10	0.16	274	4.5
17.	=10	Girja Kumar	10	0.16	284	4.66
18.	=10	Raman R. Nair	10	0.16	294	4.82
19.	=10	Pandey S.K. Sharma	10	0.16	304	4.98

20.	=10	Manoj Kumar Sinha	10	0.16	314	5.14
21.	=10	C.P. Vashishth	10	0.16	324	5.3

(Source: Survey data)



Graph-6: Top 10 List of Prolific Authors from all citations

Table-10E& Graph-5E already depicts author distribution of Single author. Table 12 depicts the top 10 list of Prolific Authors. Observation done with more concentration done on the basis of the Universities of North East India, with special reference to the Department of Library and Information Science, there are three (3) Authors which comes under the top 10 list. Rank 7th of overall, Pravakar Rath, Professor, Department of Library and Information Science, Mizoram University ranked 1st position i.e. 13 (0.21%) citations followed by Rank 8th of overall, Narendra Lahkar, Professor, Department of Library and Information Science, Gauhati University holds 2nd position i.e. 12 (0.2%) citations and Rank 10th of overall, Manoj

Kumar Sinha, Professor, Department of Library and Information Science, Assam University holds 3rd position i.e. 10 (0.16%) citations.

5.9 Degree of Collaboration: Single Vs. Multiple Authors

The degree of collaborations among the authors visualizes the number of research papers authored jointly during a given period. To determine the degree of collaboration in quantitative terms for the present study, the formula formulated by Subramanayam (1983) as follows was applied.

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

where,

C = Degree of collaboration in discipline,

N_m = Number of multi-authored papers (2056+374+366 = 2796) and

N_s = Number of single authored papers (6073).

Hence, the degree of collaboration of citations made in the Ph.D. theses covered under study is,

$$C = \frac{2796}{2796+6073} = \mathbf{0.31}$$

Where, 2796 represents the total number of multiple authors like, joint authors, triple authors and more than three authors in the given study and 6073 represents the single authors.

Again, while making an analysis of the degree of collaboration i.e. single vs. multiple authors who constitute joint, triple, more than three, and organization, it was observed that the degree of collaboration in the discipline is calculated as **0.31** and this shows the prevalence solo research in the field.

Degree of Collaboration (Journals Article)

Table-13: Degree of Collaboration (Journals Article)

Sl. No.	**Year**	**Single Authors**	**%**	**Multi-Authored**	**%**	**Total No. of Articles**	**Degree of Collaboration**
1.	1839-2015	1846	64.2	1030	35.8	2876 (100%)	**0.36**

(Source: Survey data)

Where, 1,030 represents the total number of multiple authors like two, three, four, five, six, seven and more than seven authors in the given study and 1,846 represents the single authors.

Again, while making an analysis of the degree of collaboration i.e. single vs. multiple authors who constitute two, three, four, five six, seven and more than seven authors, it was observed that,

$$C = \frac{1030}{1030+1846}$$

$$= \mathbf{0.36}$$

This shows the prevalence solo research in the field.

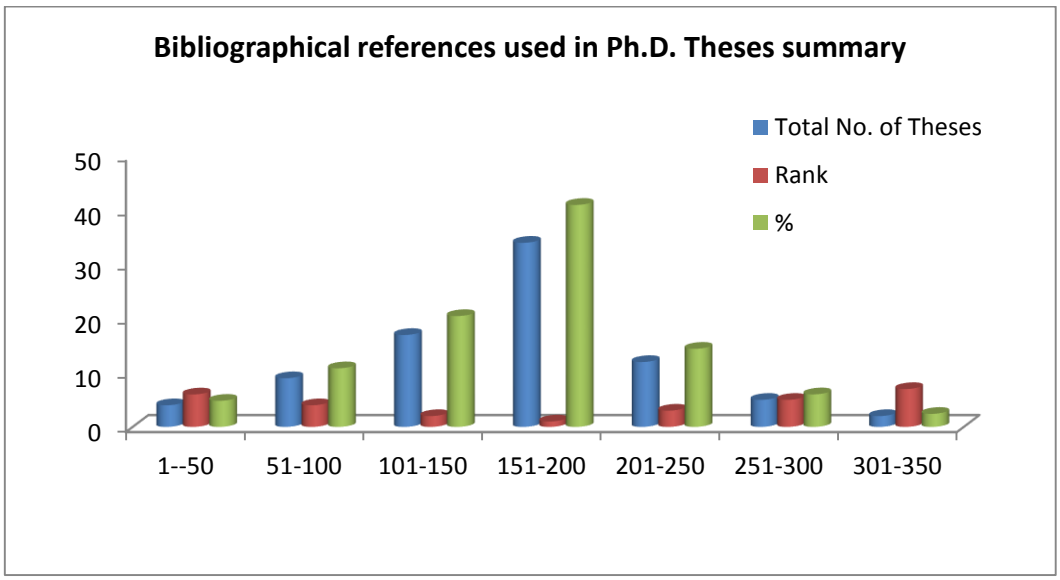
5.10 Bibliographical References used in Ph.D. Theses Summary & Average Citation per Thesis

The bibliographical references appended at the end of each thesis are counted and analyzed according to rank-wise as well as average citation per thesis. The calculations are performed taking into account the total number of citations divided by the number of theses submitted during the study period. The data summary grouped under 50 each of the bibliographical references of all 83 Ph.D. theses covered under the period of the study are placed in Table-14 for analysis and the same is supported with graphical representation in Graph- 7.

Table-14: Bibliographical references used in Ph.D. Theses summary

Sl.No.	References	Total No. of Theses	Rank	%
1.	1-50	4	6	4.82
2.	51-100	9	4	10.84
3.	101-150	17	2	20.5
4.	151-200	34	1	40.96
5.	201-250	12	3	14.45
6.	251-300	5	5	6.02
7.	301-350	2	7	2.41
Total		**83**	**-**	**100**

(Source: Survey data)



Graph-7: Bibliographical references used in Ph.D. Theses summary

Table 14 shows the total references used by Ph.D. scholars after submitting their theses in the Department of Library and Information science during the period of the study. The table on the analysis found that the highest range of references out of the total number of 12,707 references comes to 151-200 covering 34 (40.96%) Theses and hence, occupy 1st rank in the order. This is followed by the range of 101-150 references covering 17 (20.5%) theses and 12 (14.45%) theses with a range of 201-250 references and thus, occupies 2nd and 3rd rank respectively in the ranking order.

Average Citation per Theses: - Average Citation per Theses is calculated from the total number of references as already mentioned in **5.1** i.e. 12,707 divided by the total number of Theses i.e. **83** in total. This comes to 153.09.

$$ACT = \frac{TR}{TT} \qquad \text{i.e.,} \qquad \frac{12707}{83} = 153.09$$

Where,

ACT = Average Citation per Theses,

TR = Total no. of References and

TT = Total no. of Theses.

(It is calculated by the scholar's own idea)

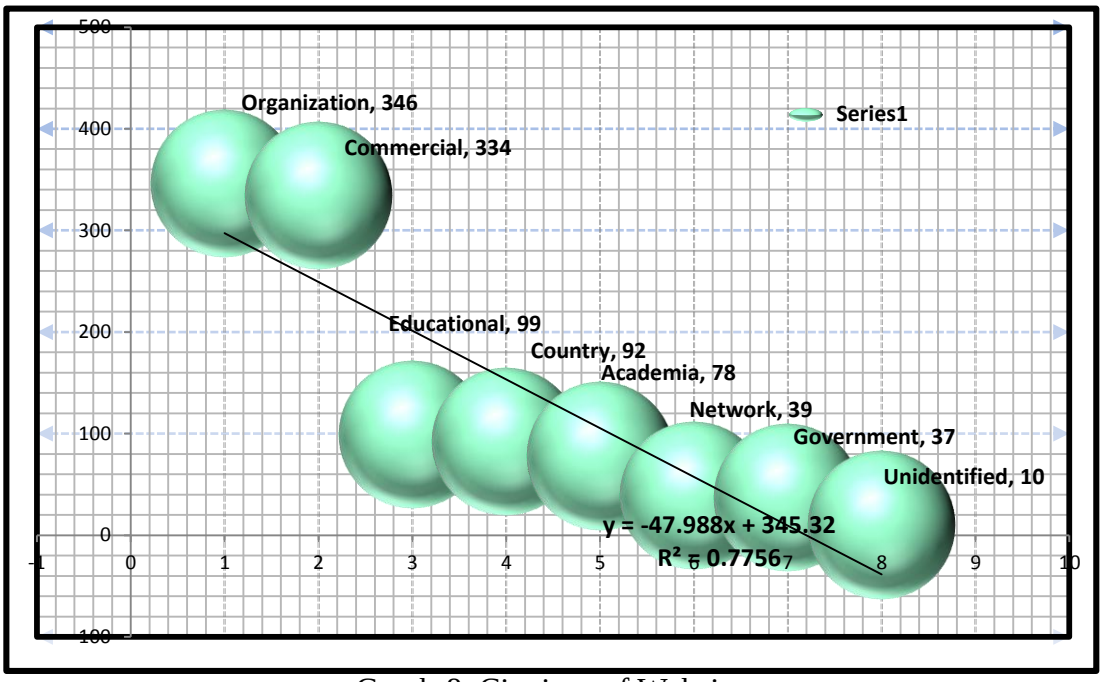
5.11 Citation of Websites

Websites facilitate a good length of useful information to the scholars for research. In most of the organizations, authors publish their research papers in electronic form either through open-source or priced-based journals or in social networking sites. In the process, the researcher comes across multiple electronic resources concerning their research area. All the 83 scholars have accessed various websites available through Academia, Commercial, Educational, Country, Government, Network, Organization and Unidentified (which cannot be ignored) to elicit the information for their research work. The data relating to the websites visited by the scholar either through attached documents and link citations alone in their theses have been placed in Table-15 which reflects the domain name, citation frequency, and the percentage. This is well supported with the Graph-8 for clear understanding.

Table-15: Citation of Websites

Sl/No	Domain Name	Frequency	%	Cumulative Frequencies	Cumulative %
1.	Academia	78	7.54	78	7.54
2.	Commercial	334	32.27	412	39.81
3.	Country	92	8.89	504	48.7
4.	Educational	99	9.56	603	58.26
5.	Government	37	3.57	640	61.83
6.	Network	39	3.77	679	65.6
7.	Organization	346	33.43	1025	99.03
8.	Unidentified	10	0.97	1035	100
Total		**1035**	**100**		

(Source: Survey data)



Graph-8: Citations of Website

Analysis of the Table-15 reflected that Organization sites stand at the apex because of 346 citations (33.43%) out of 1035 in total followed by 334 (32.27%) commercial sites citations and Educational sites 99 (9.56%) and thus, it constitutes 1st, 2nd, 3rd in ranking order. It is further deduced from the analysis that, the other websites

such as Country-Specific, Academia, Network domain, and Government equally contribute a plethora of information in various fields of study which are most relevant for research purpose. The research scholars accessed such websites to substantiate the information required for their research work. This further revealed that scholars are quite used to computer literacy and network literacy to elicit information in various fields of research available on multiple websites.

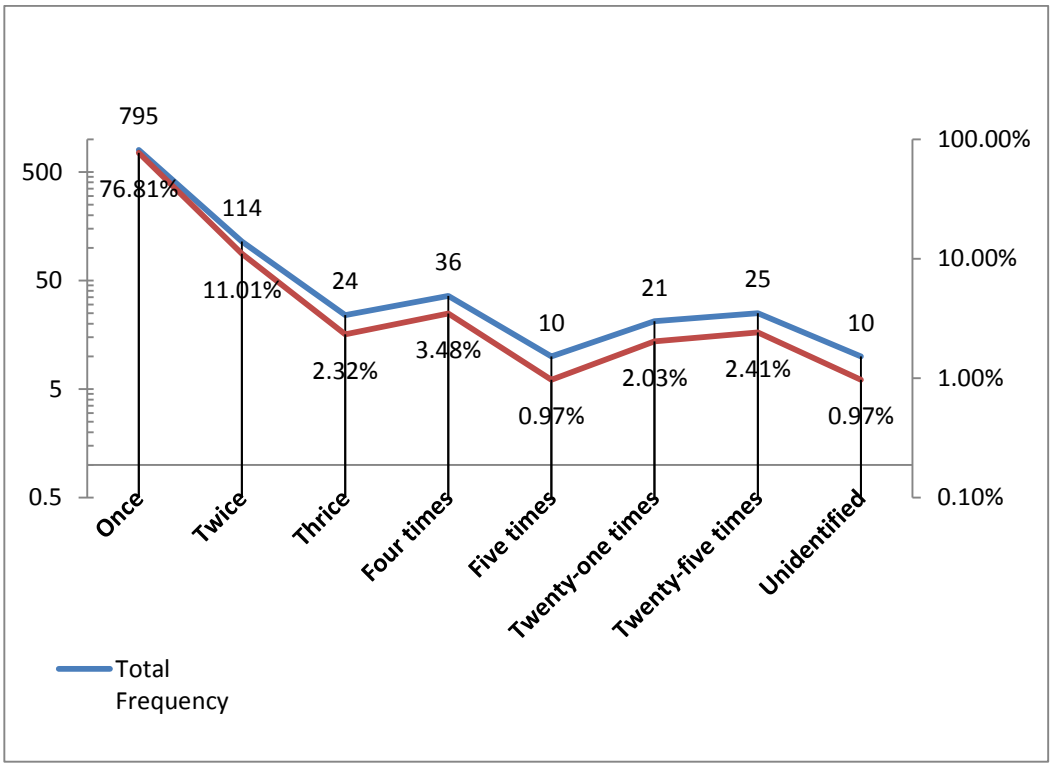
5.12 Website Citation Frequencies

Information prevails in websites contribute immensely for research work and its substantial value-added information from Academia, Commercial, Country, Educational, Government, Network, and Organization sites as already discussed. The visit of various websites by the scholars and citations of the same thereto, in their theses, has been mentioned in Table-16 for analysis. Here, the citation frequencies combined of Academia, Commercial, Country, Educational, Government, Network, and Organization have been reflected. It has also been supported with Graph-9 for a clear understanding. Further, data relating citation of website frequency by the scholars in their theses have been grouped under seven categories such as Once, Twice, Thrice, Four times, Five times, Twenty-one times and Twenty-five times excluding unidentified.

Table-16: Websites Citation Frequencies

Sl/No	Citation of Website Frequency	Citation Frequency	Total Frequency	%	Cumulative Frequencies	Cumulative %
1.	Once	795	795	76.81	795	76.81
2.	Twice	57	114	11.01	909	87.82
3.	Thrice	8	24	2.32	933	90.14
4.	Four times	9	36	3.48	969	93.62
5.	Five times	2	10	0.97	979	94.59
6.	Twenty-one times	1	21	2.03	1000	96.62
7.	Twenty-five times	1	25	2.41	1025	99.03
8.	Unidentified	10	10	0.97	1035	100
		Total	**1035**	**100**		

(Source: Survey data)



Graph-9: Websites Citation Frequencies

The analysis of the websites citation frequencies analysis placed in Table-16deduced that in the ranking order, one time citation constitutes the highest i.e., 795 citation frequencies (76.81%) out of 1035, followed by Two times citations which form 114 citation frequencies (11.01%) and Four times citations 36 citation frequencies (3.48%) thus, occupy 1st, 2nd, and 3rd position respectively in the ranking order. Further analysis of the table showed that, other websites citation frequency status comes to Twenty-five times citations for only 1 time with the percentage of 2.41%, Thrice for 8 times which constitute 24 (2.32%), Twenty-one times citations for only 1 time with the percentage 2.03%, Five times citations for 2 times that constitute 0.97% and Unidentified 10 citations forms 0.97%. The scholars browse these websites to elicit information in different ways.

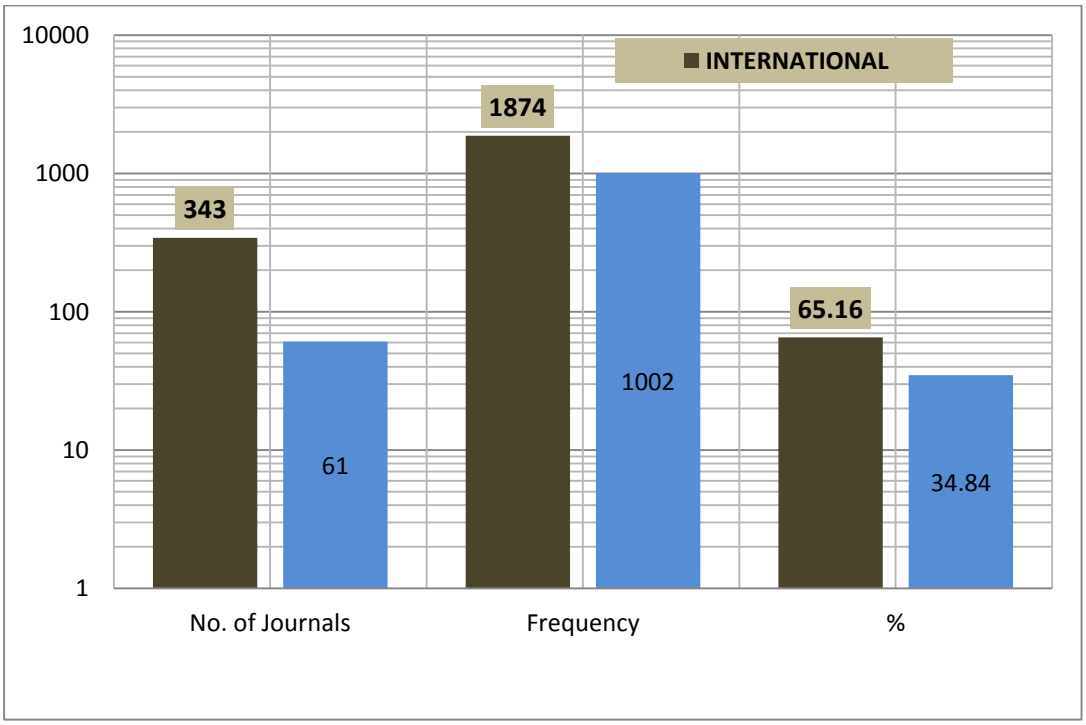
5.13 Categorization of Journals

Categorizations of journals are studied from among the cited articles by the scholars of all 83 theses covered under the study. Among the list of articles cited, a total of 2876 citations from 404 journals were cited by the scholars. The categorization of the journal has been classified into two types such as National and International and has been listed in decreasing order of their citing frequency in Table-17 supported with Graph-10 for clear understanding.

Table-17: Categorization of Journals

S/N	Category	No. of Journals	Frequency	%	Cumulative Frequencies	Cumulative %
1.	International	343 (84.9%)	1874	65.16	1874	65.16
2.	National	61 (15.1%)	1002	34.84	2876	100
Total		**404**	**2876**	**100**		

(Source: Survey data)



Graph-10: Categorization of Journals

In all 83 Doctoral theses, a total number of 12707 citations were examined where the scholar identified 2876 citations from 404 different journals in total that comprises both national and international. Analysis of the Table-17 reflected that while there are 343 international (84.9%) journals out of 404, national journals comes to 61 (15.1%). Further, out of 2876 citations in total from both the types of journals, 1874 citations (65.16%) are having International status while 1002 citations

are having national status which constitutes34.84%. This visualizes that, the scholars are more prone to cite the journals emanated from outside rather than home. This is primarily due to the availability of international journals through consortia in the libraries. However, sporadic attempts are required to be initiated by the library to use more e-resources available through consortia to get the return value.

5.14 Cited Articles from Journals

Journal-wise distributions of articles are studied among the cited articles from both electronic and print sources. Among the list of articles cited from the journals both print and electronic, there were total numbers of 2876 citations by all 83 Ph.D. theses. Most highly cited articles i.e., the number of times cited from the journals in the theses covered under the study have been placed below in Table-18and it is supplemented with Graph-11 in the decreasing sequence. The scholar has distributed all the 2876 citations from 404 journals in the Table showing the number of times cited, its' percentage and cumulative frequencies with percentage.

Table-18: Cited Articles from the Journals

S.N	Journal (s) (in figure)	No. of times cited	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	135	135	4.7	135	4.7
2.	1	111	111	3.86	246	8.56
3.	1	97	97	3.37	343	11.93
4.	1	91	91	3.16	434	15.09
5.	1	84	84	2.92	518	18.01
6.	1	82	82	2.85	600	20.86
7.	1	75	75	2.61	675	23.47
8.	2	68	136	4.73	811	28.2
9.	1	66	66	2.3	877	30.5

10.	1	59	59	2.05	936	32.55
11.	1	55	55	1.91	991	34.46
12.	1	54	54	1.88	1045	36.34
13.	1	50	50	1.74	1095	38.08
14.	1	49	49	1.7	1144	39.78
15.	3	44	132	4.6	1276	44.38
16.	3	43	129	4.48	1405	48.86
17.	1	42	42	1.46	1447	50.32
18.	1	40	40	1.4	1487	51.72
19.	1	37	37	1.3	1524	53.02
20.	1	35	35	1.22	1559	54.24
21.	1	34	34	1.18	1593	55.42
22.	1	32	32	1.11	1625	56.53
23.	1	31	31	1.1	1656	57.63
24.	2	29	58	2.02	1714	59.65
25.	1	28	28	0.97	1742	60.62
26.	1	27	27	0.94	1769	61.56
27.	2	26	52	1.81	1821	63.37
28.	1	25	25	0.87	1846	64.24
29.	2	23	46	1.6	1892	65.84
30.	1	22	22	0.76	1914	66.6
31.	1	21	21	0.73	1935	67.33
32.	2	19	38	1.32	1973	68.65
33.	2	18	36	1.25	2009	69.9
34.	2	17	34	1.18	2043	71.08
35.	2	15	30	1.04	2073	72.12
36.	2	14	28	0.97	2101	73.09
37.	1	13	13	0.45	2114	73.54
38.	2	12	24	0.83	2138	74.37
39.	2	11	22	0.76	2160	75.13
40.	3	10	30	1.04	2190	76.17
41.	1	9	9	0.31	2199	76.48
42.	6	8	48	1.67	2247	78.15
43.	6	7	42	1.46	2289	79.61
44.	4	6	24	0.83	2313	80.44
45.	17	5	85	2.95	2398	83.39
46.	16	4	64	2.22	2462	85.61
47.	29	3	87	3.02	2549	88.63
48.	59	2	118	4.1	2667	92.73
49.	209	1	209	7.27	2876	100
Total	**404**		**2876**	**100**		

(Source: Survey data)

Graph-11: Cited Articles from the Journals

Analysis of the data placed in Table-18 reflected that, the highly cited rate is 135 times (4.7%) out of 2876, followed by 111 times (3.86%), 97 times (3.37%), 91 times (3.16%), 84 times (2.92%), 82 times (2.85%), 75 times (2.61%) for 1 journal each, 68 for 2 journals (2.37%) each, 66 times (2.3%), and 59 times (2.05%) for 1 journal each and so on. Further, the cited rates from the remaining 393 journals have been placed and analyzed which shows the importance of the research articles of the journals. However, due to multiple access provisions, the scholars also cite other journals in the research subject.

5.15 Ranking of Journals

Highly cited journals have a higher impact factor which is a common parameter for measuring the relative importance of a journal. It is also important to determine the journals most resourceful for researchers. Citations of journals in all 83 theses across 2876 citations from 404 Library and Information Journals are listed in decreasing order of their frequency of citations in Table-19 along with Graph-12 with clear visualization. Besides, the list of Top 10 International Journals and Top 10 National Journals are highlighted in Table-19A and Table-19B, the list of Top 5 Printed and Top 5 Electronic Journal are also highlighted in Table-19C and Table-19D respectively in their ranking order.

Table-19: Ranking of Journals

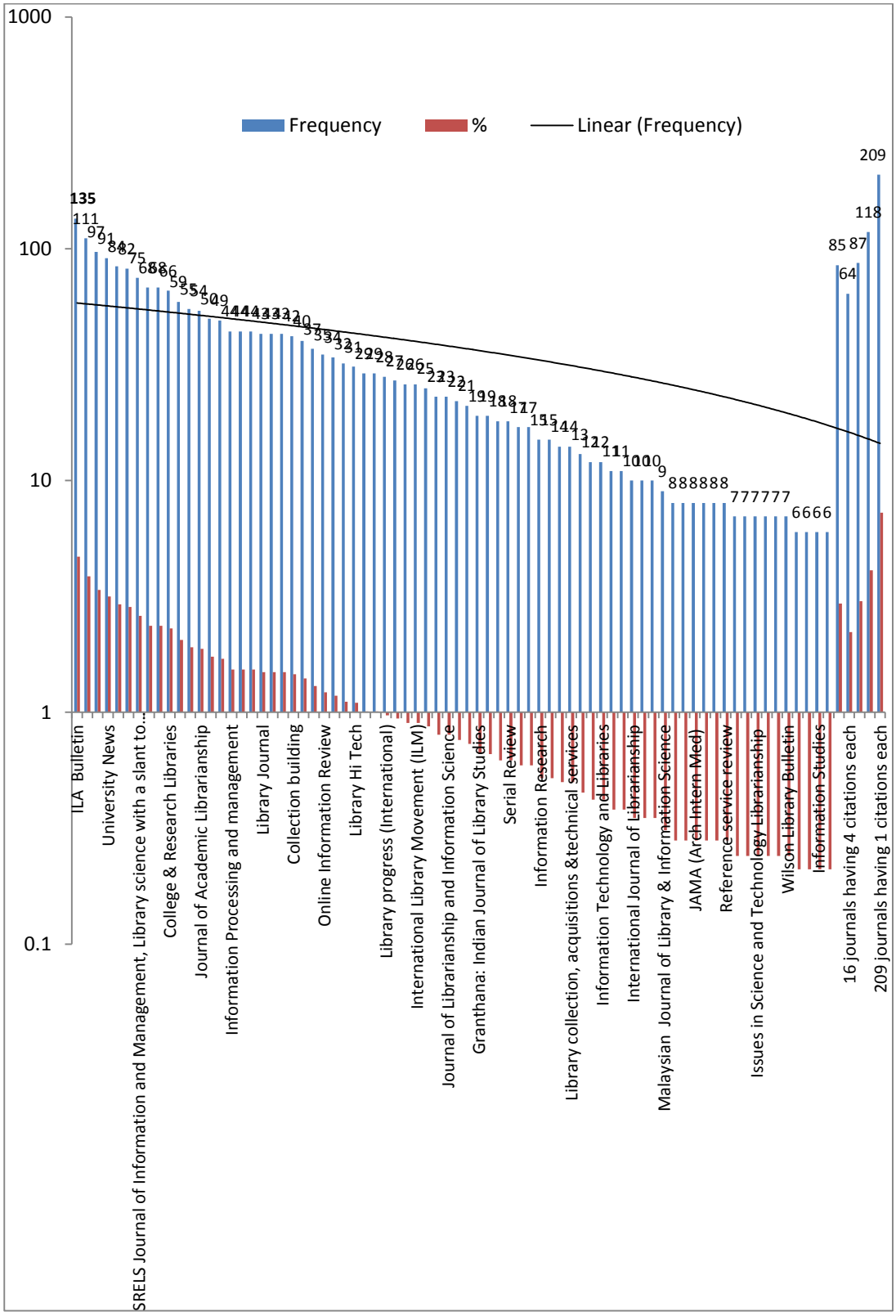
S/N	Rank	Name of Journal	Frequency	%	Cumulative Frequency	Cumulative %
1.	1	ILA Bulletin	135	4.7	135	4.7
2.	2	DESIDOC Journal of library and information Technology	111	3.86	246	8.56
3.	3	Annals of Library & Information Studies (Annals of Library Science & Documentation)	97	3.37	343	11.93
4.	4	University News	91	3.16	434	15.09
5.	5	IASLIC Bulletin	84	2.92	518	18.01
6.	6	Library Herald	82	2.85	600	20.86
7.	7	SRELS Journal of Information and Management, Library science with a slant to documentation	75	2.61	675	23.47
8.	8	Herald of Library Science	68	2.36	743	25.83
9.	8	Journal of Documentation	68	2.36	811	28.19
10.	9	College & Research Libraries	66	2.3	877	30.49
11.	10	Electronic Library	59	2.05	936	32.54
12.	11	New Library World (Asian Libraries)	55	1.91	991	34.45
13.	12	Journal of Academic Librarianship	54	1.88	1045	36.33

14.	13	Indian Journal of Information Library and Society (IJILIS)	50	1.74	1095	38.07
15.	14	ASLIB proceedings	49	1.7	1144	39.77
16.	15	Information Processing and Management	44	1.53	1188	41.3
17.	=15	Journal of the American Society for Information Science & Technology	44	1.53	1232	42.83
18.	=15	Library & Archival security	44	1.53	1276	44.36
19.	16	Library Journal	43	1.49	1319	45.85
20.	=16	Library Review	43	1.49	1362	47.34
21.	=16	Program	43	1.49	1405	48.83
22.	17	Collection Building	42	1.46	1447	50.29
23.	18	Library Trends	40	1.4	1487	51.69
24.	19	Journal of Library & Information Science	37	1.3	1524	52.99
25.	20	Online Information Review	35	1.22	1559	54.21
26.	21	Journal of Education for Library and Information Science	34	1.18	1593	55.39
27.	22	IFLA Journal	32	1.11	1625	56.5
28.	23	Library Hi Tech	31	1.1	1656	57.6
29.	24	BMJ (British Medical Journal)	29	1.01	1685	58.61
30.	=24	Libri	29	1.01	1714	59.62
31.	25	Library Progress (International)	28	0.97	1742	60.59
32.	26	Library Management	27	0.94	1769	61.53
33.	27	Library & Information science research	26	0.9	1795	62.43
34.	=27	International Library Movement (ILM)	26	0.9	1821	63.33
35.	28	Library Philosophy & Practice	25	0.87	1846	64.2
36.	29	Indian Journal of Information Resources and Services	23	0.8	1869	65
37.	=29	Journal of Librarianship and Information Science	23	0.8	1892	65.8
38.	30	Annual Review of Information Science and Technology (ARIST)	22	0.76	1914	66.56
39.	31	Education for Information	21	0.73	1935	67.29
40.	32	Granthana: Indian Journal of Library Studies	19	0.66	1954	67.95
41.	32	Journal of Library Administration	19	0.66	1973	68.61
42.	33	Journal of Information Science	18	0.62	1991	69.23
43.	=33	Serial Review	18	0.62	2009	69.85
44.	34	D-Lib Magazine	17	0.59	2026	70.44

45.	=34	The Assam Review & tea news	17	0.59	2043	71.03
46.	35	Information Research	15	0.52	2058	71.55
47.	35	Library Quarterly	15	0.52	2073	72.07
48.	36	International Information & Library Review	14	0.5	2087	72.57
49.	=36	Library Collection, Acquisitions & Technical Services	14	0.5	2101	73.07
50.	37	CLIS Observer	13	0.45	2114	73.52
51.	38	Computers in Libraries	12	0.42	2126	73.94
52.	=38	Information Technology and Libraries	12	0.42	2138	74.36
53.	39	Scientometrics	11	0.38	2149	74.74
54.	=39	VINE The Journal of Information and Knowledge Management Systems	11	0.38	2160	75.12
55.	40	International Journal of Librarianship	10	0.35	2170	75.47
56.	=40	Journal of Medical Internet Research	10	0.35	2180	75.82
57.	=40	OCLC systems & Services	10	0.35	2190	76.17
58.	41	Malaysian Journal of Library & Information Science	9	0.31	2199	76.48
59.	42	American Libraries	8	0.28	2207	76.76
60.	=42	Ariadne	8	0.28	2215	77.04
61.	=42	JAMA (Arch Intern Med)	8	0.28	2223	77.32
62.	=42	Bottom-Line: Managing Library Finance	8	0.28	2231	77.6
63.	=42	KELPRO Bulletin	8	0.28	2239	77.88
64.	=42	Reference Service Review	8	0.28	2247	78.16
65.	43	International Library Review	7	0.24	2254	78.4
66.	=43	Internet Research Electronic Networking Applications and Policy	7	0.24	2261	78.64
67.	=43	Issues in Science and Technology Librarianship	7	0.24	2268	78.88
68.	=43	Science & Technology Libraries	7	0.24	2275	79.12
69.	=43	Special Libraries	7	0.24	2282	79.36
70.	=43	Wilson Library Bulletin	7	0.24	2289	79.6
71.	44	American Archivist	6	0.21	2295	79.81
72.	=44	Cataloguing and Classification Quarterly	6	0.21	2301	80.02
73.	=44	Information Studies	6	0.21	2307	80.23
74.	=44	Journal of Education for Librarianship	6	0.21	2313	80.44

75.	45	17 journals having 5 citations each	85	2.95 (0.17 each)	2398	83.39
76.	46	16 journals having 4 citations each	64	2.22 (0.13 each)	2462	85.61
77.	47	29 journals having 3 citations each	87	3.02 (0.1 each)	2549	88.63
78.	48	59 journals having 2 citations each	118	4.1 (0.06 each)	2667	92.73
79.	49	209 journals having 1 citations each	209	7.27 (0.03 each)	2876	100
80.		**Total**	**2876**	**100**		

(Source: Survey data)



Graph-12: Ranking of Journals

While analyzing the ranking of journals placed in Table-19, it was observed that, out of a total number of 2876 citations from 404 journals as already discussed (Table-18) while, ILA Bulletin stands at the apex for having been maximum 135 (4.7%) citations and thus keeps 1st position in the ranking order, DESIDOC Journal of library and information technology is at the 2nd position in the ranking order for having 111 citations (3.86%) and Annals of Library & Information Studies (Annals of Library Science & Documentation) in the 3rd position for having 97 citations (3.37%). The ranking order of other journals cited by the scholars have been depicted in the table which clearly shows that, University News has 91 (3.16%) citations while, IASLIC Bulletin 84 (2.92%) citations, Library Herald 82 (2.85%) citations, SRELS Journal of Information and Management, Library science with a slant to documentation 75 (2.61%) citations, Herald of Library Science and Journal of Documentation each having 68 (2.36%) citations, College & Research Libraries having 66 (2.3%) citations, Electronic Library 59 (2.05%) citations, New Library World (Asian Libraries) 55 (1.91%) citations, Journal of Academic Librarianship 54 (1.88%) citations, Indian Journal of Information Library and society (IJILIS) 50 (1.74%) citations, ASLIB proceedings 49 (1.7%) citations, Information Processing and management, Journal of the American Society for Information Science & Technology and Library & Archival security each having 44 (1.53%) citations each, Library Journal, Library review and Program each having 43 (1.49%) citations, Collection building 42 (1.46%) citations, Library Trends 40 (1.4%) citations, Journal of Library & Information Science 37 (1.3%) citations, Online Information Review 35 (1.22%) citations, Journal of Education for Library and Information Science 34 (1.18%) citations, IFLA Journal 32 (1.11%) citations, Library Hi Tech 31 (1.1%) citations,

BMJ (British Medical Journal) and Libri each having 29 (1.01% citations, Library progress (International) 28 (0.97%) citations, Library Management 27 (0.94%) citations, Library & Information science research and International Library Movement (ILM) each having 26 (0.9%) citations, Library Philosophy & Practice 25 (0.87%) citations, Indian Journal of Information Resources and Services and Journal of Librarianship and Information Science each having 23 (0.8%) citations, Annual Review of Information science and Technology (ARIST) 22 (0.76%) citations, Education for Information 21 (0.73%) citations, Granthana: Indian Journal of Library Studies and Journal of Library Administration each having 19 (0.66%) citations, Journal of Information Science and Serial Review each having 18 (0.62%) citations, D-Lib Magazine and The Assam Review & tea news each having 17 (0.59%) citations, Information Research and Library quarterly each having 15 (0.52%) citations, International Information & Library Review and Library collection, acquisitions &technical services each having 14 (0.5%) citations, CLIS Observer 13 (0.45%) citations, Computers in libraries and Information Technology and Libraries each having 12 (0.42%) citations, Scientometrics and VINE The Journal of Information and Knowledge Management Systems each having 11 (0.38%) citations, International Journal of Librarianship, Journal of Medical Internet Research and OCLC systems & Services each having 10 (0.35%) citations, Malaysian Journal of Library & Information Science 9 (0.31%) citations, American Libraries, Ariadne, JAMA (Arch Intern Med), Journal of The bottom Line Managing Library finance, KELPRO Bulletin and Reference service review having 8 (0.28%) citations each, International Library Review, Internet Research Electronic Networking Applications and Policy, Issues in Science and Technology Librarianship, Science & Technology

Libraries, Special Libraries and Wilson Library Bulletin having 7 citations (0.24%) each, American Archivist, Cataloguing and Classification Quarterly, Information Studies and Journal of Education for Librarianship having 6 citations (0.21%) each. The other 17 journals are having 5 citations each and 16 journals having 4 citations each thus forms 85 (2.95%) i.e. (0.17% each) and 64 (2.22%) i.e. (0.13% each) respectively. The 29 journals having 3 citations each having 87 (3.02%) i.e. (0.1% each), all 59 journals having 2 citations each having 118 (4.1%) i.e. (0.06% each) and all 209 journals having 1 citation each having 209 (7.27%) i.e. (0.03% each). It is interesting to note that, majority of the journal citation, cited by the scholar goes to international journals compared to the national journal as per the analysis. This also further reflects that the international journals lead in the number of journals, the citation frequency as well as percentage.

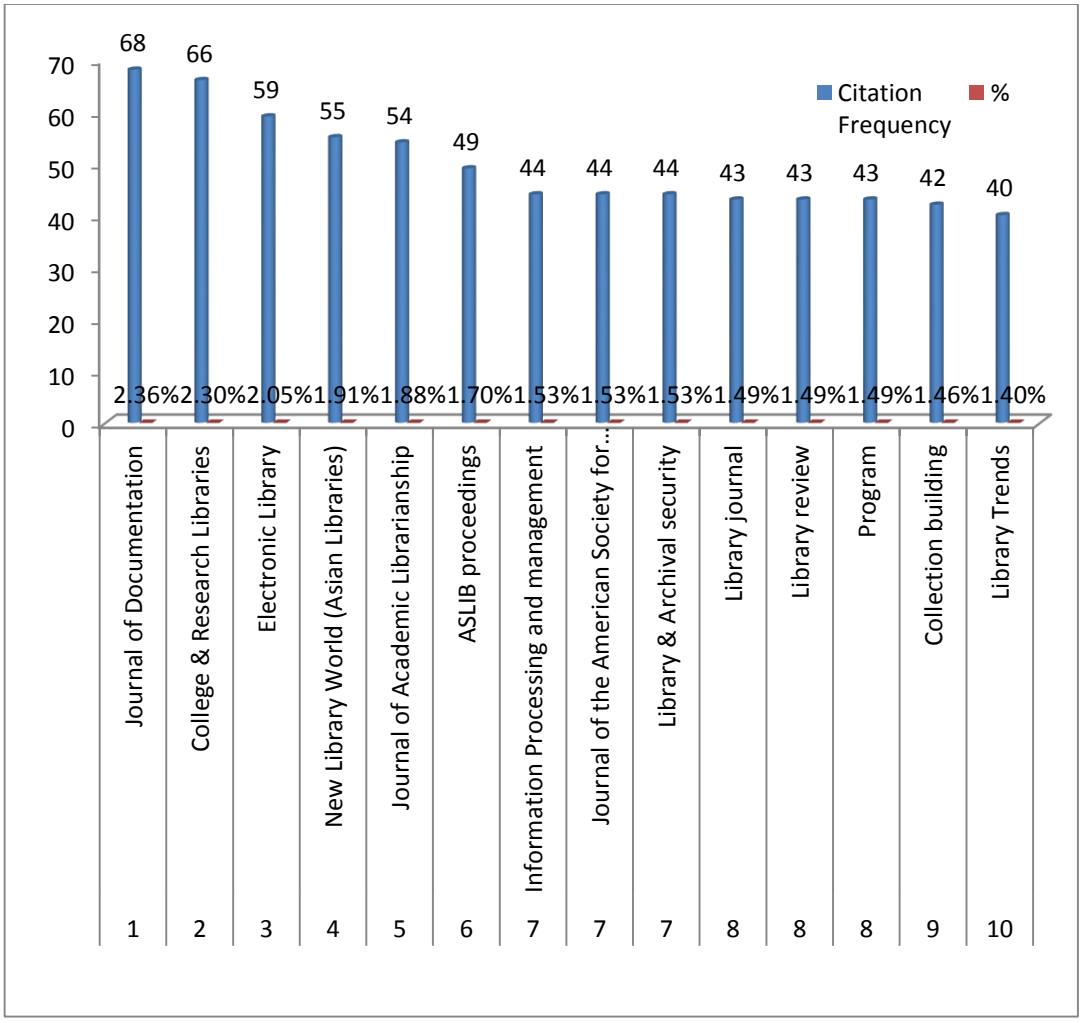
Top 10 International Journals and Top 10 National Journals has been listed in decreasing order of their citing frequency in Table-19A and Table-19B supported with Graph-12A and Graph-12B for clear understanding.

Table-19A: Top 10 International Journals

Sl.No	**Rank**	**Title of the Journal**	**Citation Frequency**	**%**	**% out of Total Journal Citations 2876**
1.	1	Journal of Documentation	68	9.79	2.36
2.	2	College & Research Libraries	66	9.51	2.30
3.	3	The Electronic Library	59	8.50	2.05
4.	4	New Library World (Asian Libraries)	55	7.92	1.91
5.	5	Journal of Academic Librarianship	54	7.78	1.88
6.	6	ASLIB proceedings	49	7.06	1.70
7.	7	Information	44	6.34	1.53

		Processing and management			
8.	7	Journal of the American Society for Information Science & Technology	44	6.34	1.53
9.	7	Library & Archival security	44	6.34	1.53
10.	8	Library Journal	43	6.19	1.49
11.	8	Library Review	43	6.19	1.49
12.	8	Program	43	6.19	1.49
13.	9	Collection Building	42	6.05	1.46
14.	10	Library Trends	40	5.76	1.40
		Total	**694**	**99.96 or 100**	

(Source: Survey data)

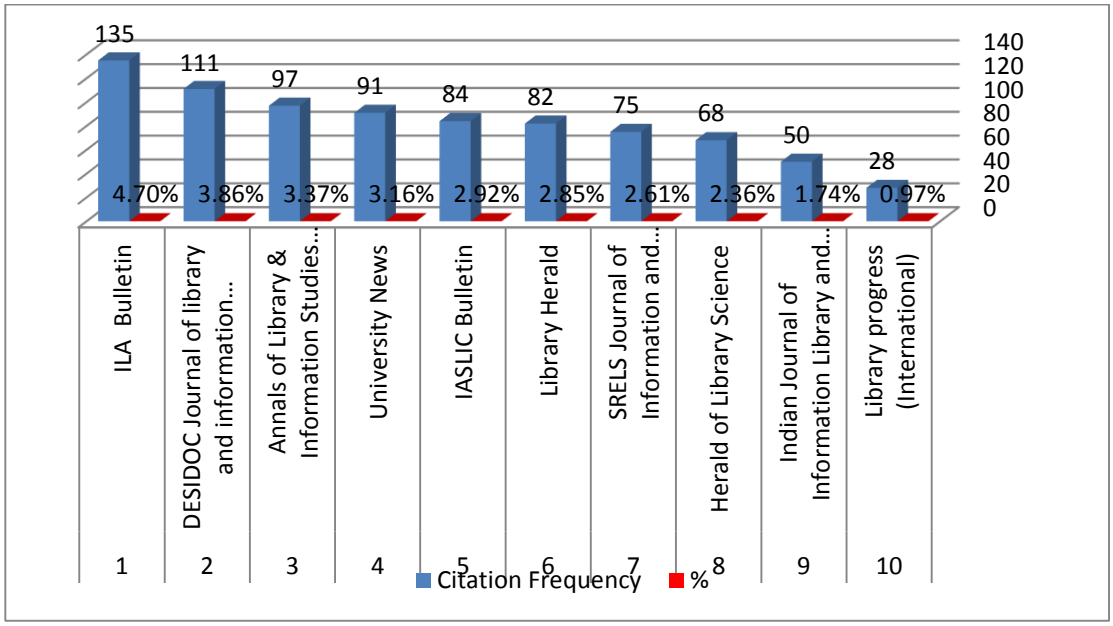


Graph-12A: Top 10 International Journals

Table-19B: Top 10 National Journals

Sl.No	Rank	Title of the Journal	Citation Frequency	%	% out of Total Journal Citations 2876
1.	1	ILA Bulletin	135	16.44	4.70
2.	2	DESIDOC Journal of Library and Information Technology	111	13.52	3.86
3.	3	Annals of Library & Information Studies (Annals of Library Science & Documentation)	97	11.81	3.37
4.	4	University News	91	11.08	3.16
5.	5	IASLIC Bulletin	84	10.23	2.92
6.	6	Library Herald	82	9.98	2.85
7.	7	SRELS Journal of Information and Management, Library Science with a slant to Documentation	75	9.13	2.61
8.	8	Herald of Library Science	68	8.28	2.36
9.	9	Indian Journal of Information Library and Society (IJILIS)	50	6.09	1.74
10.	10	Library Progress (International)	28	3.41	0.97
		Total	**821**	**99.97 or 100**	

(Source: Survey data)



Graph-12B: Top 10 National Journals

It is surprising to know that 343 numbers of international journals and 61 numbers of national journals were cited as shown in Table-19. But while studying the ranking of journals placed in Table-19, the top 10 rankings of International Journals placed in Table-19A and the top 10 rankings of National Journals placed in Table-19B, it could be found out that, the national journal status is high as compared to international journals. This is due to the fact that the scholars have cited a maximum of 68 (2.36%) citation frequencies of the international journals, while they have cited maximum 135 (4.7%) citation frequencies of the national journals. Besides, the number of Journals, the number of citation frequency and the number of percentages, International Journal leads in the three (3) criteria. Out of top 10, in the overall ranking, 8 numbers of journals are the National including one International journal in the ranking order of 8. The other 2 number of Journals out of top 10 are the international. This visualized that, the scholar gets an easy access to national journal

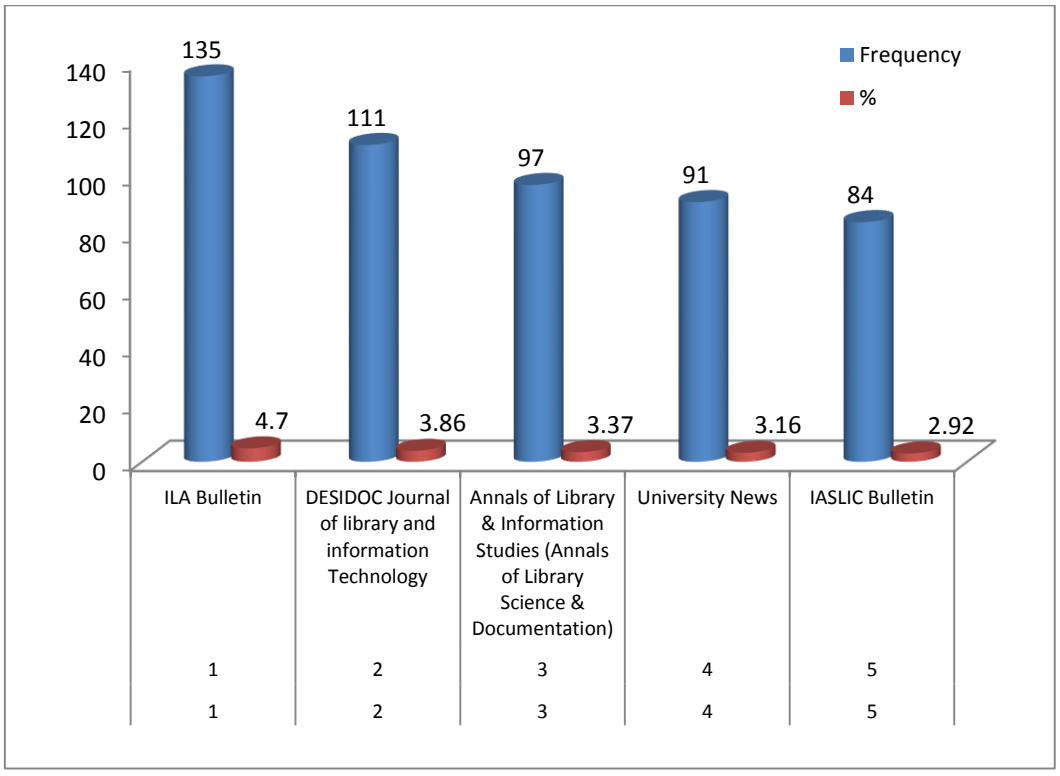
compared to International Journals. This also coupled with constraints by the international journals in getting the articles through open source.

Top 5 Printed Journals and Top 5 Electronic Journals has been listed in decreasing order of their citing frequency in Table-19C and Table-19D supported with Graph-12C and Graph-12D for clear visualization.

Table-19C: Top 5 Printed Journals

S/N	Rank	Name of Journal	Frequency	% out of Total Journal Citations 2876
1.	1	ILA Bulletin	135	4.7
2.	2	DESIDOC Journal of library and information Technology	111	3.86
3.	3	Annals of Library & Information Studies (Annals of Library Science & Documentation)	97	3.37
4.	4	University News	91	3.16
5.	5	IASLIC Bulletin	84	2.92

(Source: Survey data)

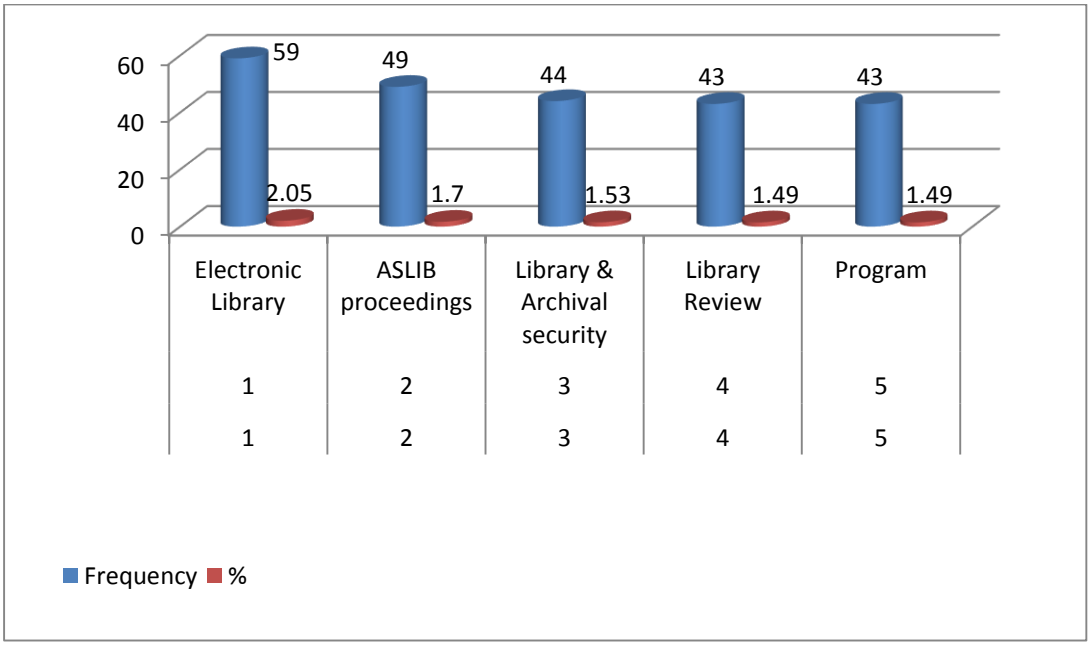


Graph-12C: Top 5 Printed Journals

Table-19D: Top 5 Electronic Journals

S/N	Rank	Name of Journal	Frequency	% out of Total Journal Citations 2876
1.	1	Electronic Library	59	2.05
2.	2	ASLIB proceedings	49	1.7
3.	3	Library & Archival security	44	1.53
4.	4	Library Review	43	1.49
5.	5	Program	43	1.49

(Source: Survey data)



Graph-12D: Top 5 Electronic Journals

While analyzing both Table 19C and Table 19D showing the top 5 journals of both print and electronic above respectively it was deduced that, compared to electronic journals, larger number of citation frequency goes to Printed Journals namely, ILA Bulletin 135 (4.7%) citations out of 2876 and thus occupy 1st in ranking order while, DESIDOC Journal of Library and Information Technology 111 (3.86%) citations in 2nd ranking order followed by Annals of Library and Information Studies 97 (3.37%) citations in 3rd rank, University News 91 (3.16%) citations in 4th rank and

IASLIC Bulletin 84 (2.92%) citations in 5th rank. The top 5 electronic journals in the ranking order however, comprise the Electronic Library in rank order 1 for having been cited 59 (2.05%) citations followed by ASLIB Proceedings 49 (1.7%) citations in ranking order 2 (Overall ranking No.14), Library & Archival Security 44 (1.53%) citations in ranking order 3 (Overall ranking No.15), Library Review 43 (1.49%) citations in ranking order 4 (Overall ranking No.16)and Program 43 (1.49%) citations in ranking order 5 (Overall ranking No.16). In the analysis regarding Top-5 Electronic and Printed Journals, it can be assumed that Printed Journals are having more citation frequency comparing to Electronic Journals. This is represented by Graph-12C and Graph-12D for clear visualization. The reason behind this is that Printed Journals are reader-friendly and easy-accessible and comfortable for being subscribed by the libraries under survey as compared to Electronic Journals.

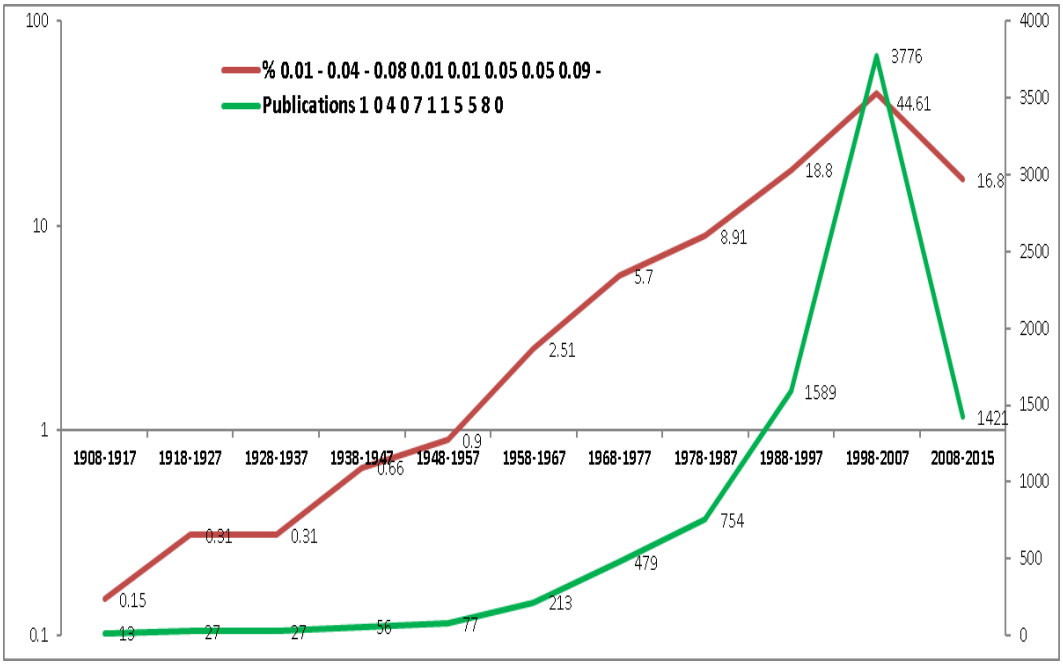
5.16 Chronological Distribution of Documents

The chronological distributions of documents cited by the scholars in their theses have been depicted below in Table-20. This is also one of the major components of the study to determine the research value of a journal including the obsolescence of literature in a given field of study. The total periods commencing from 1807 to 2015 have been split into 22 groups with a gap of 10 years in between each showing the citation frequency and the percentage thereto, including the cumulative frequencies and its percentage.

Table-20: Chronological Distribution of Documents

Sl.No.	Year (10 yrs Gap)	Publications	%	Cumulative Publications	Cumulative %
1.	1807	1	0.01	1	0.01
2.	1808-1817	0	-	1	0.01
3.	1818-1827	4	0.04	5	0.05
4.	1828-1837	0	-	5	0.05
5.	1838-1847	7	0.08	12	0.13
6.	1848-1857	1	0.01	13	0.14
7.	1858-1867	1	0.01	14	0.15
8.	1868-1877	5	0.05	19	0.2
9.	1878-1887	5	0.05	24	0.25
10	1888-1897	8	0.09	32	0.34
11.	1898-1907	0	-	32	0.34
12.	1908-1917	13	0.15	45	0.49
13.	1918-1927	27	0.31	72	0.8
14.	1928-1937	27	0.31	99	1.11
15.	1938-1947	56	0.66	155	1.77
16.	1948-1957	77	0.9	232	2.67
17.	1958-1967	213	2.51	445	5.18
18.	1968-1977	479	5.7	924	10.88
19.	1978-1987	754	8.91	1678	19.79
20.	1988-1997	1589	18.8	3267	38.59
21.	1998-2007	3776	44.61	7043	83.2
22.	2008-2015	1421	16.8	8464	100
Total		**8464**	**100**		

(Source: Survey data)



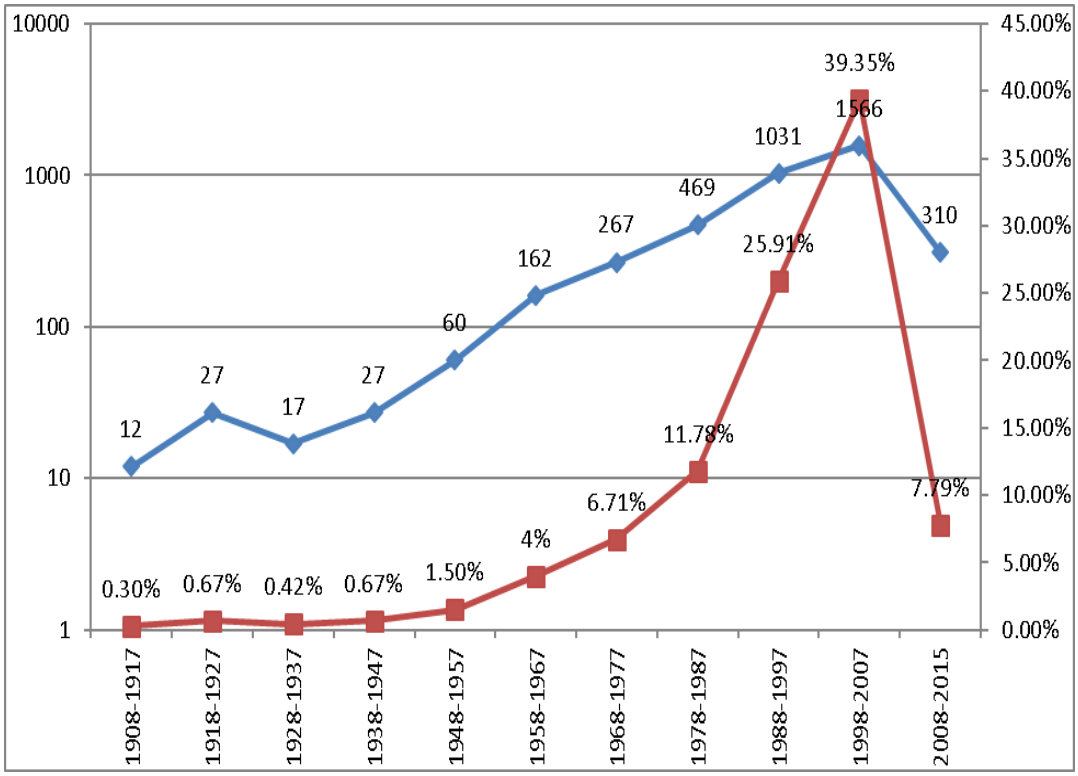
Graph-13: Chronological Distribution of Documents

The analysis of the chronological distributions of the documents placed in Table-20 shows that, between 1998-2007 there is the highest citation rate i.e. 3776 (44.61%) out of 8464 followed by 1589 citations (18.8%) in between 1988-1997 and 1421 citations (16.8%) during 2008-2015 and thus, keeps 1st, 2nd, 3rd respectively in the ranking order. It is surprising to know that, the number of citations increased from 77 (0.9%) to 213 (2.51%) during 1948-1967 and chronologically, it went on exceeding the number of citations till 2007. Again, it could be pointed out that during the period of 1808-1817, 1828-1837 and 1898-1907 that, there was no citation in the study, which may be due to the fact that either the research output during the period is negligible or the documents are not available in the library or may not be having any research value of the articles either in books or journal. Chronological Distribution of Documents placed in Table-20 can be assumed that the research importance increases in the light of present trends that are visible from the present study.

Table-20A: Chronological Distribution of Documents (Print Domain)

Sl.No	Year (10 yrs Gap)	Publications	%	Cumulative Publications	Cumulative %
1.	1807	1	0.02	0.2	1
2.	1808-1817	0	-	0.2	1
3.	1818-1827	4	0.1	0.3	5
4.	1828-1837	0	-	0.3	5
5.	1838-1847	7	0.17	0.47	12
6.	1848-1857	1	0.02	0.49	13
7.	1858-1867	1	0.02	0.51	14
8.	1868-1877	5	0.12	0.63	19
9.	1878-1887	5	0.12	0.75	24
10	1888-1897	7	0.17	0.92	31
11.	1898-1907	0	-	0.92	31
12.	1908-1917	12	0.3	1.22	43
13.	1918-1927	27	0.67	1.89	70
14.	1928-1937	17	0.42	2.31	87
15.	1938-1947	27	0.67	2.98	114
16.	1948-1957	60	1.5	4.48	174
17.	1958-1967	162	4	8.48	336
18.	1968-1977	267	6.71	15.19	603
19.	1978-1987	469	11.78	26.97	1072
20.	1988-1997	1031	25.91	52.88	2103
21.	1998-2007	1566	39.35	92.23	3669
22.	2008-2015	310	7.79	100.02	3979
Total		**3979**	**100**		

(Source: Survey data)



Graph-13A: Chronological Distribution of Documents (Print Domain)

The analysis of the chronological distributions of the documents (Print Domain) placed in Table-20A shows that, between 1998-2007 there is the highest citation rate i.e. 1566 (39.35%) out of 3979 followed by 1031 citations (25.91%) in between 1988-1997 and 469 citations (11.78%) during 1978-1987 and thus, keeps 1st, 2nd, 3rd respectively in the ranking order. It is surprising to know that, the number of citations increased from 60 (1.5%) to 162 (4%) during 1948-1967 and chronologically, it went on exceeding the number of citations till 2007. During the period of 1808-1817, 1828-1837 and 1898-1907 that, there was no citation in the study, which may be due to the fact that the documents are not available for access. Chronological Distribution of Documents (Print Domain) placed in Table-20A can be assumed that the research importance increases in the light of present trends that are visible from the present study which is shown in Graph13A for clear visualization.

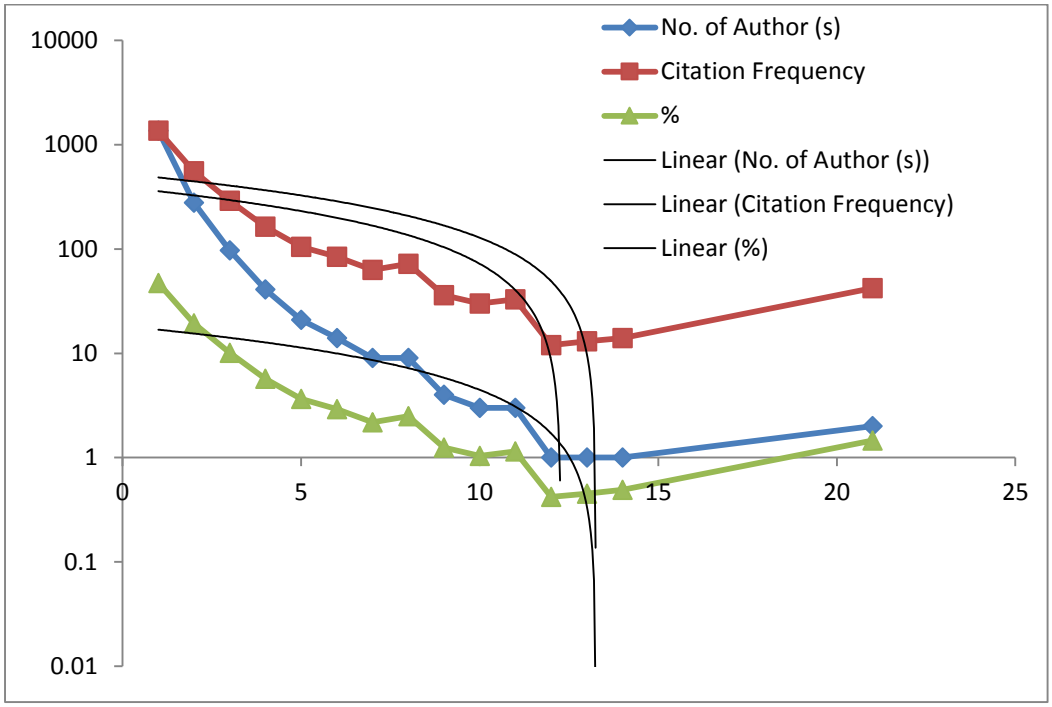
5.17 Application of Lotka's Law of Scientific Productivity

Lotka's law is widely employed to measure the scientific productivity of an author. Lotka claimed that a large proportion of the literature is produced by a small number of authors (De Bellis, 2009). The application of Lotka's Law of Scientific productivity for the present study has been reflected in Table-21 supplemented with Graph-14 and Graph-14A for a number of articles and percentages respectively.

Table-21: Lotka's Law of Scientific Productivity

S/N	No. of Article (s)	No. of Author (s)	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	1361	1361	47.32	1361	47.32
2.	2	278	556	19.33	1917	66.65
3.	3	97	291	10.12	2208	76.77
4.	4	41	164	5.7	2372	82.47
5.	5	21	105	3.65	2477	86.12
6.	6	14	84	2.92	2561	89.04
7.	7	9	63	2.19	2624	91.23
8.	8	9	72	2.5	2696	93.73
9.	9	4	36	1.25	2732	94.98
10.	10	3	30	1.04	2762	96.02
11.	11	3	33	1.15	2795	97.17
12.	12	1	12	0.42	2807	97.59
13.	13	1	13	0.45	2820	98.04
14.	14	1	14	0.49	2834	98.53
15.	21	2	42	1.46	2876	99.99 or 100
Total		**1845**	**2876**	**99.99 or 100**		

(Source: Survey data)



Graph-14: Lotka's Law of Scientific Productivity (No. of Authors and Citation Frequency)

Lotka's Law is mathematically expressed as

$$Y_x = \frac{C}{X^n}$$

Where Y is the number of authors credited with X (1,2,3,4,5,……) papers.

C is the number of authors contributing one paper

and *n* is rate

X^n **x** Y_x = C where X=1

i.e. 1 x 1361 = C

(C=1361, number of authors contributing one paper

When X=2

2^n x 278 = C (C=1361)

$$2^n = \frac{1361}{278}$$

= 4.89 (by applying log)

n log (2) = log (4.89)

$$n = \frac{\log (4.89)}{\log (2)}$$

where log (4.89) = 0.689 and log (2) = 0.301

n = 2.29

Therefore,

When Y=1 $\frac{Y_1}{X^n} \quad \frac{C}{2^{2.29}} \quad \frac{1361}{1^{2.29}} \quad \frac{1361}{1} = 1361$

When Y=2 $\frac{Y_2}{X^n} \quad \frac{C}{2^{2.29}} \quad \frac{1361}{2^{2.29}} \quad \frac{1361}{4.89} = 278$

When Y=3 $\frac{Y_3}{X^n} \quad \frac{C}{2^{2.29}} \quad \frac{1361}{3^{2.29}} \quad \frac{1361}{12.37} = 110$

When Y=4 $\frac{Y_4}{X^n} \quad \frac{C}{2^{2.29}} \quad \frac{1361}{4^{2.29}} \quad \frac{1361}{23.91} = 56$

When Y=5 $\frac{Y_5}{X^n} \quad \frac{C}{2^{2.29}} \quad \frac{1361}{5^{2.29}} \quad \frac{1361}{39.86} = 34$

When Y=6 $\frac{Y_6}{X^n} \quad \frac{C}{6^{2.29}} \quad \frac{1361}{2^{2.29}} \quad \frac{1361}{60.52} = 22$

When Y=7 $\frac{Y_7}{X^n} \quad \frac{C}{2^{2.29}} \quad \frac{1361}{7^{2.29}} \quad \frac{1361}{86.15} = 15$

When Y=8 $\frac{Y_8}{X^n} \quad \frac{C}{8^{2.29}} \quad \frac{1361}{2^{2.29}} \quad \frac{1361}{116.97} = 11$

When Y=9 $\frac{Y_9}{X^n} \quad \frac{C}{2^{2.29}} \quad \frac{1361}{9^{2.29}} \quad \frac{1361}{153.18} = 8$

When Y=10 $\frac{Y_{10}}{X^n} \quad \frac{C}{2^{2.29}} \quad \frac{1361}{10^{2.29}} \quad \frac{1361}{194.98} = 6$

When Y=11 $\frac{Y_{11}}{X^n}$ $\frac{C}{2^{2.29}}$ $\frac{1361}{11^{2.29}}$ $\frac{1361}{242.54}$ = 5

When Y=12 $\frac{Y_{12}}{X^n}$ $\frac{C}{2^{2.29}}$ $\frac{1361}{12^{2.29}}$ $\frac{1361}{296.02}$ = 4

When Y=13 $\frac{Y_{13}}{X^n}$ $\frac{C}{2^{2.29}}$ $\frac{1361}{13^{2.29}}$ $\frac{1361}{355}$ = 4

When Y=14 $\frac{Y_{14}}{X^n}$ $\frac{C}{2^{2.29}}$ $\frac{1361}{14^{2.29}}$ $\frac{1361}{421.34}$ = 3

When Y=15 $\frac{Y_{15}}{X^n}$ $\frac{C}{2^{2.29}}$ $\frac{1361}{15^{2.29}}$ $\frac{1361}{493.45}$ = 3

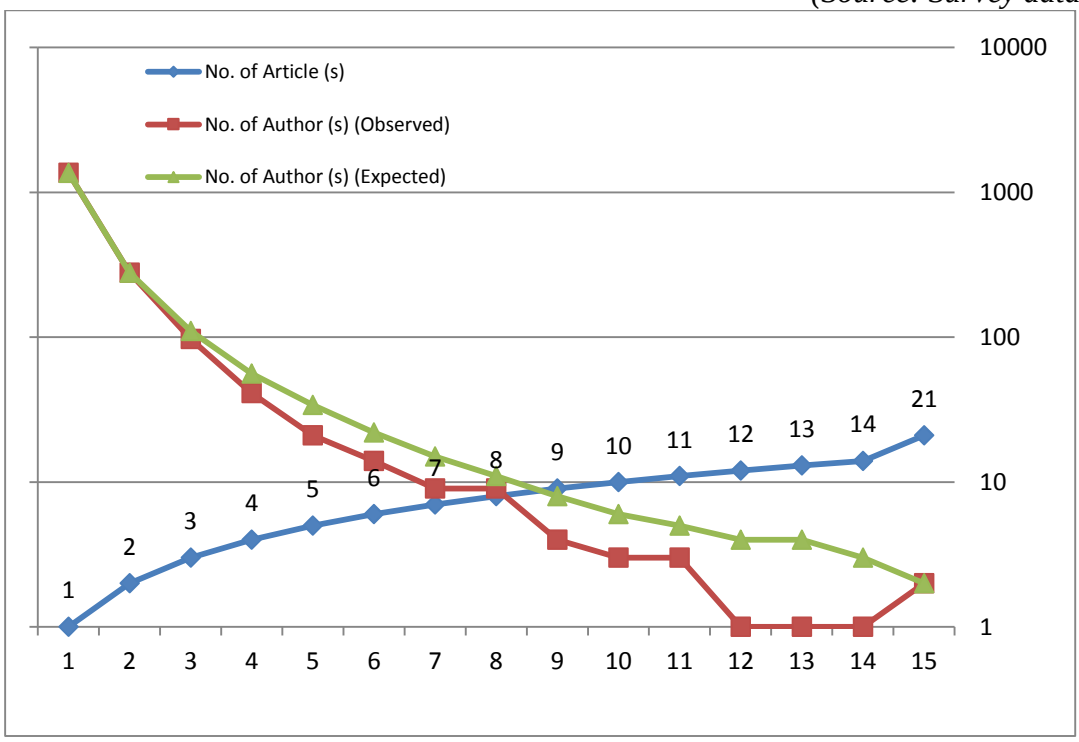
To study the Lotka's law of Scientific Productivity, following Table 21A is prepared.

Table-21A: Lotka's Law of Scientific Productivity (Observed and Expected No. of Authors)

S/N	No. of Article (s)	No. of Author (s) (Observed)	%	No. of Author (s) (Expected)	%
1.	1	1361	47.32	1361	70.92
2.	2	278	19.33	278	14.49
3.	3	97	10.12	110	5.73
4.	4	41	5.7	56	2.92
5.	5	21	3.65	34	1.77
6.	6	14	2.92	22	1.15
7.	7	9	2.19	15	0.78
8.	8	9	2.5	11	0.57
9.	9	4	1.25	8	0.42
10.	10	3	1.04	6	0.31
11.	11	3	1.15	5	0.26
12.	12	1	0.42	4	0.21

13.	13	1	0.45	4	0.21
14.	14	1	0.49	3	0.16
15.	21	2	1.46	2	0.1
Total		**1845**	**100**	**1919**	**100**

(Source: Survey data)



Graph-14A: Lotka's Law of Scientific Productivity (Observed and Expected No. of Authors)

In the present study, 1845 authors have contributed 2876 articles during the period 1839-2015. There are 1361 (47.32%) authors who contributed One (01) article, 278 (19.33%) authors contributed Two (02) articles, 97 (10.12%) authors contributed Three (3) articles, 41 (5.7%) authors contributed Four (4) articles, 21 (3.65%) authors contributed Five (5) articles, 14 (2.92%) authors contributed Six (6) articles. Further, while 9 (2.19%) contributed Seven (7) articles, the other 9 (2.5%) authors contributed Eight (8) articles and 4 (1.25%) authors contributed 9 articles, 3

(1.04%) and 3 (1.14%) authors each contributed Ten (10) and Eleven (11) articles respectively, 1 (0.42%) 1 (0.45%) and 1 (0.49%) authors each contributed Twelve (12) , Thirteen (13) and Fourteen (14) articles and 2 (1.46%) authors contributed Twenty-one (21) articles.

To calculate the value of *n*, data from observed authors is used and is found to be 2.29. It is clear from Table-21A that the observed and expected authors are not similar *n*=2.29 and the difference is 74 numbers of authors. Moreover, the frequency distributions of the author's productivity match the generalized Lotka's Law.

5.18 Application of Bradford's Law of Scattering

Taking Bradford's Law of Scattering into account that predicts the increasing productivity of Journals from one zone to the next (in expression 1: n: n^2), a total number of citations can be divided into three equal zones (Hertzel, 2010, p.560-573). The approximation of the first zone which contains 11 journals are considered Bradford's core journals. The second quantum of citations forming the second zone contained 26 journals and the last quantum of citations contained in the next 367 journals (Hertzel, 2010, p.560-573). The zone-wise distribution of journals for the present study is depicted in Table-22 and predicted zones in Table -22A.

Table-22: Application of Bradford's Law of Scattering

S/N	Zone	Name of Journal	Frequency	%	Cumulative Frequencies	Cumulative %
1	1	ILA Bulletin	135	4.7	135	4.7
2	1	DESIDOC Journal of Library and Information Technology	111	3.86	246	8.56
3	1	Annals of Library & Information Studies (Annals of Lib. Science &Documentation)	97	3.37	343	11.93
4	1	University News	91	3.16	434	15.09
5	1	IASLIC Bulletin	84	2.92	518	18.01
6	1	Library Herald	82	2.85	600	20.86
7	1	SRELS Journal of Information and Management, Library science with a slant to documentation	75	2.61	675	23.47
8	1	Herald of Library Science	68	2.36	743	25.83
9	1	Journal of Documentation	68	2.36	811	28.19
10	1	College & Research Libraries	66	2.3	877	30.49
11	1	The Electronic Library	59	2.05	936	32.54
12	2	New Library World (Asian Libraries)	55	1.91	991	34.45
13	2	Journal of Academic Librarianship	54	1.88	1045	36.33
14	2	Indian Journal of Information Library and Society (IJILIS)	50	1.74	1095	38.07
15	2	ASLIB proceedings	49	1.7	1144	39.77
16	2	Information Processing and management	44	1.53	1188	41.3
17	2	Journal of the American Society for Information Science & Technology	44	1.53	1232	42.83
18	2	Library & Archival security	44	1.53	1276	44.36
19	2	Library Journal	43	1.49	1319	45.85
20	2	Library review	43	1.49	1362	47.34

21	2	Program	43	1.49	1405	48.83
22	2	Collection building	42	1.46	1447	50.29
23	2	Library Trends	40	1.4	1487	51.69
24	2	Journal of Library & Information Science	37	1.3	1524	52.99
25	2	Online Information Review	35	1.22	1559	54.21
26	2	Journal of Education for Library and Information Science	34	1.18	1593	55.39
27	2	IFLA Journal	32	1.11	1625	56.5
28	2	Library Hi Tech	31	1.1	1656	57.6
29	2	BMJ (British Medical Journal)	29	1.01	1685	58.61
30	2	Libri	29	1.01	1714	59.62
31	2	Library progress (International)	28	0.97	1742	60.59
32	2	Library Management	27	0.94	1769	61.53
33	2	Library & Information science research	26	0.9	1795	62.43
34	2	International Library Movement (ILM)	26	0.9	1821	63.33
35	2	Library Philosophy & Practice	25	0.87	1846	64.2
36	2	Indian Journal of Information Resources and Services	23	0.8	1869	65
37	2	Journal of Librarianship and Information Science	23	0.8	1892	65.8
38	3	Annual Review of Information science and Technology (ARIST)	22	0.76	1914	66.56
39	3	Education for Information	21	0.73	1935	67.29
40	3	Granthana: Indian Journal of Library Studies	19	0.66	1954	67.95
41	3	Journal of Library Administration	19	0.66	1973	68.61
42	3	Journal of Information Science	18	0.62	1991	69.23
43	3	Serial Review	18	0.62	2009	69.85

44	3	D-Lib Magazine	17	0.59	2026	70.44
45	3	The Assam Review & tea news	17	0.59	2043	71.03
46	3	Information Research	15	0.52	2058	71.55
47	3	Library quarterly	15	0.52	2073	72.07
48	3	International Information & Library Review	14	0.5	2087	72.57
49	3	Library collection, acquisitions &technical services	14	0.5	2101	73.07
50	3	CLIS Observer	13	0.45	2114	73.52
51	3	Computers in libraries	12	0.42	2126	73.94
52	3	Information Technology and Libraries	12	0.42	2138	74.36
53	3	Scientometrics	11	0.38	2149	74.74
54	3	VINE The Journal of Information and Knowledge Management Systems	11	0.38	2160	75.12
55	3	International Journal of Librarianship	10	0.35	2170	75.47
56	3	Journal of Medical Internet Research	10	0.35	2180	75.82
57	3	OCLC systems & Services	10	0.35	2190	76.17
58	3	Malaysian Journal of Library & Information Science	9	0.31	2199	76.48
59	3	American Libraries	8	0.28	2207	76.76
60	3	Ariadne	8	0.28	2215	77.04
61	3	JAMA (Arch Intern Med)	8	0.28	2223	77.32
62	3	Journal of The bottom Line Managing Library finance	8	0.28	2231	77.6
63	3	KELPRO Bulletin	8	0.28	2239	77.88
64	3	Reference service review	8	0.28	2247	78.16
65	3	International Library Review	7	0.24	2254	78.4

66	3	Internet Research Electronic Networking Applications and Policy	7	0.24	2261	78.64
67	3	Issues in Science and Technology Librarianship	7	0.24	2268	78.88
68	3	Science & Technology Libraries	7	0.24	2275	79.12
69	3	Special Libraries	7	0.24	2282	79.36
70	3	Wilson Library Bulletin	7	0.24	2289	79.6
71	3	American Archivist	6	0.21	2295	79.81
72	3	Cataloguing and Classification Quarterly	6	0.21	2301	80.02
73	3	Information Studies	6	0.21	2307	80.23
74	3	Journal of Education for Librarianship	6	0.21	2313	80.44
75	3	17 journals having 5 citations each	85	2.95	2398	83.39
76	3	16 journals having 4 citations each	64	2.22	2462	85.61
77	3	29 journals having 3 citations each	87	3.02	2549	88.63
78	3	59 journals having 2 citations each	118	4.1	2667	92.73
79	3	209 journals having 1 citations each	209	7.27	2876	100
		Total	**2876**	**100**		

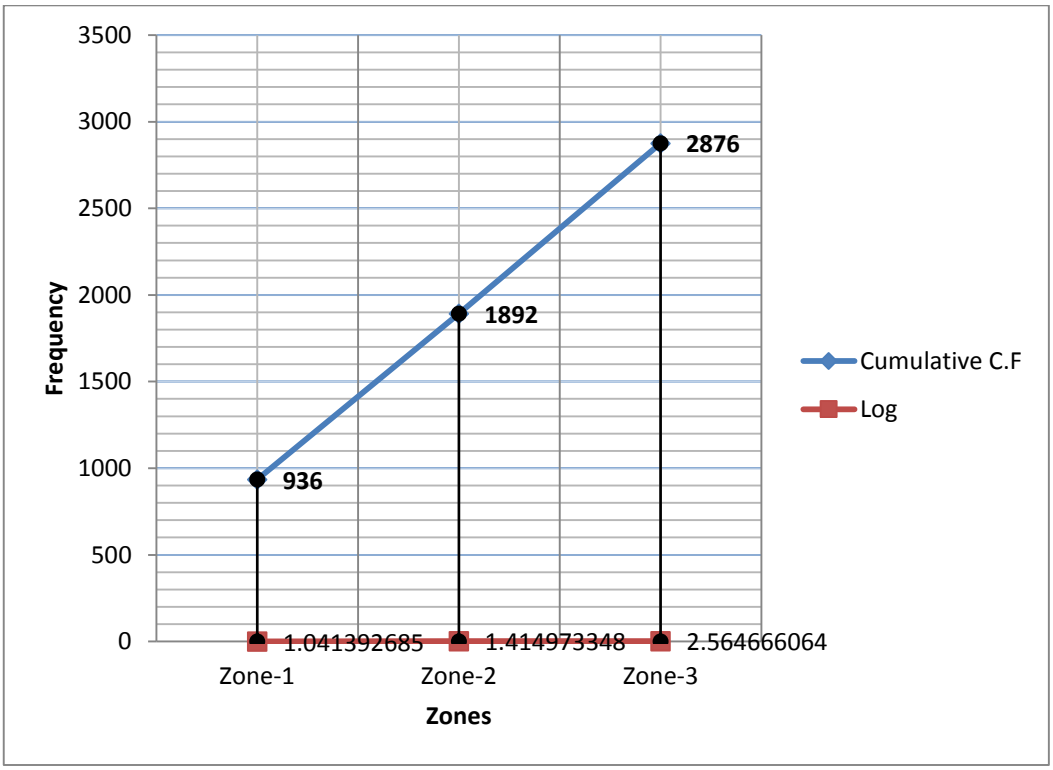
(Source: Survey data)

Distribution of journals according to the Bradford's predicted zones (on an approximation) is- Zone-1: 11 journals (936 citations), Zone-2: 26 journals (956 citations), Zone-3: 367 journals (984 citations).

Table-22A: Distribution of journals according to the Bradford's predicted zones

Zone	No. of Journals	Citation Frequency	Cumulative C.F	%	Log
Zone-1	11	936	936	32.55	1.041392685
Zone-2	26	956	1892	33.24	1.414973348
Zone-3	367	984	2876	34.21	2.564666064
Total	**404**	**2876**	**2876**	**100**	**-**

(Source: Survey data)



Graph-15: Distribution of journals according to the Bradford's predicted zones

The analysis of Table-22 and Table-22A reflected that the distribution of articles in Zone-1 consists of 11 journals which constitute (32.55%) out of 2876 journals. Zone-2 consists of 26 journals i.e. (33.24%) having 956 citations and Zone-3

consists of 367 journals i.e. (34.21%) having 984 citations and has the highest citations. Based on the law, the zones thus, identified form an approximately geometric series in the form of 1: *n*: n^2. The relationship of each zone in the present study is 11:26:367. Here, 1 denotes the number of Journals in the nucleus and the mean Bradford multiplier is 67.33.

Hence, $1:67.33 \text{ x } :1 \text{ x } (67.33)^2$

1: 67.33 : 4533.32 > 4601.65

The Percentage of error= $\frac{4601.65-404x100}{404}$ = 1039.02%

From the above calculation, the percentage of error is very high and hence, the present data do not fit into Bradford's Law of Scattering of Journals (Joshi, Mamdapur & Rajgoli, 2015).

Graphical Formulation

Graph-15 is a logarithmic plot of cumulative Frequency of journal titles and cumulative Logarithmic value of each Zones i.e. Zone-1, Zone-2 and Zone-3. The graph visualizes a steep rise of initially as shown in Table-22 and Table-22A. An almost steady straight line is observed as well which represents a partially Bradford's 'Groos droop'. This shows a graphical presentation of Bradford's zone is valid.

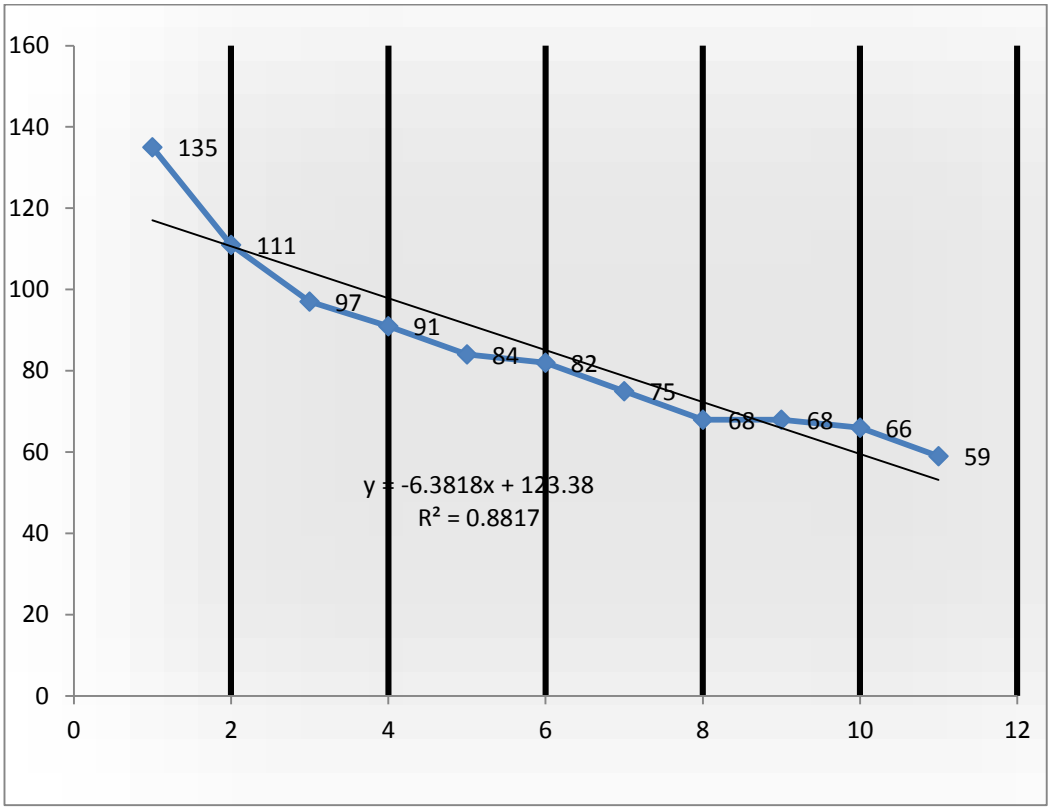
5.18.1 ZONE-1 (NUCLEUS ZONE) DISTRIBUTION OF ARTICLES

Zone-1 distributions of articles are studied among the cited articles from national and international journals and there are 11 journals which are considered as Bradford's core journals constituting 936 (32.55%) citations in total and are listed in decreasing order of their frequency of citations in Table-22B with Graph-15Awith clear visualization. The table also shows the percentage, cumulative frequencies, and percentage along with log and percentage as log value.

Table-22B: Zone-1 (Nucleus Zone) Distribution of Articles

S/N	Zone	Title of Journal	Citation Frequency	% out of 2876	Cumulative Frequencies	Cumulative %	Log	% as Log Value
1.	1	ILA Bulletin	135	4.7	135	4.7	2.1303338	0.672098
2.	1	DESIDOC Journal of Library and Information Technology	111	3.86	246	8.56	2.04532298	0.586587
3.	1	Annals of Library & Information Studies (Annals of Lib. Science &Documentation)	97	3.37	343	11.93	1.98677173	0.52763
4.	1	University News	91	3.16	434	15.09	1.95904139	0.499687
5.	1	IASLIC Bulletin	84	2.92	518	18.01	1.92427929	0.465383
6.	1	Library Herald	82	2.85	600	20.86	1.91381385	0.454845
7.	1	SRELS Journal of Information and Management, Library science with a slant to documentation	75	2.61	675	23.47	1.87506126	0.416641
8.	1	Herald of Library Science	68	2.36	743	25.83	1.83250891	0.372912
9.	1	Journal of Documentation	68	2.36	811	28.19	1.83250891	0.372912
10.	1	College & Research Libraries	66	2.3	877	30.49	1.81954394	0.361728
11.	1	Electronic Library	59	2.05	936	32.54	1.77085201	0.311754

(Source: Survey data)



Graph-15A: Zone-1 (Nucleus Zone) Distribution of Articles

Analysis of Table-22B deduced that, ILA Bulletin stands at the apex because of 135 citations (4.7%) out of 404 journals having 2876 citations (Table-18) followed by DESIDOC Journal of Library and Information Technology 111 citations (3.86%), Annals of Library & Information Studies (Annals of Lib. Science &Documentation) 97 citations (3.37%), University News91 times (3.16%), IASLIC Bulletin 84 citations (2.92%), Library Herald 82 citations (2.85%), SRELS Journal of Information and Management, Library science with a slant to documentation 75 citations (2.61%), Herald of Library Science and Journal of Documentation 68 citations (2.36%) each, College & Research Libraries 66 citations (2.3%) and Electronic Library 59 citations (2.05%). This shows the significance of the research articles of the journals.

5.18.2 ZONE-2 (LINEAR ZONE) DISTRIBUTION OF ARTICLES

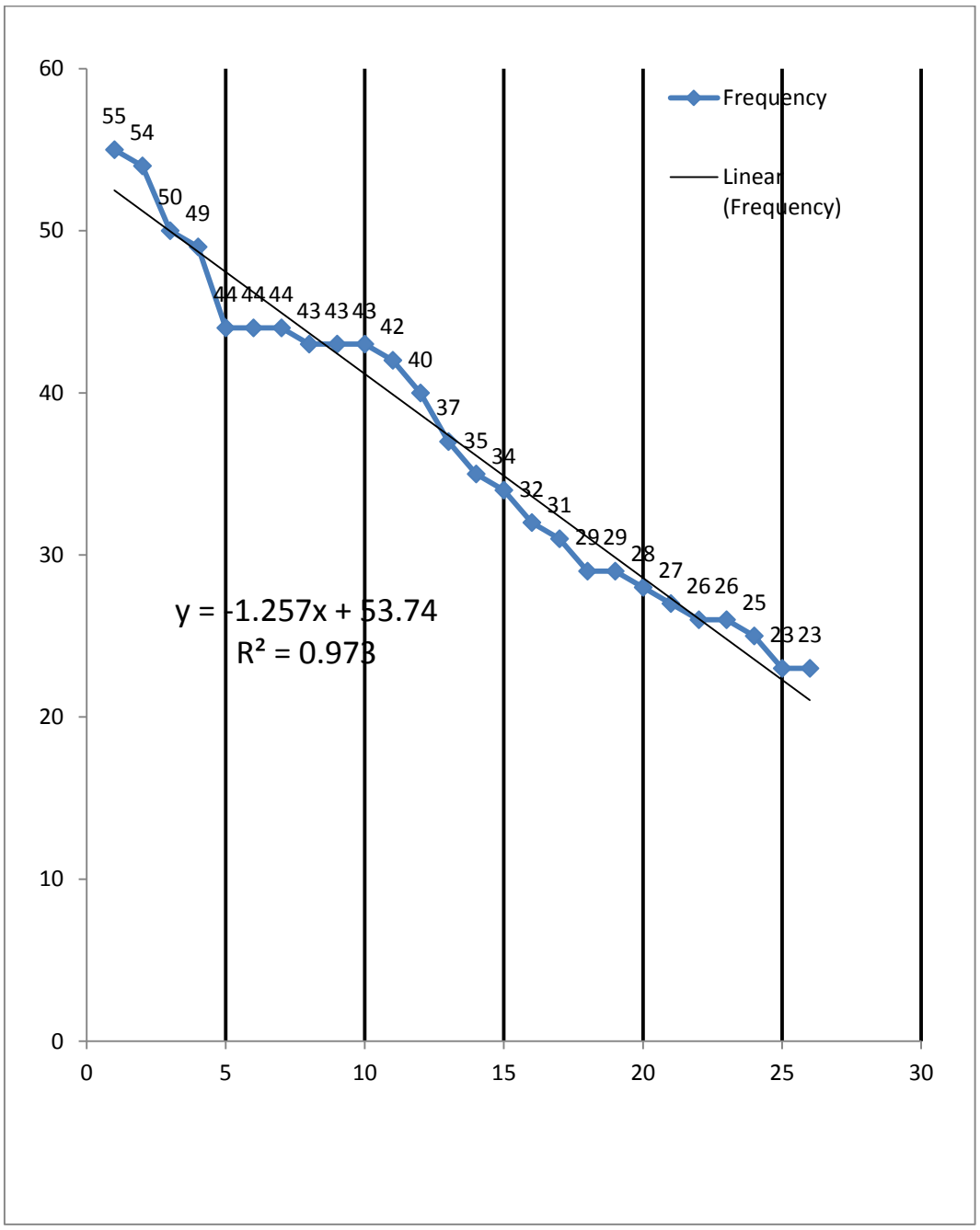
Zone-2 distributions of articles are studied among the cited articles from both National and International journals and there are 26 journals included in zone-2 constituting 956 (33.24%) citations in total which are listed in decreasing order of their frequency of citations in Table-22C with Graph-15B with clear visualization. The table also shows the percentage, cumulative frequencies, and percentage along with log and percentage as log value.

Table-22C: Zone-2 (Linear Zone) Distribution of Articles

S/N	Zone	Name of Journal	Frequency	%	Cumulative Frequencies	Cumulative %	Log	% as Log Value
1.	2	New Library World (Asian Libraries)	55	1.91	55	1.91	1.740363	0.281033
2.	2	Journal of Academic Librarianship	54	1.88	109	3.79	1.732394	0.274158
3.	2	Indian Journal of Information Library and society (IJILIS)	50	1.74	159	5.53	1.69897	0.240549
4.	2	ASLIB proceedings	49	1.7	208	7.23	1.690196	0.230449
5.	2	Information Processing and management	44	1.53	252	8.76	1.643453	0.184691
6.	2	Journal of the American Society for Information Science & Technology	44	1.53	296	10.29	1.643453	0.184691
7.	2	Library & Archival security	44	1.53	340	11.82	1.643453	0.184691
8.	2	Library Journal	43	1.49	383	13.31	1.633468	0.173186
9.	2	Library review	43	1.49	426	14.8	1.633468	0.173186
10.	2	Program	43	1.49	469	16.29	1.633468	0.173186
11.	2	Collection building	42	1.46	511	17.75	1.623249	0.164353

12.	2	Library Trends	40	1.4	551	19.15	1.60206	0.146128
13.	2	Journal of Library & Information Science	37	1.3	588	20.45	1.568202	0.113943
14.	2	Online Information Review	35	1.22	623	21.67	1.544068	0.08636
15.	2	Journal of Education for Library and Information Science	34	1.18	657	22.85	1.531479	0.071882
16.	2	IFLA Journal	32	1.11	689	23.96	1.50515	0.045323
17.	2	Library Hi Tech	31	1.1	720	25.06	1.491362	0.041393
18.	2	BMJ (British Medical Journal)	29	1.01	749	26.07	1.462398	0.004321
19.	2	Libri	29	1.01	778	27.08	1.462398	0.004321
20.	2	Library progress (International)	28	0.97	806	28.05	1.447158	-0.01323
21.	2	Library Management	27	0.94	833	28.99	1.431364	-0.02687
22.	2	Library & Information Science Research	26	0.9	859	29.89	1.414973	-0.04576
23.	2	International Library Movement (ILM)	26	0.9	885	30.79	1.414973	-0.04576
24.	2	Library Philosophy & Practice	25	0.87	910	31.66	1.39794	-0.06048
25.	2	Indian Journal of Information Resources and Services	23	0.8	933	32.46	1.361728	-0.09691
26.	2	Journal of Librarianship and Information Science	23	0.8	956	33.26	1.361728	-0.09691

(Source: Survey data)



Graph-15B: Zone-2 (Linear Zone) Distribution of Articles

Analysis of Table-22C visualized that, New Library World (Asian Libraries) have 55 (1.91%) citations, Journal of Academic Librarianship having 54 (1.88%) citations, Indian Journal of Information Library and society (IJILIS) having 50 (1.74%) citations, ASLIB proceedings having 49 (1.7%) citations, Information Processing and management, Journal of the American Society for Information Science

& Technology and Library & Archival security 44 (1.53%) citations each, Library Journal, Library review and Program 43 (1.49%) citations each, Collection building having 42 (1.46%) citations, Library Trends having 40 (1.4%) citations, Journal of Library &Information Science having 37 (1.3%) citations, Online Information Review having 35 (1.22%) citations, Journal of Education for Library and Information Science having 34 (1.18%) citations, IFLA Journal having 32 (1.11%) citations, Library Hi Tech having 31 (1.1%) citations, BMJ (British Medical Journal) and Libri29 (1.01%) citations each, Library progress (International) having 28 (0.97%) citations, Library Management having 27 (0.94%) citations, Library & Information science research and International Library Movement (ILM)having 26 (0.9%) citations each, Library Philosophy & Practice having 25 citations (0.87%), Indian Journal of Information Resources and Services and Journal of Librarianship and Information Science having 23 (0.8%) citations each. This shows the significance of the research articles of the journals.

5.18.3 ZONE-3 (NON-LINEAR ZONE) DISTRIBUTION OF ARTICLES

Zone-3 distributions of articles are studied among the cited articles from national and international journals and there are 367 journals included in zone-3 constituting 984 (34.21%) citations in total and are listed in decreasing order of their frequency of citations in Table-22D with Graph-15C with clear visualization. The table also shows the percentage, cumulative frequencies, and percentage along with log and percentage as log value.

Table-22D: Zone-3 (Non-Linear Zone) Distribution of Articles

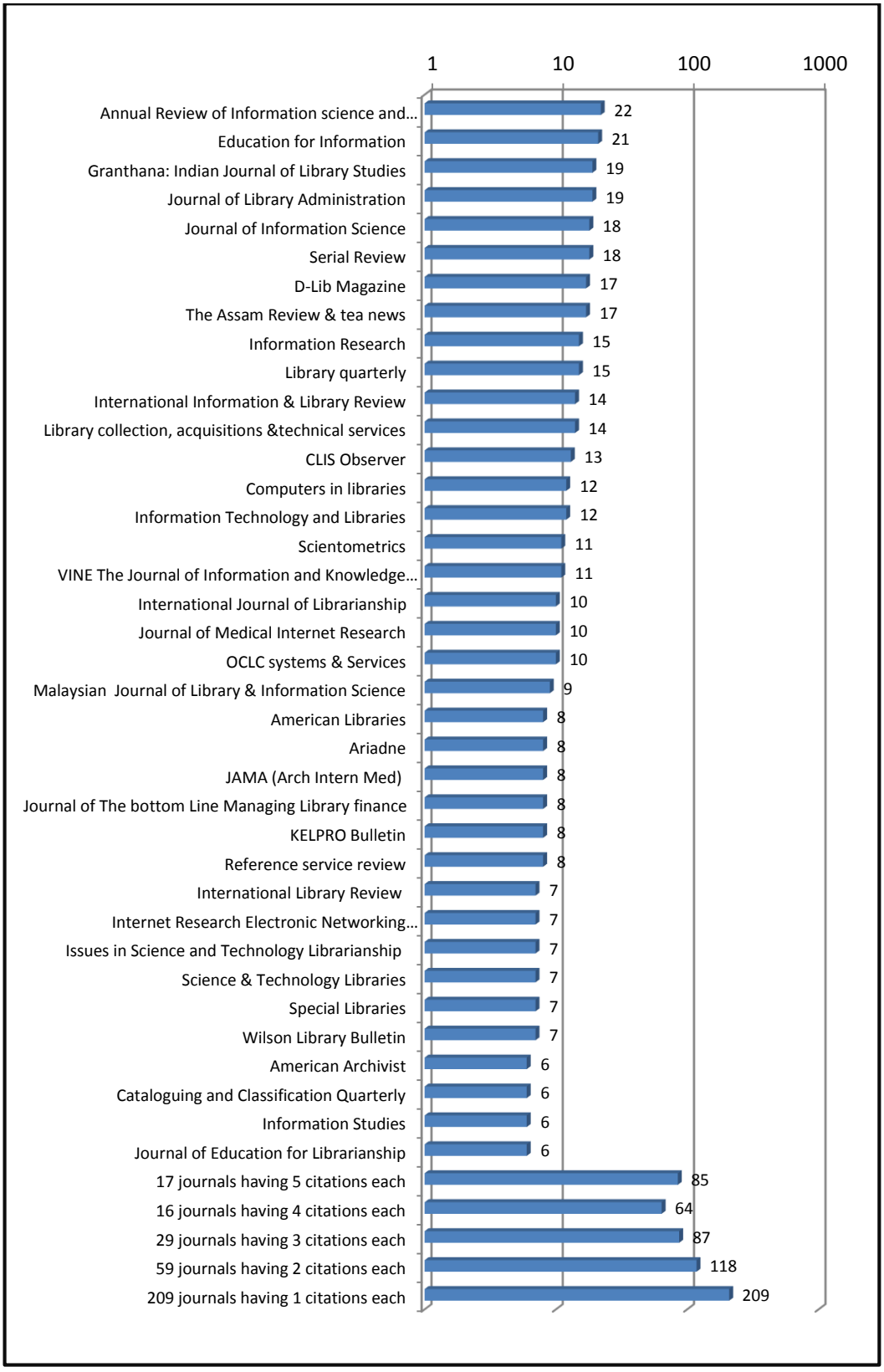
S/N	Zone	Name of Journal	Frequency	%	Cumulative Frequencies	Cumulative %	Log	% as Log Value
1.	3	Annual Review of Information science and Technology (ARIST)	22	0.76	22	0.76	1.342423	-0.11919
2.	3	Education for Information	21	0.73	43	1.49	1.322219	-0.13668
3.	3	Granthana: Indian Journal of Library Studies	19	0.66	62	2.15	1.278754	-0.18046
4.	3	Journal of Library Administration	19	0.66	81	2.81	1.278754	-0.18046
5.	3	Journal of Information Science	18	0.62	99	3.43	1.255273	-0.20761
6.	3	Serial Review	18	0.62	117	4.05	1.255273	-0.20761
7.	3	D-Lib Magazine	17	0.59	134	4.64	1.230449	-0.22915
8.	3	The Assam Review & Tea News	17	0.59	151	5.23	1.230449	-0.22915
9.	3	Information Research	15	0.52	166	5.75	1.176091	-0.284
10.	3	Library Quarterly	15	0.52	181	6.27	1.176091	-0.284
11.	3	International Information & Library Review	14	0.5	195	6.77	1.146128	-0.30103
12.	3	Library Collection, Acquisitions &Technical	14	0.5	209	7.27	1.146128	-0.30103

		Services						
13.	3	CLIS Observer	13	0.45	222	7.72	1.113943	-0.34679
14.	3	Computers in libraries	12	0.42	234	8.14	1.079181	-0.37675
15.	3	Information Technology and Libraries	12	0.42	246	8.56	1.079181	-0.37675
16.	3	Scientometrics	11	0.38	257	8.94	1.041393	-0.42022
17.	3	VINE The Journal of Information and Knowledge Management Systems	11	0.38	268	9.32	1.041393	-0.42022
18.	3	International Journal of Librarianship	10	0.35	278	9.67	1	-0.45593
19.	3	Journal of Medical Internet Research	10	0.35	288	10.02	1	-0.45593
20.	3	OCLC systems & Services	10	0.35	298	10.37	1	-0.45593
21.	3	Malaysian Journal of Library & Information Science	9	0.31	307	10.68	0.954243	-0.50864
22.	3	American Libraries	8	0.28	315	10.96	0.90309	-0.55284
23.	3	Ariadne	8	0.28	323	11.24	0.90309	-0.55284
24.	3	JAMA (Arch Intern Med)	8	0.28	331	11.52	0.90309	-0.55284
25.	3	Journal of The bottom Line Managing	8	0.28	339	11.8	0.90309	-0.55284

		Library finance						
26.	3	KELPRO Bulletin	8	0.28	347	12.08	0.90309	-0.55284
27.	3	Reference service review	8	0.28	355	12.36	0.90309	-0.55284
28.	3	International Library Review	7	0.24	362	12.6	0.845098	-0.61979
29.	3	Internet Research Electronic Networking Applications and Policy	7	0.24	369	12.84	0.845098	-0.61979
30.	3	Issues in Science and Technology Librarianship	7	0.24	376	13.08	0.845098	-0.61979
31.	3	Science & Technology Libraries	7	0.24	383	13.32	0.845098	-0.61979
32.	3	Special Libraries	7	0.24	390	13.56	0.845098	-0.61979
33.	3	Wilson Library Bulletin	7	0.24	397	13.8	0.845098	-0.61979
34.	3	American Archivist	6	0.21	403	14.01	0.778151	-0.67778
35.	3	Cataloguing and Classification Quarterly	6	0.21	409	14.22	0.778151	-0.67778
36.	3	Information Studies	6	0.21	415	14.43	0.778151	-0.67778
37.	3	Journal of Education for Librarianship	6	0.21	421	14.64	0.778151	-0.67778
38.	3	17 journals having 5	85	2.95	506	17.59	1.929419	0.469822

		citations each						
39.	3	16 journals having 4 citations each	64	2.22	570	19.81	1.80618	0.346353
40.	3	29 journals having 3 citations each	87	3.02	657	22.83	1.939519	0.480007
41.	3	59 journals having 2 citations each	118	4.1	775	26.93	2.071882	0.612784
42.	3	209 journals having 1 citation each	209	7.27	984	34.2	2.320146	0.861534

(Source: Survey data)



Graph-15C: Zone-3 (Non-Linear Zone) Distribution of Articles

Analysis of Table-22D reflected that, there are 22 citations (0.76%) for Annual Review of Information Science and Technology (ARIST) while, Education for Information is having 21citations (0.73%) followed by Granthana: Indian Journal of Library Studies and Journal of Library Administration with 19 (0.66%) citations each, Journal of Information Science and Serial Review each having 18 (0.62%) citations, D-Lib Magazine and The Assam Review & tea news having 17 (0.59%) citations each, Information Research and Library quarterly 15 (0.52%) citations each, International Information & Library Review and Library Collection, Acquisitions & Technical Services with 14 (0.5%) citations each, CLIS Observer having 13 (0.45%) citations, Computers in Libraries and Information Technology and Libraries having 12 (0.42%) citations each, Scientometrics and VINE The Journal of Information and Knowledge Management Systems having 11 (0.38%) citations each, International Journal of Librarianship, Journal of Medical Internet Research and OCLC systems & Services each having 10 (0.35%) citations, Malaysian Journal of Library & Information Science having 9 (0.31%) citations, American Libraries, Ariadne, JAMA (Arch Intern Med), Journal of The bottom Line Managing Library finance, KELPRO Bulletin and Reference service review each having 8 (0.28%) citations, International Library Review, Internet Research Electronic Networking Applications and Policy, Issues in Science and Technology Librarianship, Science & Technology Libraries, Special Libraries and Wilson Library Bulletin each having 7 (0.24%) citations, American Archivist, Cataloguing and Classification Quarterly, Information Studies and Journal of Education for Librarianship each having 6 (0.21%) citations. The other 17 journals are having 5 citations each having 85 (2.95%) i.e. 0.17% each, 16 journals having 4 citations each which come to 64 (2.22%) citations i.e. 0.13% each, 29

journals having 3 citations each having 87 (3.02%) citations i.e. 0.1% each, 59 journals having 2 citations each having 118 (4.1%) citations i.e. 0.06% each and 209 journals having 1 citation each having 20.9 (7.27%) citations i.e. 0.03%. This visualizes the importance of the research articles of the journals.

5.19 Application of Zipf's Law of Word Occurrence

The Law in a relatively lengthy text establishes that, in the list of words occurring within that text in decreasing frequency, the rank of a word on that list is multiplied by its frequency which will be equal a constant. The equation for this relationship can be formulated as $r \times f = k$ where r is the rank of the word, f is the frequency, and k is the constant (Potter, 1988; De, 2009, p.75; Hertzel, 2010, p.560-573; Jose, 2012). For the present study, the words with more than 500 in frequency are listed in Table-23.

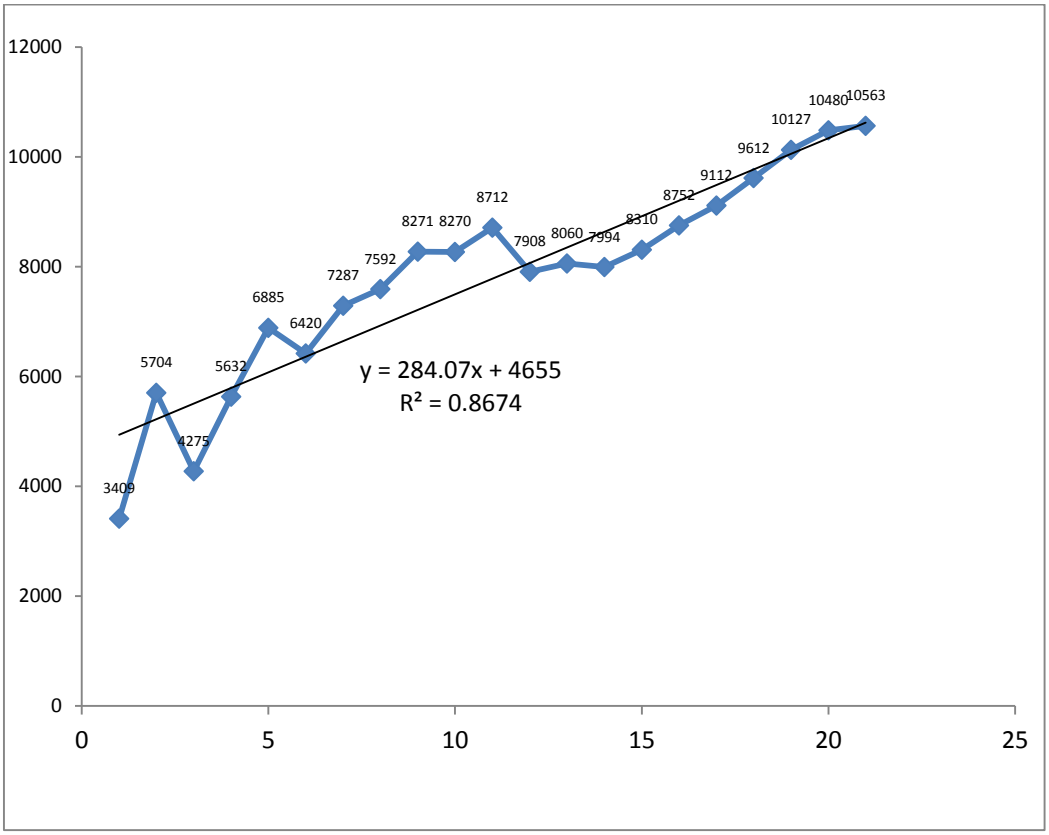
Table-23: Zipf's Law of Word Occurrence (Based on whole data)

Sl. No	Rank (*r*)	Word	Frequency (*f*)	$r \times f=k$ (expected constant)
1.	1	Library	3409	3409
2.	2	Information	2852	5704
3.	3	Libraries	1425	4275
4.	4	New	1408	5632
5.	5	India	1377	6885
6.	6	Science	1070	6420
7.	7	Search	1041	7287
8.	8	University	949	7592
9.	9	Journal	919	8271
10.	10	Education	827	8270
11.	11	Era	792	8712
12.	12	Retrieve	659	7908
13.	13	Access	620	8060

14.	14	Research	571	7994
15.	15	Source	554	8310
16.	16	National	547	8752
17.	17	Management	536	9112
18.	18	Development	534	9612
19.	19	Service	533	10127
20.	20	Technology	524	10480
21.	21	Librarian	503	10563

(Source: Survey data)

Table-23 represents the word of occurrence of Zipf's law based on whole data. Analysis of the table deduced that, the word 'Library' secured 1st position in ranking order with 3409 frequency followed by the word 'Information' with 2852 frequency, 'Libraries' 1425 frequency, 'New' 1408 frequency followed by 'India' with 1377 frequency and thus, secured 2nd, 3rd, 4th, and 5th in ranking order respectively. The equation for a relationship that is $r \times f = k$ where r is the rank of the word, f is the frequency, and k is the constant, it is found that rank and frequency of words in Table-23 are not always related and multiplication of them is not equal a constant. Therefore, Zipf's Law did not match with the findings. This is supported by Graph-16 for clear visualization.



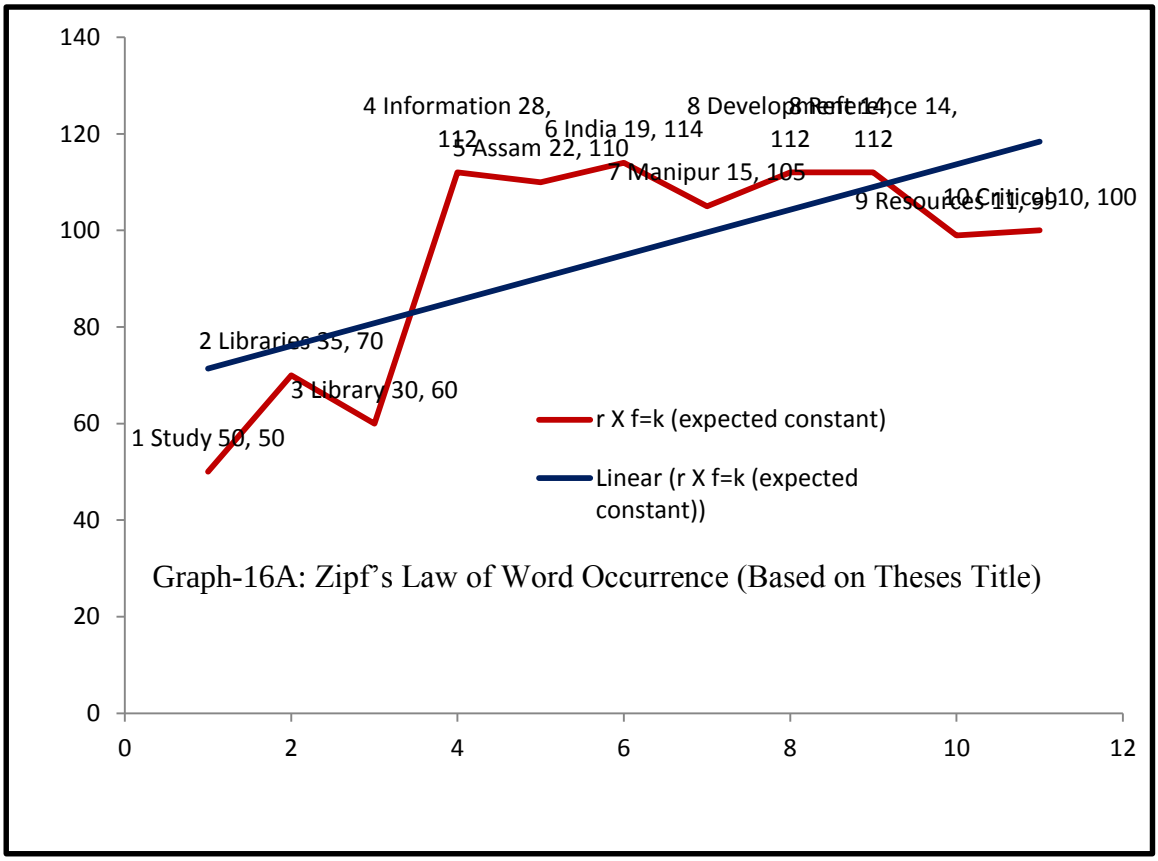
Graph-16: Zipf's Law of Word Occurence (Based on whole data)

Zipf's Law have been tested on the basis of title of 83 theses which were submitted during 2006-2015. Top 10 according to their ranking order have been highlighted in Table-23A with Graph-16A for clear visualization.

Table-23A: Zipf's Law of Word Occurrence (Based on Theses Title)

Sl.no	Rank (*r*)	Word	Frequency (*f*)	*r* X *f*=*k* (expected constant)
1.	1	Study	50	50
2.	2	Libraries	35	70
3.	3	Library	30	60
4.	4	Information	28	112
5.	5	Assam	22	110
6.	6	India	19	114
7.	7	Manipur	15	105
8.	8	Development	14	112
9.	8	Reference	14	112
10.	9	Resources	11	99
11.	10	Critical	10	100

(Source: Survey data)



Graph-16A: Zipf's Law of Word Occurrence (Based on Theses Title)

Table-23A represents the occurrence of the word of Zipf's law (Based on Theses Title).

The word 'Study' secured 1st position in ranking order with 50 frequencies. The word 'Libraries' with 35 frequency, 'Library' 30 frequency, 'Information' 28 frequency followed by 'Assam' with 22 frequency and it constitutes 2nd, 3rd, 4th, and 5th in ranking order respectively. Other words such as 'India' stands with 19 frequency, 'Manipur' with 15 frequency, 'Development' and 'Reference' with 14 frequency, 'Resources' with 11 frequency, and 'Critical' with 10 frequency and thus, they constitute 6th, 7th, 8th, 9th and 10th in ranking order. The equation for a relationship that is $r \times f = k$ where r is the rank of the word, f is the frequency, and k is the constant, it is found that rank and frequency of words in Table-23A are not always

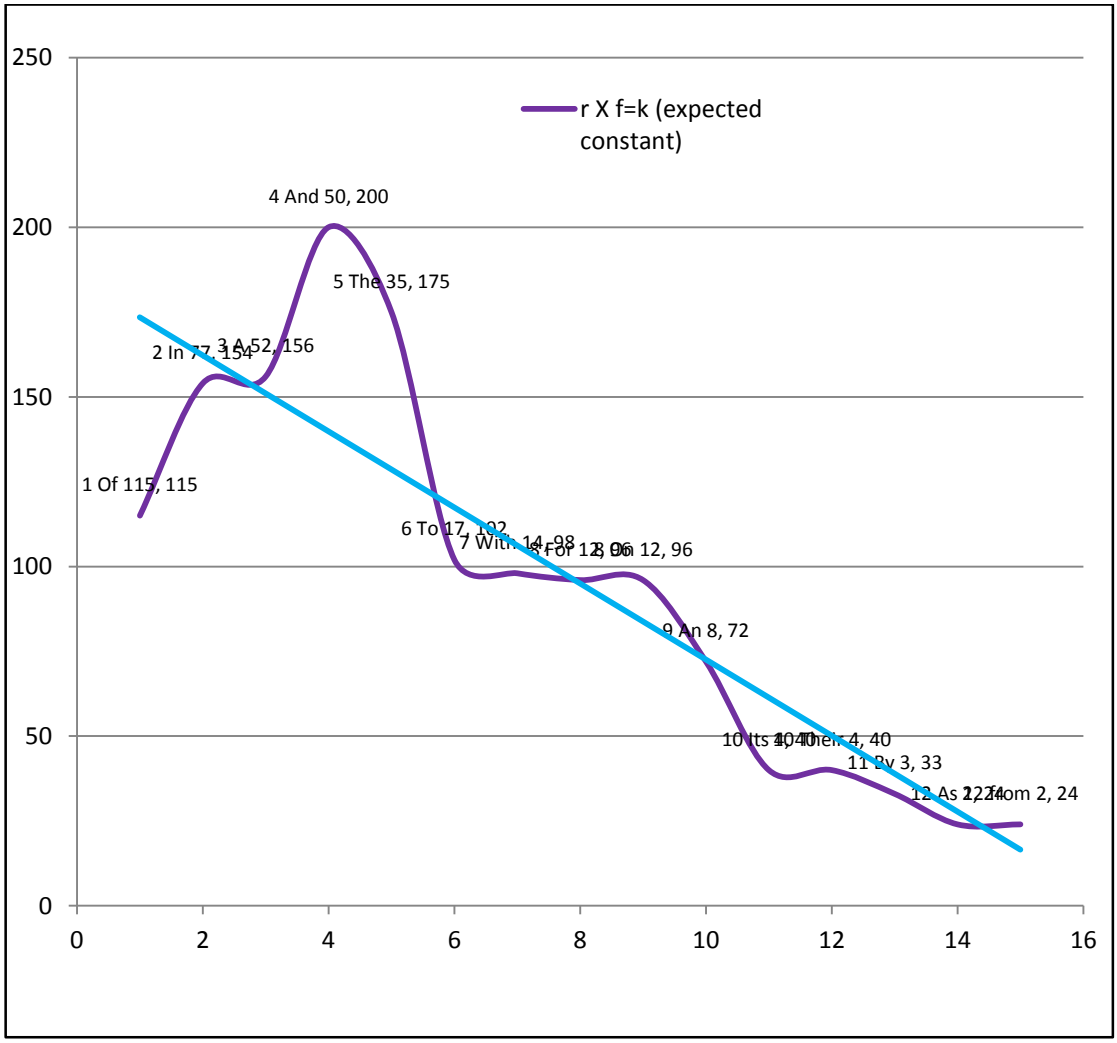
related and multiplication of them is not equal a constant. Therefore, Zipf's Law did not match with the findings. This is supported by Graph-16A for clear visualization.

Connections of Word have been studied to compliment Zipf's Law of Word Occurrence on the basis of Title in the Theses (Table-23A). These connections of word are calculated on the basis of title in the theses. Table -23B highlighted the 15 connection of word, which are arranged in decreasing order of their frequency and is supported by Graph-16B for clear understanding.

Table-23B: Zipf's Law of Word Occurrence (Connection of word)

Sl.no	Rank (*r*)	Word	Frequency (*f*)	*r* X *f*=*k* (expected constant)
1.	1	Of	115	115
2.	2	In	77	154
3.	3	A	52	156
4.	4	And	50	200
5.	5	The	35	175
6.	6	To	17	102
7.	7	With	14	98
8.	8	For	12	96
9.	8	On	12	96
10.	9	An	8	72
11.	10	Its	4	40
12	10	Their	4	40
13.	11	By	3	33
14.	12	As	2	24
15	12	from	2	24

(Source: Survey data)



Graph-16B: Zipf's Law of Word Occurrence (connection of word)

Table-23B represents the word occurrence of Zipf's law (connection of word). The word 'Of' secured 1st position in ranking order with 115 frequency while, the word 'In' with 77 frequency, 'A' with 52 frequency, 'And' with 50 frequency followed by 'The' with 35 frequency and thus, they constitute 2nd, 3rd, 4th, and 5th in ranking order respectively. The equation for a relationship that is $r \times f = k$ where r is the rank of the word, f is the frequency, and k is the constant, it is found that rank and frequency of words in Table-23A are not always related and multiplication of them is not equal a constant. Therefore, Zipf's Law did not match with the findings.

5.20 Link Analysis

A user's query is necessary to solve as soon as possible. In the present Information technology era, an enormous collection of documents in electronic form is available for retrieval and use. It is one of the primary services of the library to provide such resources to the scholars and for this, link analysis is necessary to save the time of the user. Link analysis is used not only to study the connection and relationship between Journal articles but also to determine the research value of a journal's articles in a given field of study.

Here in Table-24, it is selected on the basis of the e-journals cited by the scholars in all 83 theses covered under the study. This has been filtered according to the links provided, whether the link is still available or not and whether it is accessible or not. The filtered documents are again arranged alphabetically and all the duplicate items are removed. The selected articles come up to 82 in total. The scholar has taken measures to confirm its availability by retrieving article from three databases such as Google Scholar, Scopus, and Web of Science. Data relating to the component has been placed in Table-24 which is also supported with Graph-17 for clear understanding and visualization of the density of databases.

Table-24: Link Analysis

Sl.No	Code	Author	Title	Title of Journal	Google Scholar	Scopus	Web of Science
1.	1	Abdulahi, I., Kajberg, L., &Virkus, S.	Internationalization of LIS education in Europe and North America	New Library World	✓	✓	
2.	2	Abdullahi, I.	Diversity and intercultural issues in library and information science (LIS) education	New Library World	✓	✓	
3.	3	Adeka, G.	Internet use among faculty members of Universities in Ghana	Library Review	✓	✓	
4.	4	Albanese, A. R.	Moving from Books to Bytes	Library Journal	✓	✓	✓
5.	5	Ali, R.M. Naushad&Nisha, Faizul	Use of e-journals among research scholars at Central Science Library, University of Delhi	Collection Building	✓	✓	
6.	6	Attebury, R. I., &Finnell, J.	What do LIS students in the United States know about liaison duties?	New Library World	✓	✓	
7.	7	Audunson, R., Nordlie, R., &Spangen, I. C.	The complete librarian: An outdated species? LIS between profession and discipline	New Library World	✓	✓	
8.	8	Bhardwaj, R.K., &Shukla, R.K.	A Practical Approach to Library Automation	Library Progress (International)	✓		
9.	9	Bodnar, J.	Information and learning commons, faculty and student benefits	New Library World	✓	✓	
10	10	Brunt, R.	Information storage and retrieval in the professional curriculum	Library Review	✓	✓	
11.	11	Chaudhry, A. S.	Collaboration in LIS education in Southeast Asia	New Library World	✓	✓	

12.	12	Chiu, Kang	Building public support for public libraries: Chicago- a case study	New Library World	✓	✓	
13.	13	Choi, Youngok, &Rasmussenb, Edie.	What Qualifications and Skills are Important for Digital Librarian Positions in Academic Libraries? A Job Advertisement Analysis	The Journal of Academic Librariansh ip	✓	✓	✓
14.	14	Corradnini, E.	Competencies and curriculum for IL	New Library World		✓	
15.	15	Cronin, B. Devenport, E. & Martinson, A.	Women's Studies: Bibliometric and Content analysis of the Formative years	Journal of Documenta tion	✓	✓	✓
16.	16	Deng, Hepu	Emerging patterns and trends in utilizing electronic resources in a higher education environment: an empirical analysis	New Library World	✓	✓	
17.	17	Dent, Valedafrances.	Modeling the rural community library: characteristics of the kingtengesa library in rural Uganda	New Library World	✓	✓	
18.	18	De-Vicente, A., Crawford, J and clink, S.	Use and awareness of electronic information services by academic staff at Glasgow Caledonian University	Library Review	✓	✓	
19.	19	Dilevko, J., & Gottlieb, L.	Print sources in an electronic age: a Vital part of the research process for Undergraduate students	The Journal of Academic Librariansh ip	✓	✓	✓
20.	20	Ethan, J. A., & Roberta, K. W.	Graduate student searching proficiencies in the selection of qualitative and quantitative journal references.	The Journal of Academic Librariansh ip	✓	✓	✓
21.	21	Frohmann, B.	Revisiting "What is a Document?	Journal of Documenta tion	✓	✓	✓

22.	22	Geetha, M., &Mamatha, K. R.	Use of Library Portal by Research Scholars and Faculty Members at Kuvempu University: A Survey	DESIDOC Journal of Library & Information Technology	✓	✓	
23.	23	Gerolimos, M.	Skills developed through library and information science education	Library Review	✓	✓	
24.	24	GhoshMatrayee	The public library system in India: challenges and opportunities	Library Review	✓	✓	
25.	25	Goodman, Valeda F. Dent	Rural library services: historical development and modern-day examples from West Africa	New Library World	✓	✓	
26.	26	Gorman, M.	Whither library education?	New Library World	✓	✓	
27.	27	Haridasan, S., Ahmad, K. M.	Use of web resources by the students of Zakir Hussain College of engineering and technology	AMU Aligarh Library herald	✓		
28.	28	Hood, David, and Kay Henderson.	Branding in the United Kingdom public library service	New Library world	✓	✓	
29.	29	Jamali, H. R., Nicholas, D., & Huntington, P	The use and users of scholarly e-journals: a review of log analysis studies	Aslib Proceedings	✓	✓	
30.	30	Jange, S., & Sami, L. K.	Influence of the Internet on Library and Information centers of National Institutes of Technology in India	Annals of Library and Information Studies	✓		
31.	31	Jay, Margaret, and Sheila Webber	Impact of internet on delivery of reference services in English public libraries	Program: Electronic Library and Information Systems	✓	✓	
32.	32	Johannsen, Carl Gustav	Money makes the world go around-fee	New Library	✓	✓	

			based services in Danish public libraries 2000-2003	World			
33.	33	Karun, Breda.	Slovene public libraries.	New Library World	✓	✓	
34.	34	Kelley, K. B., & Orr, G. J.	Trends in distant student use of electronic resources: A survey	College & Research Libraries	✓	✓	✓
35.	35	Khamadi, Shem Isindu Davison	A Proposal for Change at Moi University Library: Staff Development, Training, and Promotion	New Library World	✓	✓	
36.	36	Khan, Noor Shed and David Bawden	Community informatics in libraries in Pakistan: current status, future prospects	New Library World	✓	✓	
37.	37	Kichuk, D.	Electronic collection growth: an academic library cases study	Collection Building	✓	✓	
38.	38	Kirk, Wendy, David McMenemy and Alan Poulter	Family learning services in UK public libraries: an investigation of current provision and ongoing development	New Library World	✓	✓	
39.	39	Koulikourdi, Anna.	Library Services for people with disabilities in Greece	Library Review	✓	✓	
40.	40	Lee, K., & Jessica, B.	Virtually local: Social media and Community among polish nationals in Dublin	Aslib Proceedings New Information Prospects	✓	✓	
41.	41	Lee, Seongsin. 2007	Vroom's expectancy theory and the public library customer motivation model	Library Review	✓	✓	
42.	42	Liu, Z.	Print vs Electronic resources: A study of user perceptions, preferences, and use	Information Processing and Management	✓	✓	✓
43.	43	Loan, F. A.	Open access e-book collection on central Asia in selected	Collection Building	✓	✓	

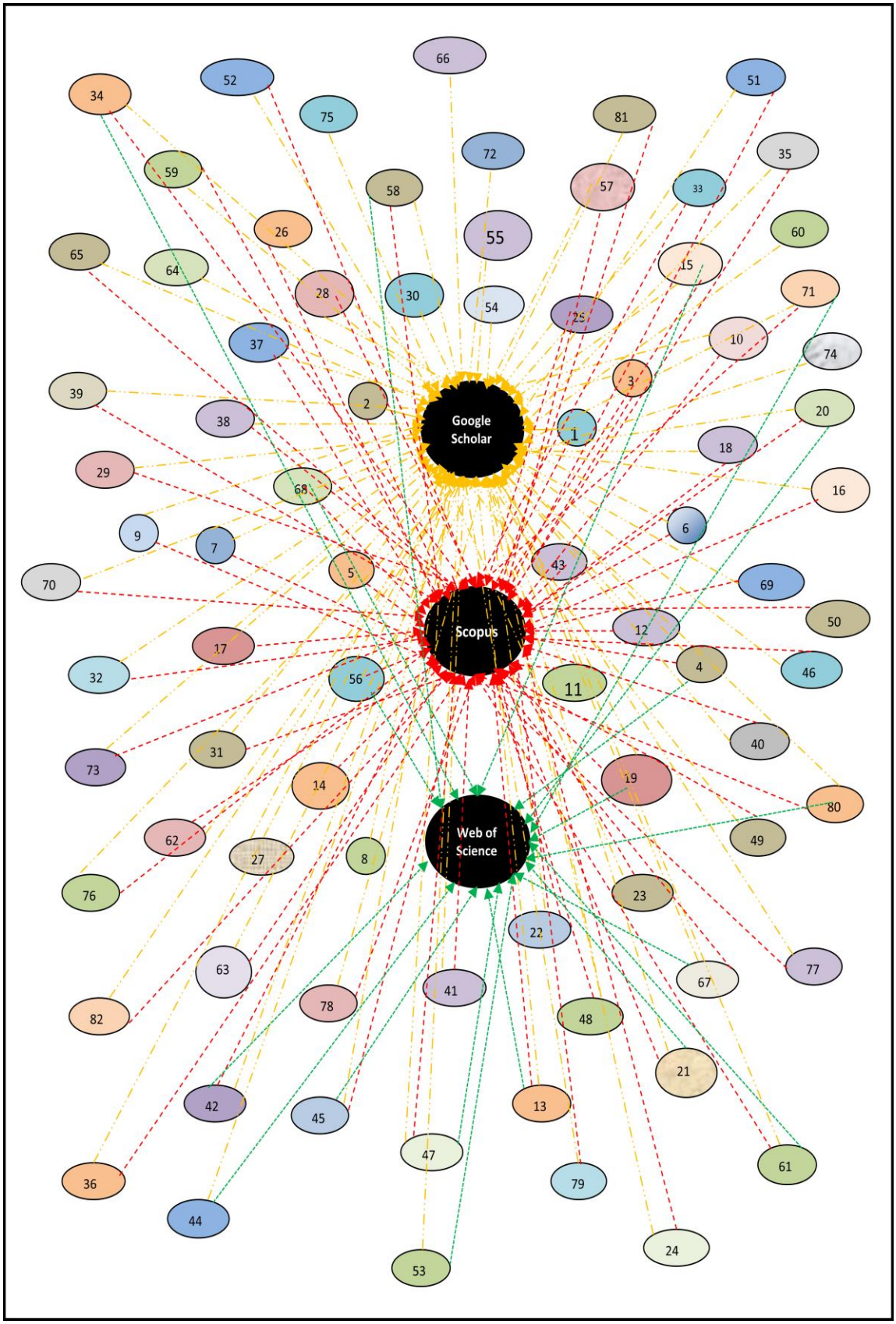
			digital archives				
44.	44	Lwoga, TE &Chilimo.WL	Resource Mobilization in Public University Libraries in Tanzania, University of Dar es Salaam	Library Journal	✓		✓
45.	45	Morris, Anne, Catherine Ayre, and Amy Jones	Audiovisual materials in UK public libraries: economic sense	Journal of Documentation	✓	✓	✓
46.	46	Mullins, John and Margaret Linehan	Senior public librarians looking to the future	New Library world	✓	✓	
47.	47	Neveol, A., &Rogozan, A.	Automatic indexing of online health resources for a French quality controlled gateway	Information Processing and Management	✓	✓	✓
48.	48	Ocholla, D., &Bothma, T.	Trend challenge and opportunities for LIS education and training in Eastern and Southern Africa	New Library World	✓	✓	
49.	49	Oduwale, AdebamboAdewale &Oyewumi, Olatundun	Accessibility and use of web-based electronic resources by physicians in a psychiatric institution in Nigeria	Program: Electronic Library and Information Systems	✓	✓	
50.	50	Owen, David	An idealist charter for public libraries	New Library World		✓	
51.	51	Pantry, S.	Whither the information professional? Challenges and opportunities the cultivation of information professional for the new millennium	ASLIB Proceedings	✓	✓	
52.	52	Pors, Niels Ole	The public library and student's information needs	New Library World	✓	✓	
53.	53	Pritchard, A.	Statistical Bibliography or Bibliometrics	Journal of Documentation	✓		✓
54.	54	Raghavan, K. S.	Education for the information	DESIDOC Bulletin of	✓		

			management profession: Challenges and opportunities	Information Technology			
55.	55	Ramana.P.V., &Rao, V.C.	Use of Information technology in central university libraries in India	DESIDOC Bulletin of Information Technology	✓		
56.	56	Rogers, Sally A	Electronic Journal Usage at Ohio State University	College & Research Libraries	✓		✓
57.	57	Rowbotham, J.	Librarians architects of the future	Aslib Proceedings	✓	✓	
58.	58	Rubin,N.	Preserving digital public television: Not just an archive. But a new attitude to preserve public broadcasting	Library Trends	✓	✓	✓
59.	59	Sahoo, B. B., &Agarwal, G.P.	INDEST-AICTE Consortium: A decade of service for engineering, science and technology community of the country	Annals of library and Information Studies (ALIS)	✓	✓	
60.	60	Singh, R. J., Devi, M., &Raychaudhury, A.	Use of internet-based e-resources at Manipur University: a survey	Annals of Library and Information Studies	✓		
61.	61	Smith, L.C.	Citation analysis	Library trends	✓	✓	✓
62.	62	Spacey, Rachel and Anne Goulding	Learners support in UK public libraries	Aslib Proceedings: New Information Perspectives	✓	✓	
63.	63	Suaiden, Emir Jose	The social impact of public libraries	Library Review	✓	✓	
64.	64	Suman, A.	Libraries: Perspectives and Objectives	DESIDOC Bulletin of Information Technology	✓		

65.	65	Swain, Dillip K. & Panda, K.C	Use of e-services by faculty members of business schools in a state of India: a study	Collection Building	✓	✓	
66.	66	Tariang, B. L.	Evaluation of websites used by social scientists of northeast India	Library Herald	✓		
67.	67	Tennant, R.	The most important management decision: Hiring staff for the new millennium.	Library Journal	✓	✓	✓
68.	68	Tennant, R.	Skills for the new millennium	Library Journal	✓	✓	✓
69.	69	Ti-Yu	A new model of faculty-librarian collaboration: The faculty member as a library specialist	New Library World	✓	✓	
70.	70	Todaro, Alicia Julia	Library Services for the people with disabilities in Argentina	New Library World	✓	✓	
71.	71	Tsakonas, G., &Paptheodorou, C.	Exploring usefulness and usability in the evaluation of open-access digital libraries	Information processing and management	✓	✓	✓
72.	72	Tucker, J.C.	E-book collection analysis: Subject and publisher trends	Collection Building	✓		
73.	73	Vagaan, R.W.	LIS education-repackaging infopreneurs or promoting value-based skills	New Library World	✓	✓	
74.	74	Varalakshmi, R. S. R.	Need for a national consensus on library and information science education in India	DESIDOC Bulletin of Information Technology	✓		
75.	75	VasanthaRaju, N., &Harinarayana, N. S.	An analysis of the usability features of library web sites	Annals of Library and Information Studies	✓		
76.	76	Virkus, S., & Wood, L.	Change and innovation in	New Library	✓	✓	

			European LIS education	World			
77.	77	Vrana, Radovan, and Ana Barbaric	Improving the visibility of public libraries in the local community: a study of five public libraries in Zagreb, Croatia	New Library World	✓	✓	
78.	78	Wijetunge, P.	A critical evaluation of the curriculum development strategy of the LIS education programs in Sri Lanka	Library Review	✓	✓	
79.	79	Williamson, A.	Strategies for managing digital content formats	Library Review	✓	✓	
80.	80	Worrell, D.	The learning organization: management theory for information age or new age fad	The Journal of Academic Librariansh ip	✓	✓	✓
81.	81	Yilmaz, Bulent.	Social change, Industrialization, and public libraries: a theoretical approach	Aslib Proceeding s	✓	✓	
82.	82	Zhang, Liye, Ye, Pinghao& Liu, Qihua	A survey of the use of electronic resources at seven universities in Wuhan, China	Program: Electronic Library and Informatio n Systems	✓	✓	
				Total	**80 (97.56 %)**	**68 (82.9 2%)**	**19 (23.1 7%)**

(Each % is calculated from a single database total number) *(Source: Survey data)*



Graph-17: Link Analysis

While analyzing the Link analysis placed in Table-24 it is found that the total number of all journal articles after verification with the three databases reached 82 where coding is given according to the serial number. Further, the individual analysis of the databases placed on the table revealed that, the availability of major chunk of articles i.e, 80 (97.56%) out of 82 are from Google Scholar databases while, it is 68 (82.92%) out of 82 in Scopus and 19 (23.17%) out of 82 in Web of Science databases and thus, Google Scholar, Scopus, and Web of Science occupy 1st, 2nd, and 3rd in ranking order respectively. The journal articles which are commonly available in all three databases namely Google Scholar, Scopus, and Web of science are 16. There are 53 Journals which appeared in two databases. However, the combination of two databases differs from one another. The combination of Google Scholar and Scopus databases includes 50 Journal's Articles. The combination of Google Scholar and Web of Science databases includes 3 Journal's Article. There is no combination of Scopus and Web of Science databases alone. The availability of Journal's Article in one database alone includes 13 in total, where Google Scholar database have11 articles and Scopus database alone has 2 articles. It is surprising to know that the availability of Journal's article alone in Web of Science Databases remains zero. A graphical representation in Graph-16 has been shown to get a clear picture of the link analysis.

5.21 Subject-Wise Distribution of Documents

Subject-wise distribution of documents is studied from among the cited documents by the scholars in their theses. Among the list of documents cited, a total of 3151 titles were cited by the scholars and the titles of the articles were classified in to

different sub facets of the broad subject area of Library and Information Science. The scholar used Library of Congress Subject Heading and Sears List of Subject Heading for resolving the subject headings. A total number of 55 subject areas of Library and Information Science were determined, which comes up to 38th rank, which has been reflected below in decreasing order of their citing frequency in Table-25 supplemented with Graph-18 for clear understanding.

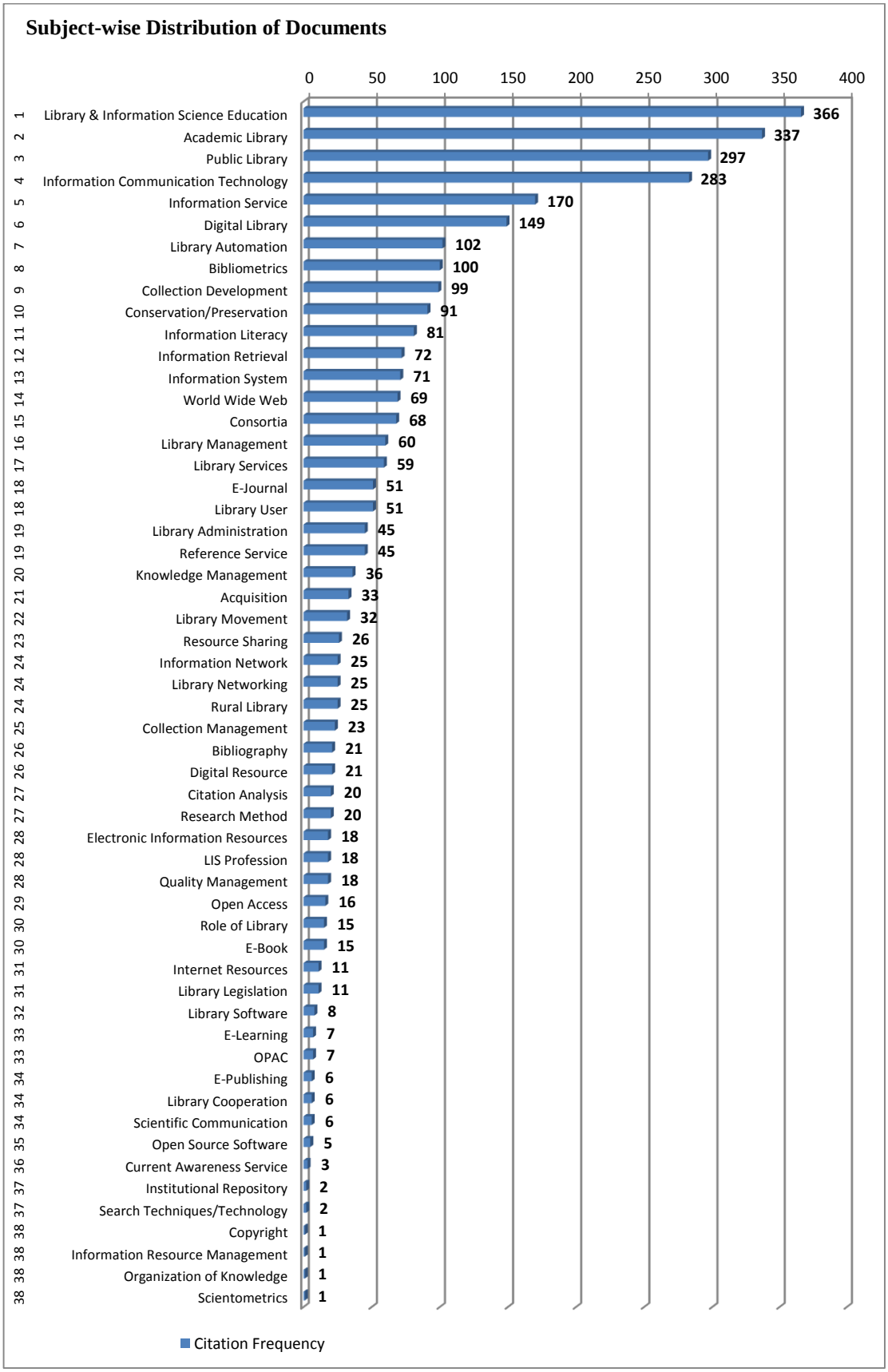
Table-25: Subject-wise distribution of Documents

Sl.No.	Rank	Subject	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1.	1	Library & Information Science Education	366	11.61	366	11.61
2.	2	Academic Library	337	10.7	703	22.31
3.	3	Public Library	297	9.42	1000	31.73
4.	4	Information Communication Technology	283	8.98	1283	40.71
5.	5	Information Service	170	5.4	1453	46.11
6.	6	Digital Library	149	4.73	1602	50.84
7.	7	Library Automation	102	3.24	1704	54.08
8.	8	Bibliometrics	100	3.17	1804	57.25
9.	9	Collection Development	99	3.14	1903	60.39
10.	10	Conservation/Preservation	91	2.89	1994	63.28
11.	11	Information Literacy	81	2.57	2075	65.85
12.	12	Information Retrieval	72	2.28	2147	68.13
13.	13	Information System	71	2.25	2218	70.38
14.	14	World Wide Web	69	2.19	2287	75.57
15.	15	Consortia	68	2.16	2355	74.73
16.	16	Library Management	60	1.9	2415	76.63

17.	17	Library Services	59	1.87	2474	78.5
18.	18	E-Journal	51	1.62	2525	80.12
19.	=18	Library User	51	1.62	2576	81.74
20.	19	Library Administration	45	1.43	2621	83.17
21.	=19	Reference Service	45	1.43	2666	84.6
22.	20	Knowledge Management	36	1.14	2702	85.74
23.	21	Acquisition	33	1.05	2735	86.79
24.	22	Library Movement	32	1.01	2767	87.8
25.	23	Resource Sharing	26	0.82	2793	88.62
26.	24	Information Network	25	0.8	2818	89.42
27.	=24	Library Networking	25	0.8	2843	90.22
28.	=24	Rural Library	25	0.8	2868	91.02
29.	25	Collection Management	23	0.73	2891	91.75
30.	26	Bibliography	21	0.66	2912	92.41
31.	=26	Digital Resource	21	0.66	2933	93.07
32.	27	Citation Analysis	20	0.63	2953	93.7
33.	=27	Research Method	20	0.63	2973	94.33
34.	28	Electronic Information Resources	18	0.57	2991	94.9
35.	=28	LIS Profession	18	0.57	3009	95.47
36.	=28	Quality Management	18	0.57	3027	96.04
37.	29	Open Access	16	0.51	3043	96.55
38.	30	Role of Library	15	0.48	3058	97.03
39.	=30	E-Book	15	0.48	3073	97.51
40.	31	Internet Resources	11	0.35	3084	97.86

41.	=31	Library Legislation	11	0.35	3095	98.21
42.	32	Library Software	8	0.25	3103	98.46
43.	33	E-Learning	7	0.22	3110	98.68
44.	=33	OPAC	7	0.22	3117	98.9
45.	34	E-Publishing	6	0.2	3123	99.1
46.	=34	Library Cooperation	6	0.2	3129	99.3
47.	=34	Scientific Communication	6	0.2	3135	99.5
48.	35	Open Source Software	5	0.16	3140	99.66
49.	36	Current Awareness Service	3	0.1	3143	99.76
50.	37	Institutional Repository	2	0.06	3145	99.82
51.	=37	Search Techniques/Technology	2	0.06	3147	99.88
52.	38	Copyright	1	0.03	3148	99.91
53.	=38	Information Resource Management	1	0.03	3149	99.94
54.	=38	Organization of Knowledge	1	0.03	3150	99.97
55.	=38	Scientometrics	1	0.03	3151	100
		Total	**3151**			

(Source: Survey data)



Graph-18: Subject-wise distribution of Documents

Analysis of the Table-25 shows that while, Library & Information Science Education is the highest 366 (11.61%) citations by the scholars in their theses in the subject-wise distribution, Academic Library 337 (10.7%) and Public Library has 297 (9.42%) citations and thus, it forms 1st, 2nd and 3rd in the ranking order respectively. The other subjects covered by the scholars in their theses include, Information Communication Technology (ICT) 283 (8.98%) citations, Information Service 170 (5.4%) citations, Digital Library 149 (4.73%) citations, Library Automation 102 (3.24) citations, Bibliometrics 100 (3.17%) citations, Collection Development 99 (3.14%) citations, Conservation/Preservation 91 (2.89%) citations, Information Literacy 81 (2.57%) citations, Information Retrieval 72 (2.28%) citations, Information System 71 (2.25%) citations, World Wide Web (WWW) 69 (2.19%) citations, Consortia 68 (2.16%) citations, Library Management 60 (1.9%) citations, Library Services 59 (1.87%) citations, e-Journal and Library User 51 (1.62%) citations each, Library Administration and Reference Service 45 (1.43%) citations each, Knowledge Management 36 (1.14%) citations, Acquisition 33 (1.05%) citations, Library Movement 32 (1.01%) citations, Resource Sharing 26 (0.82%) citations, Information Network, Library Networking and Rural Library 25 (0.8%) citations each, Collection Management 23 (0.73%) citations, Bibliography and Digital resources (0.66%) citations each, Citation Analysis and Research Method 20 (0.63%) citations each, Electronic Information Resources, LIS Profession and Quality Management 18 (0.57%) citations each, Open Access 16 (0.51%) citations, E-Book and Role of Library 15 (0.48%) citations each, Internet Resources and Library Legislation 11 (0.35%) citations each, Library Software 8 (0.25%) citations, E-Learning and OPAC (Online Public Access Catalogue) 7 (0.22%) citations each, E-Publishing, Library

Cooperation and Scientific Communication 6 (0.2%) citations each, Open Source Software 5 (0.16%) citations, Current Awareness Service (CAS) 3 (0.1%) citations, Institutional Repository and Search Techniques/Technology 2 (0.06%) citations each, Copyright, Information Resource Management, Organization of Knowledge, and Scientometrics 1 (0.03%) citations each. This shows a remarkable phenomenon for the growth of Library and Information subject.

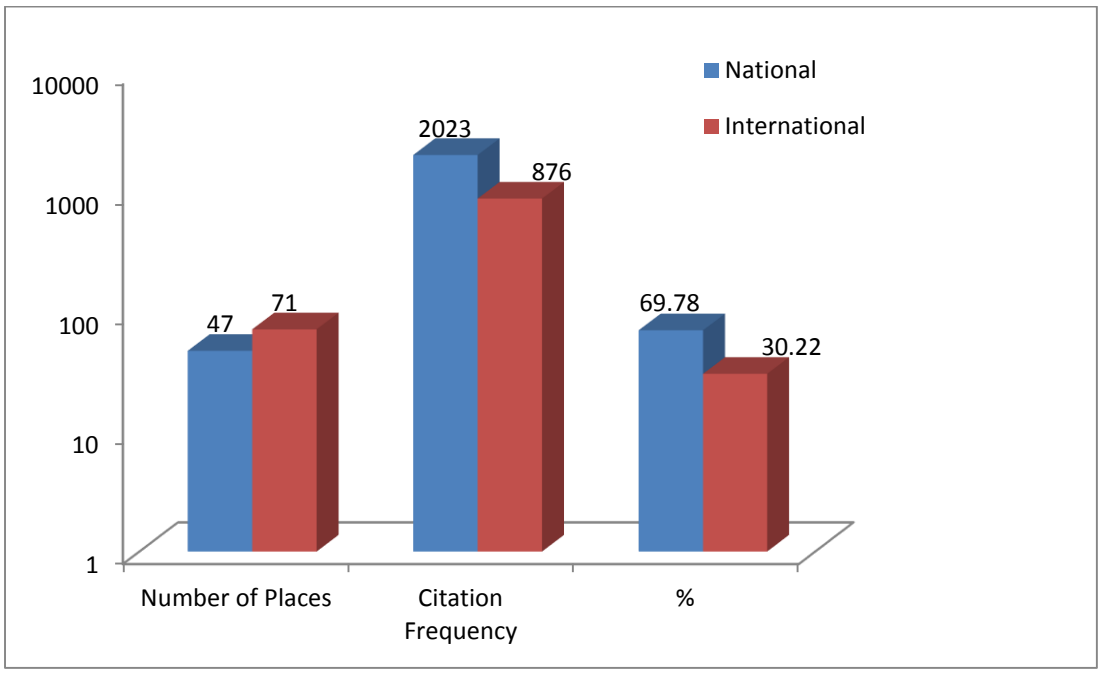
5.22 Categorization of Places

Categorization of Place is studied among the cited articles by the scholars in their dissertations. Among the list of articles cited, a total of 2899 citations from 118 places were cited by the scholars. Categorization of Place has been classified into two types such as, National and International and has been listed in Table-26 supported with Graph-19 for clear understanding.

Table-26: Categorization of Places

S/N	Type	Number of Places	Citation Frequency	%	Cumulative Frequencies	Cumulative %
1	National	47	2023	69.78	2023	69.78
2	International	71	876	30.22	2899	100
	Total	**118**	**2899**	**100**		

(Source: Survey data)



Graph-19: Categorization of Places

The scholar identified 2899 citations from 118 different places in total that constitute national and international. Analysis of the Table-26 reflects that, there are 2023 citations constitute national status i.e., 69.78% followed by 876 citations of having international status that constitute 30.22%. This visualizes that, the scholars are more prone to cite publications from home rather than abroad. This also may be due to the fact that, the international publications are out of reached which may be due to expensive as compared to national publications.

5.23 Ranking of Top Cited Places

Top cited places is based on the cited forms of documents, such as Books (Authorship), Books (Chaptered Authorship), Books (Editorial Authorship), Reference Books and Conference Proceedings and Organizations Documents which is published as a book and have publication Place have been depicted below in Table-27 supplemented with Graph-20 where, the scholar has listed out all the 2899 places and

the table further reflects in the decreasing sequence of the places covering both National and International. Further, all 118 places of 2899 citations frequency reflects 35 ranking orders showing the citation frequency and percentage thereof.

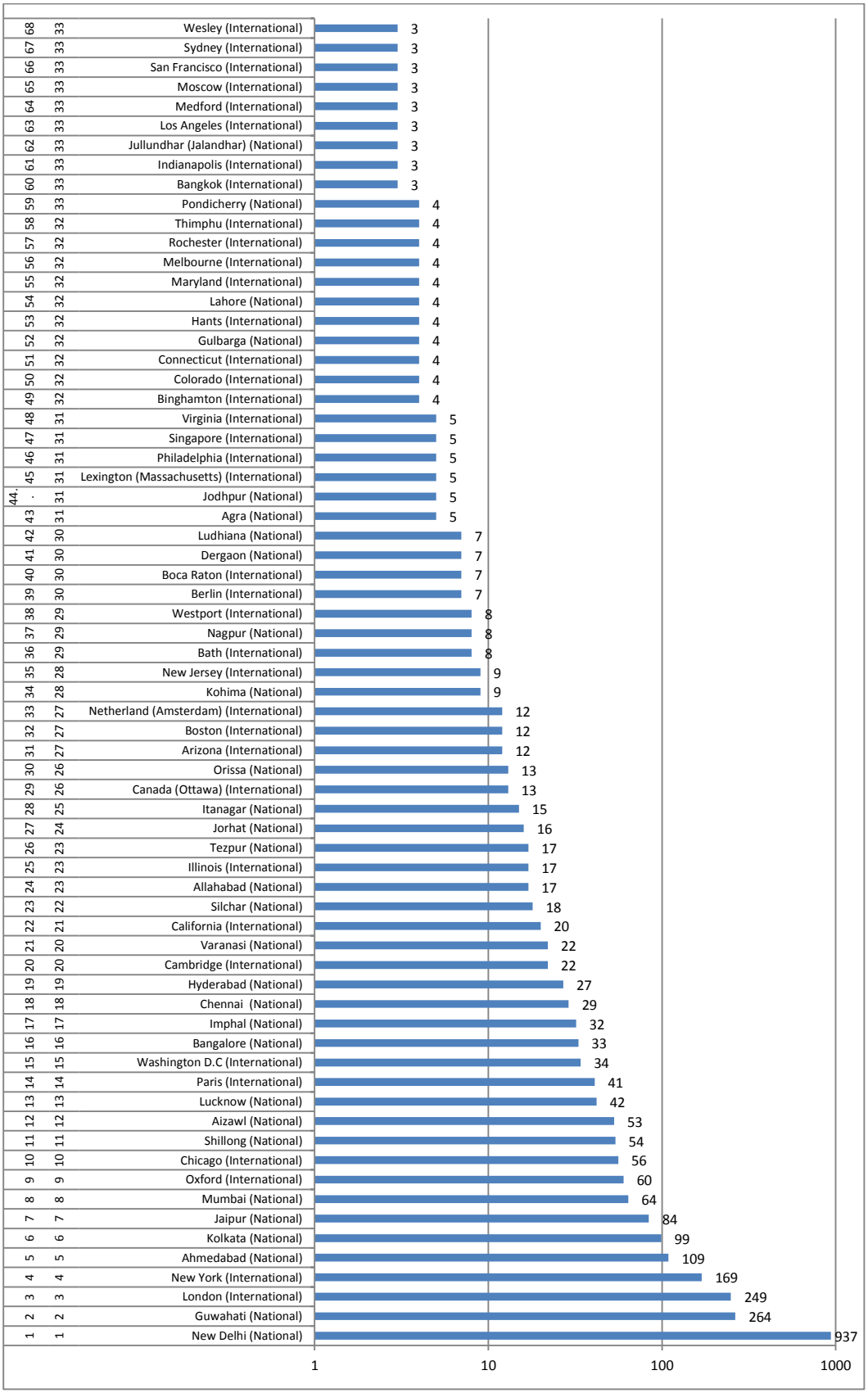
Table-27: Ranking of Top Cited Places

S/N	Rank	Name of Place	Citation Frequency	National/ International	%
1.	1	New Delhi	937	National	32.32
2.	2	Guwahati	264	National	9.11
3.	3	London	249	International	8.6
4.	4	New York	169	International	5.83
5.	5	Ahmadabad	109	National	3.76
6.	6	Kolkata	99	National	3.41
7.	7	Jaipur	84	National	2.9
8.	8	Mumbai	64	National	2.21
9.	9	Oxford	60	International	2.07
10.	10	Chicago	56	International	1.93
11.	11	Shillong	54	National	1.86
12.	12	Aizawl	53	National	1.83
13.	13	Lucknow	42	National	1.45
14.	14	Paris	41	International	1.41
15.	15	Washington D.C	34	International	1.17
16.	16	Bangalore	33	National	1.14
17.	17	Imphal	32	National	1.1
18.	18	Chennai	29	National	1
19.	19	Hyderabad	27	National	0.93
20.	20	Cambridge	22	International	0.76
21.	=20	Varanasi	22	National	0.76
22.	21	California	20	International	0.7

23.	22	Silchar	18	National	0.62
24.	23	Allahabad	17	National	0.6
25.	=23	Illinois	17	International	0.6
26.	=23	Tezpur	17	National	0.6
27.	24	Jorhat	16	National	0.55
28.	25	Itanagar	15	National	0.52
29.	26	Canada (Ottawa)	13	International	0.45
30.	=26	Orissa	13	National	0.45
31.	27	Arizona	12	International	0.41
32.	=27	Boston	12	International	0.41
33.	=27	Netherland (Amsterdam)	12	International	0.41
34.	28	Kohima	9	National	0.31
35.	=28	New Jersey	9	International	0.31
36.	29	Bath	8	International	0.27
37.	=29	Nagpur	8	National	0.27
38.	=29	Westport	8	International	0.27
39.	30	Berlin	7	International	0.24
40.	=30	Boca Raton	7	International	0.24
41.	=30	Dergaon	7	National	0.24
42.	=30	Ludhiana	7	National	0.24
43.	31	Agra	5	National	0.17
44..	=31	Jodhpur	5	National	0.17
45.	=31	Lexington (Massachusetts)	5	International	0.17
46.	=31	Philadelphia	5	International	0.17
47.	=31	Singapore	5	International	0.17
48.	=31	Virginia	5	International	0.17
49.	32	Binghamton	4	International	0.14

50.	=32	Colorado	4	International	0.14
51.	=32	Connecticut	4	International	0.14
52.	=32	Gulbarga	4	National	0.14
53.	=32	Hants	4	International	0.14
54.	=32	Lahore	4	National	0.14
55.	=32	Maryland	4	International	0.14
56.	=32	Melbourne	4	International	0.14
57.	=32	Rochester	4	International	0.14
58.	=32	Thimphu	4	International	0.14
59.	=32	Pondicherry	4	National	0.14
60.	33	Bangkok	3	International	0.1
61.	=33	Indianapolis	3	International	0.1
62.	=33	Jullundhar (Jalandhar)	3	National	0.1
63.	=33	Los Angeles	3	International	0.1
64.	=33	Medford	3	International	0.1
65.	=33	Moscow	3	International	0.1
66.	=33	San Francisco	3	International	0.1
67.	=33	Sydney	3	International	0.1
68.	=33	Wesley	3	International	0.1
69.	34	16 places having 2 citations each	16X2=32	(National=5 International=11)	1.1 (0.07 each)
70.	35	34 places having 1 citation each	34X1=34	(National=12 International=22)	1.17 (0.03 each)
		Total	**2899**	(National=47 International=71) **Total Place=118**	**99.99 or 100**

(Source: Survey data)



Graph-20: Ranking of Top Cited Places

Analysis of all 118 places of 2899 citations shown in Table-27 reflects that, New Delhi (National) has got maximum of 937 citations (32.32%) followed by Guwahati (National) having 264 citations (9.11%), London (International) 249 citations (8.6%), New York (International) with 169 citations (5.83%), Ahmadabad (National) having 109 citations (3.76%), Kolkata (National) 99 citations (3.41%), Jaipur (National) 84 citations(2.9%), Mumbai (National) 64 citations (2.21%), Oxford (International) 60 citations (2.07%), Chicago (International) 56 citations (1.93%), Shillong (National) 54 citations (1.86%), Aizawl (National) 53 citations (1.83%), Lucknow (National) 42 citations (1.45%), Paris (International) 41 citations (1.41%), Washington D.C (International) 34 citations (1.17%), Bangalore (National) 33 citations (1.14%), Imphal (National) 32 citations (1.1%), Chennai (National) 29 citations (1%), Hyderabad (National) 27 citations (0.93%), Cambridge (International) and Varanasi (National) 22 citations (0.76%) each, California (International) 20 citations (0.7%), Sichar (National) 18 citations (0.63%), Allahabad (National), Illinois (International) and Tezpur (National) 17 citations (0.6%) each, Jorhat (National) 16 citations (0.55%), Itanagar (National) 15 citations (0.52%), Canada (Ottawa) (International) and Orissa (National) 13 citations (0.45%) each, Arizona (International), Boston (International) and Netherland (Amsterdam) (International) 12 citations (0.41%) each, Kohima (National) and New Jersey (International) 9 citations (0.31%) each, Bath (International), Nagpur(National) and Westport (International) 8 citations (0.27%) each, Berlin (International), Boca Raton (International), Dergaon (National) and Ludhiana (National) 7 citations (0.24%) each, Agra (National), Jodhpur (National), Lexington (Massachusetts) (International), Philadelphia (International), Singapore (International) and Virginia (International) 5 citations (0.17%) each,

Binghamton (International), Colorado (International), Connecticut (International), Gulbarga (National), Hants (International), Lahore (National), Maryland (International), Melbourne (International), Rochester (International), Thimphu (International) and Pondicherry (National) 4 citations (0.14%) each, Bangkok (International), Indianapolis (International), Jullundhar (Jalandhar) (National), Los Angeles (International), Medford (International), Moscow (International), San Francisco (International), Sydney (International) and Wesley (International) 3 citations (0.1%) each, 16 places having 2 citations each 32 citations in total (0.07%) each and 34 places having 1 citation each 34 citations in total (0.03%) each. The analysis further visualizes that, the scholars while accessing Books (Authorship), Books (Chaptered Authorship), Books (Editorial Authorship), Reference Books and Conference Proceedings and Organizations Documents which is published as a book and have publication Place have value throughout the globe which contributes research output. It also visualizes that, New Delhi happens to be centre of research publications.

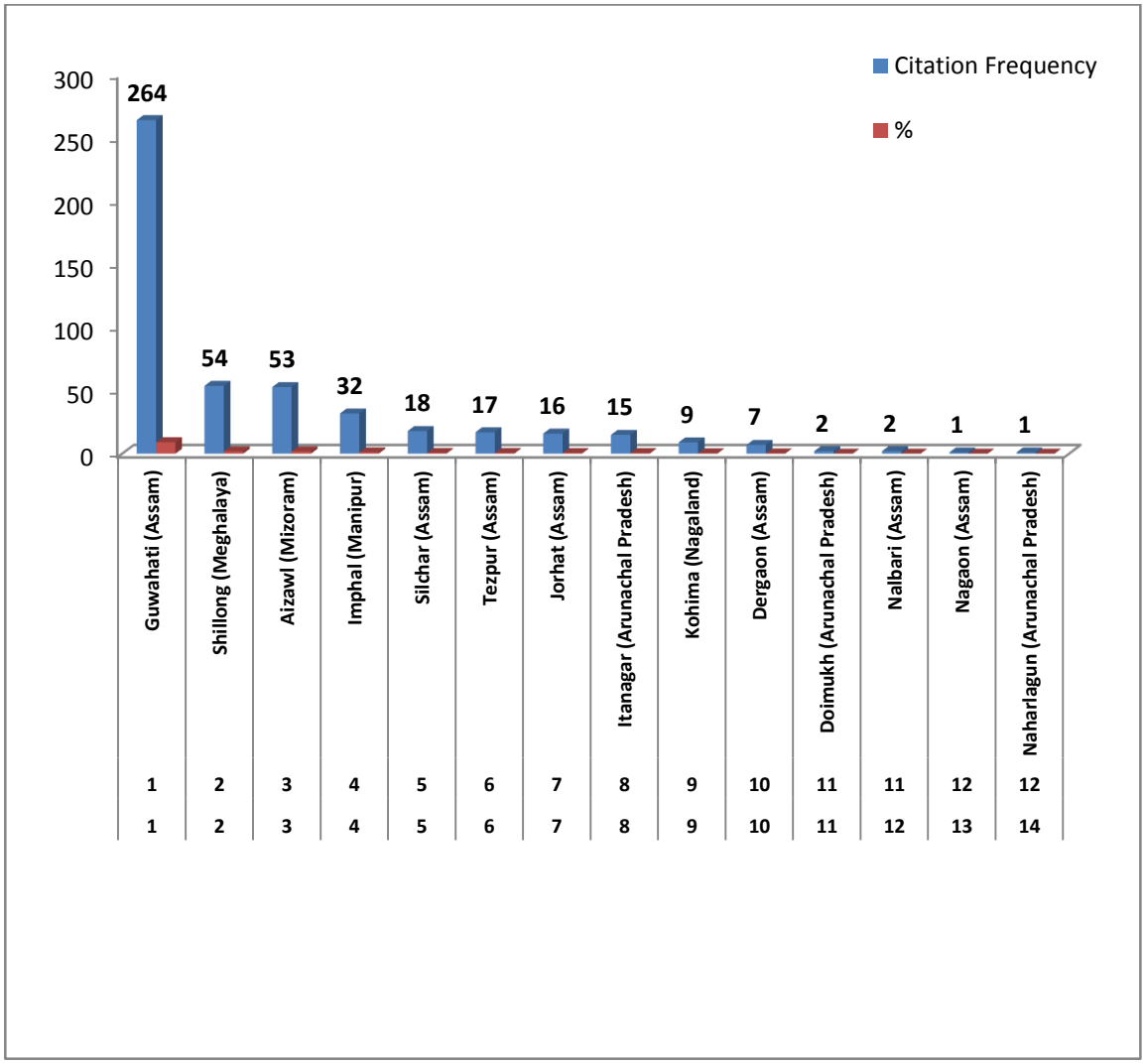
5.23A Ranking of Places with regard to North-East Region (NER)

Top cited places according to North-East Region have been depicted below in Table-27A supplemented with Graph-20A where, the scholar has listed out all the 118 places of 2899 citation frequency, there are 14 places which reflects 12 ranking order from North-East region and it is highlighted below in Table-27A which is supported with Graph-20A.

Table-27A: Ranking of Places (North East Region)

S/N	Rank	Name of Place	Name of the State	Citation Frequency	%
1.	1	Guwahati	Assam	264	9.11
2.	2	Shillong	Meghalaya	54	1.86
3.	3	Aizawl	Mizoram	53	1.83
4.	4	Imphal	Manipur	32	1.1
5.	5	Silchar	Assam	18	0.62
6.	6	Tezpur	Assam	17	0.6
7.	7	Jorhat	Assam	16	0.55
8.	8	Itanagar	Arunachal Pradesh	15	0.52
9.	9	Kohima	Nagaland	9	0.31
10.	10	Dergaon	Assam	7	0.24
11.	11	Doimukh	Arunachal Pradesh	2	0.07
12.	=11	Nalbari	Assam	2	0.07
13.	12	Nagaon	Assam	1	0.03
14.	=12	Naharlagun	Arunachal Pradesh	1	0.03

(Source: Survey data)



Graph-20A: Ranking of Places (North East Region)

Analysis of all 118 places of 2899 citations shown in Table-27A reflects that, from the North-East Region, Guwahati (Assam) stands at the apex because of 264 (9.11%) citations followed by Shillong (Meghalaya) 54 (1.86%) citations and Aizawl (Mizoram) 53 (1.83%) citations and thus it forms 1st, 2nd and 3rd in ranking order. Other places such as Imphal (Manipur) 32 (1.1%) citations, Silchar (Assam) 18 (0.62%) citations, Tezpur (Assam) 17 (0.6%) citations, Jorhat (Assam) 16 (0.55%) citations, Itanagar (Arunachal Pradesh) 15 (0.52%) citations, Kohima (Nagaland) 9 (0.31%) citations, Dergaon (Assam) 7 (0.24%) citations, Doimukh

(Arunachal Pradesh) and Nalbari (Assam) 2 (0.07%) citations each and Nagaon(Assam) and Naharlagun (Arunachal Pradesh) 1 (0.03%) citation each. From the above 14 places as shown in Table-27A, Majority places comes out from Assam State i.e 7 places followed by Arunachal Pradesh State having 3 places. All the rest such as Meghalaya, Mizoram, Manipur and Nagaland States have one places each. Other state from North-East region such as Sikkim and Tripura places name is not found in the scholar's citation. It can be conclude that, the state Assam happens to be centre of research publications in North-East Region.

5.24 Ranking of Publishers

The publishers use to publish value-added research articles in books. The highly-cited documents by the scholars in their theses are the common parameters for measuring the relative importance of a publication. It also determines the resourcefulness of the books which adds substantial value for the researchers. Citations across the theses covered under the study by the scholars comprise a total number of 2899 Library and Information Science books, Proceedings of the Seminars, Reports, Theses, Dissertations and other various forms of publications and these forms of documents showing the national/international status are listed in Table-28 in the decreasing order of their frequency of citations along with the Graph-21 for a clear understanding.

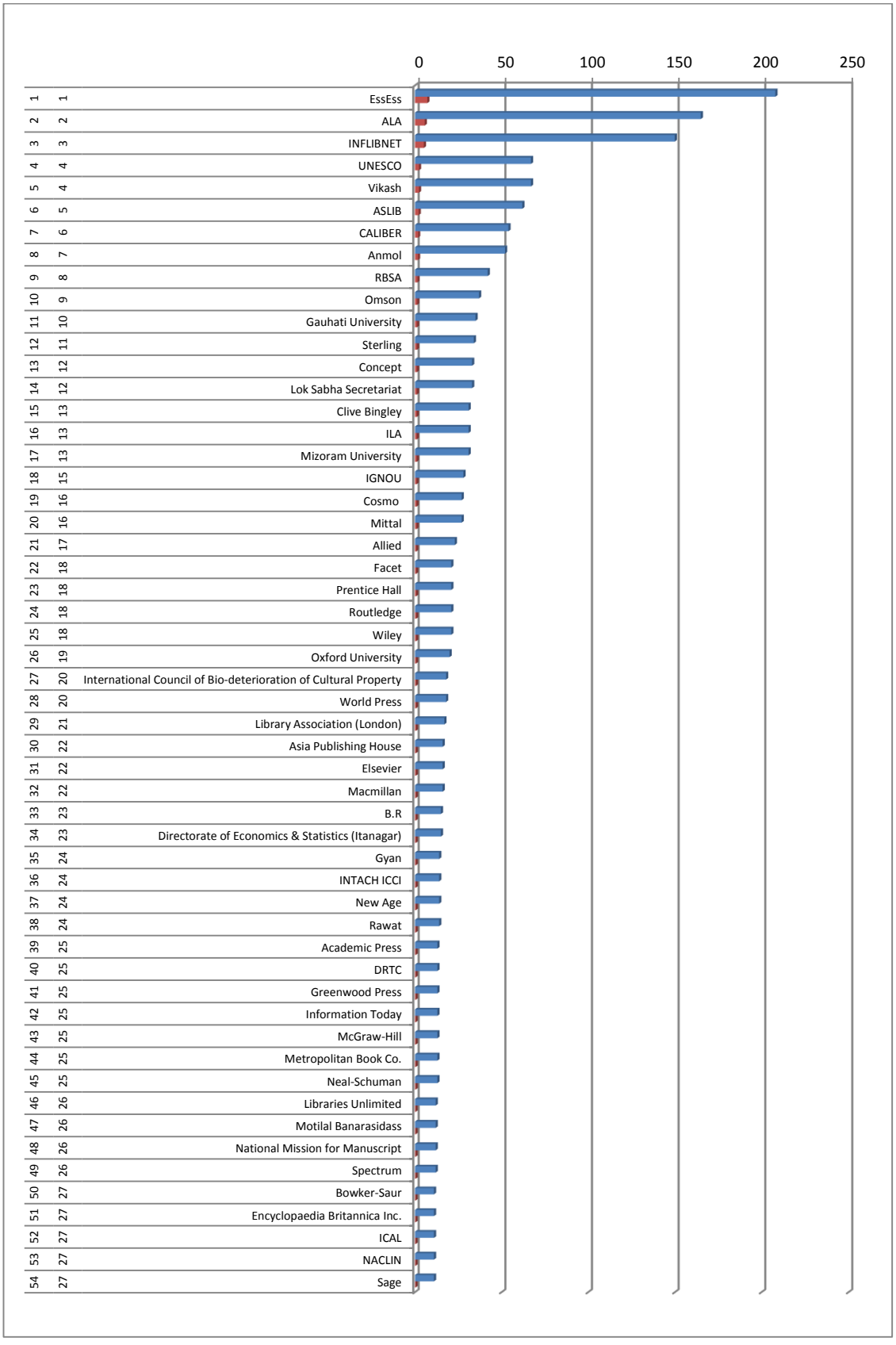
Table-28: Ranking of Publishers

S/N	Rank	Name of Publisher	Citation Frequency	%	C.F*	C. %**	National/ International
1	1	EssEss	208	7.17	208	7.17	National
2	2	ALA	165	5.7	373	12.87	International
3	3	INFLIBNET	150	5.17	523	18.04	National
4	4	UNESCO	67	2.31	590	20.35	International
5	=4	Vikash	67	2.31	657	22.66	National
6	5	ASLIB	62	2.14	719	24.8	International
7	6	CALIBER	54	1.86	773	26.66	National
8	7	Anmol	52	1.8	825	28.46	National
9	8	RBSA	42	1.45	867	29.91	National
10	9	Omson	37	1.28	904	31.19	National
11	10	Gauhati University	35	1.21	939	32.4	National
12	11	Sterling	34	1.17	973	33.57	National
13	12	Concept	33	1.14	1006	34.71	National
14	=12	Lok Sabha Secretariat	33	1.14	1039	35.85	National
15	13	Clive Bingley	31	1.07	1070	36.92	International
16	=13	ILA	31	1.07	1101	37.99	National
17	=13	Mizoram University	31	1.07	1132	39.06	National
18	15	IGNOU	28	0.96	1160	40.02	National
19	16	Cosmo	27	0.93	1187	40.95	National
20	=16	Mittal	27	0.93	1214	41.88	National
21	17	Allied	23	0.8	1237	42.68	National
22	18	Facet	21	0.72	1258	43.4	International
23	=18	Prentice Hall	21	0.72	1279	44.12	National
24	=18	Routledge	21	0.72	1300	44.84	International
25	=18	Wiley	21	0.72	1321	45.56	International
26	19	Oxford University	20	0.69	1341	46.25	International
27	20	International Council of Bio-deterioration of Cultural Property	18	0.62	1359	46.87	National
28	=20	World Press	18	0.62	1377	47.49	National
29	21	Library Association (London)	17	0.6	1394	48.09	International
30	22	Asia Publishing House	16	0.55	1410	48.64	National
31	=22	Elsevier	16	0.55	1426	49.19	International
32	=22	Macmillan	16	0.55	1442	49.74	International
33	23	B.R	15	0.52	1457	50.26	National
34	=23	Directorate of Economics	15	0.52	1472	50.78	National

		& Statistics (Itanagar)					
35	24	Gyan	14	0.5	1486	51.28	National
36	=24	INTACH ICCI	14	0.5	1500	51.78	National
37	=24	New Age	14	0.5	1514	52.28	National
38	=24	Rawat	14	0.5	1528	52.78	National
39	25	Academic Press	13	0.44	1541	53.22	International
40	=25	DRTC	13	0.44	1554	53.66	National
41	=25	Greenwood Press	13	0.44	1567	54.1	International
42	=25	Information Today	13	0.44	1580	54.54	International
43	=25	McGraw-Hill	13	0.44	1593	54.98	International
44	=25	Metropolitan Book Co.	13	0.44	1606	55.42	National
45	=25	Neal-Schuman	13	0.44	1619	55.86	International
46	26	Libraries Unlimited	12	0.41	1631	56.27	International
47	=26	Motilal Banarasidass	12	0.41	1643	56.68	National
48	=26	National Mission for Manuscript	12	0.41	1655	57.09	National
49	=26	Spectrum	12	0.41	1667	57.5	National
50	27	Bowker-Saur	11	0.38	1678	57.88	International
51	=27	Encyclopaedia Britannica Inc.	11	0.38	1689	58.26	International
52	=27	ICAL	11	0.38	1700	58.64	National
53	=27	NACLIN	11	0.38	1711	59.02	National
54	=27	Sage	11	0.38	1722	59.4	International
55	28	7 publishers having 10 citations each	7 x 10=70	2.41 (0.34 each)	1792	61.81	Both National and International
56	29	7 publishers having 9 citations each	7 x 9=63	2.17 (0.31 each)	1855	63.98	Both National and International
57	30	10 publishers having 8 citations each	10 x 8=80	2.76 (0.27 each)	1935	66.74	Both National and International
58	31	7 publishers having 7 citations each	7 x 7=49	1.7 (0.24 each)	1984	68.44	Both National and International
59	32	20 publishers having 6 citations each	20 x 6=120	4.14 (0.2 each)	2104	72.58	Both National and International
60	33	20 publishers having 5 citations each	20 x 5=100	3.45 (0.17 each)	2204	76.03	Both National and International
61	34	29 publishers having 4 citations each	29 x 4= 116	4 (0.13	2320	80.03	Both National and

				each)			International
62	35	44 publishers having 3 citations each	44 x 3= 132	4.55 (0.1 each)	2452	84.58	Both National and International
63	36	89 publishers having 2 citations each	89 x 2=178	6.14 (0.06 each)	2630	90.72	Both National and International
64	37	269 publishers having 1 citations each	269 x 1 = 269	9.28 (0.03 each)	2899	100	Both National and International
		Total	**2899**	**100**			

N.B. *- Cumulative Frequencies, **- Percentage of Cumulative Frequencies Source: Ph.D. theses)



Graph-21: Ranking of Publishers

On analysis of the Table-28 it was observed that out of a total number of 2899 citations of books and other forms of documents excluding the journals articles, the scholars have cited Ess Ess with 208 citations (7.17%) followed by ALA with 165 citations (5.7%), INFLIBNET 150 (5.17%) citations, UNESCO AND Vikash 67 (2.31%) citations each, ASLIB with 62 (2.14%) citation, CALIBER 54 (1.86%) citations, Anmol 52 (1.8%) citations, RBSA 42 (1.45%) citations,Omson37 citations (1.28%), Gauhati University 35 (1.21%) citations, Sterling 34 (1.17%) citations, Concept and Loka Sabha Secretariat 33 (1.14%) citations, Clive Bingley, ILA and Mizoram University 31 (1.07%) citations, IGNOU 28 (0.96%) citations, Cosmo and Mittal 27 (0.93%) citations, Allied 23 (0.8%) citations, Facet, Prentice Hall, Routledge and Wiley 21 (0.72%) citations, Oxford University 20 (0.69%) citations, International Council of Bio-deterioration of Cultural Property and World Press 18 (0.62%) citations, Library Association (London) 17 (0.6%) citations, Asia Publishing House, Elsevier and Macmillan 16 (0.55%) citations, B.R and Directorate of Economics & Statistics (Itanagar) 15 (0.52%) citations, Gyan, INTACH ICCI, New Age and Rawat 14 (0.5%) citations, Academic Press, DRTC, Greenwood Press, Information Today, McGraw-Hill, Metropolitan Book Co. and Neal-Schuman 13 (0.44%) citations, Libraries Unlimited, Motilal Banarasidass, National Mission for Manuscript and Spectrum 12 (0.41%) citations, Bowker-Saur, Encyclopaedia Britannica Inc., ICAL, NACLIN and Sage 11 (0.38%) citations, 7 publishers having 10 citations each forming 70 citations in total i.e. 2.41% (0.34% each), 7 publishers having 9 citations each forming 63 citations in total i.e. 2.17% (0.31% each), 10 publishers having 8 citations each forming 80 citations in total i.e. 2.76% (0.27% each), 7 publishers having 7 citations each forming 49 citations in total i.e. 1.7% (0.24% each), 20 publishers

having 6 citations each forming 120 citations in total i.e. 4.14% (0.2% each), 20 publishers having 5 citations each forming 100 citations in total i.e. 3.45% (0.17% each), 29 publishers having 4 citations each forming 116 citations in total i.e. 4% (0.13% each), 44 publishers having 3 citations each forming 132 citations in total i.e. 4.55% (0.1% each), 89 publishers having 2 citations each forming 178 citations in total i.e. 6.14% (0.06% each) and 269 publishers having 1 citations each forming thereby, 269 citations in total i.e. 9.28% (0.03% each). It was further observed that the scholars preferred to use Ess Ess Publication and hence, it secured 1st position in the ranking of Publishers. It is interesting to deduce from the analysis that, note that in spite of having a wide range of resources especially books in the library, the scholars in library and information science do prefer to use the publications of ALA and INFLIBNET and thus ranked 2nd and 3rd in ranking of publishers.

5.25 Findings of The Study

Objectives-1: Find out the core list and ranking of journals both print and electronic central to Library and Information Science.

5.13 Categorization of Journals placed in **Table-17** after analysis reflects that there are 343 international (84.9%) journals and national journals 61 (15.1%). Further, out of 2876 citations in total from both the types of journals, 1874 citations (65.16%) are having International status while, 1002 citations are having national status which constitute 34.84%. This visualizes that, the scholars are more prone to cite the journals emanated from outside rather home. This is primarily due to the availability of international journals through consortia in the libraries. (**Chapter-5, Section 5.13, Table-17, Graph-10, Page 202-204)**

5.14 With regard to cited articles from the journals placed in **Table-18** reflects that the highly cited rate is 135 times (4.7%), followed by 111 times (3.86%) and 97 times (3.37%) which constitute 1st, 2nd and 3rd in ranking order. Further, 91 times (3.16%), 84 times (2.92%), 82 times (2.85%), 75 times (2.61%) 68 for 2 journals (2.37%) each, 66 times (2.3%), and 59 times (2.05%). The scholars also have cited 393 journals of 1940 times' altogether has been placed and analyzed, which shows the importance of the research articles of the journals. (**Chapter-5, Section 5.14, Table-18, Graph-11, Page 204-206)**

5.15 While analyzing the ranking of journals placed in **Table-19** it was observed that, out of a total number of 2876 citations from 404 journals as already discussed (**Table-17**) while, ILA Bulletin stands at the apex for having been maximum 135 (4.7%) citations and thus keeps 1st position in the ranking order, DESIDOC Journal of library and information technology is at the 2nd position in the ranking order for having 111 citations (3.86%) and Annals of Library & Information Studies (Annals of Library Science & Documentation) in the 3rd position for having 97 citations (3.37%). (**Chapter-5, Section 5.15, Table-19, Graph-12, Page 207-214)**

5.15 The top 10 rankings of International Journals placed in **Table-19A** and the top 10 rankings of National Journals placed in **Table-19B**, it could be found out that, the national journal status is high as compared to international journals. This is due to the fact that the scholars have cited a maximum of 68 (2.36%) citations the international journals, while they have cited maximum 135 (4.7%) citations national journals. Besides, the number of Journals, the number of citation frequency and the number of percentage, International Journal leads in the three (3) criteria. Out of top

10, in the overall ranking, 8 numbers of journals are the National including one International journal in the ranking order of 8. The other 2 number of Journals out of top 10 are the international. This visualized that, the scholar gets an easy access to national journal compared to International Journals. This also coupled with constraints by the international journals in getting the articles through open source. (**Chapter-5, Section 5.15, Table-19A, Graph-12A, Table-19B, Graph-12B, Page 214-218)**

5.15 While analyzing both **Table-19C** and **Table-19D** showing the top 5 journals of both print and electronic above respectively it was deduced that, compared to electronic journals, larger number of citation frequency goes to Printed Journals namely, ILA Bulletin 135 (4.7%) citations out of 2876 and thus occupy 1st in ranking order while, DESIDOC Journal of Library and Information Technology 111 (3.86%) citations in 2nd ranking order followed by Annals of Library and Information Studies 97 (3.37%) citations in 3rd rank. The top 5 electronic journals in the ranking order however, comprise the Electronic Library in rank order 1 for having been cited 59 (2.05%) citations followed by ASLIB Proceedings 49 (1.7%) citations in ranking order 2 (Overall ranking No.14), Library & Archival Security 44 (1.53%) citations in ranking order 3 (Overall ranking No.15). It can be assumed that Printed Journals are having more citation frequency comparing to Electronic Journals. The reason behind this is that Printed Journals are reader-friendly and easy-accessible and comfortable for being subscribed by the libraries under survey as compared to Electronic Journals. (**Chapter-5, Section 5.15, Table-19C, Graph-12C, Table-19D, Graph-12D, Page 218-220)**

Objectives-2: Preparing link analysis of the cited electronic journals used by the scholars in their dissertations after confirmation through Web of Science, Scopus and Google Scholar databases.

5.20 While analyzing the Link analysis placed in **Table-24** it is found that the total number of all journal articles after verification with the three databases reached 82 where coding is given according to the serial number. Further, the individual analysis of the databases placed on the table revealed that, the availability of major chunk of articles i.e, 80 (97.56%) out of 82 are from Google Scholar databases while, it is 68 (82.92%) out of 82 in Scopus and 19 (23.17%) out of 82 in Web of Science databases and thus, Google Scholar, Scopus, and Web of Science occupy 1st, 2nd, and 3rd in ranking order respectively. The journal articles which are commonly available in all three databases namely Google Scholar, Scopus, and Web of science are 16. There are 53 Journals which appeared in two databases. However, the combination of two databases differs from one another. The combination of Google Scholar and Scopus databases includes 50 Journal's Articles. The combination of Google Scholar and Web of Science databases includes 3 Journal's Article. There is no combination of Scopus and Web of Science databases alone. The availability of Journal's Article in one database alone includes 13 in total, where Google Scholar database have11 articles and Scopus database alone has 2 articles. It is surprising to know that the availability of Journal's article alone in Web of Science Databases remains zero. A graphical representation in Graph- 16 has been shown to get a clear picture of the link analysis. (**Chapter-5, Section 5.20, Table-24, Graph-17, Page 255-265)**

Objectives-3: Recognize the core authors and/or group of authors in Library and Information Science.

5.5 While analyzing the data placed in **Table-9** of the authorship pattern of journal's article, it was revealed that the contribution of articles by a Single author is significantly more which comes to 1846 (64.2%) out of 2876 followed by Two (Joint) authors 779 which forms 27.08% and 169 by three authors that constitute 5.87%. The analysis, further revealed that, among 8 groups, single author, Two (joint) authors, and three authors rank First, Second and Third position respectively while four authors, five authors, six authors, seven authors and more than seven authors are insignificant. This may be due to the fact that the contribution of article by many authors is difficult. (**Chapter-5, Section 5.5, Table-9, Graph-4, Page 158-160)**

5.5 While analyzing the authorship pattern placed in **Table-9A**, it was revealed that the contribution of documents by a Single author is significantly more which comes to 6073 (48%) out of 12707 followed by Two (Joint) authors 2056 which forms 16%, 751 number of organizations as an authors that constitute 6%. The analysis further revealed that, among 6 groups, single author, Two (joint) authors, and organizations as an author rank First, Second and Third position respectively while three authors and more than three authors and without author (links alone) are insignificant. This may be due to the fact that the contribution of documents by many authors is lacking in bringing out their research publications. (**Chapter-5, Section 5.5, Table-9A, Graph-4A, Page 160-161)**

5.6.1 While analyzing the cited author distribution with special reference to Journal's Article placed in **Table-10** revealed that there are a total number of 1846

single authors and in the ranking order placed in detail up to 10, the authors Danny Sullivan and T.D. Wilson is cited maximum number of times i.e. 21 times (1.14%) out of 1846 followed by P.B. Mangla 14 times (0.76%) and Maurice B. Line 13 (0.7%) and thus, they are placed 1st, 2nd and 3rd in the ranking order respectively. The author's citation depends upon the research output of the authors where the scholars access concerning their research work. (**Chapter-5, Section 5.6, Table-10, Graph-5, Page 161-165)**

5.6.1 The analysis of cited author distribution with special reference to Journal's Article of Two Authors, **Table-10A** unveils that there are a total number of 779 Two authors and the ranking has been mentioned in detail up to 5 where Karisidappa, C.R and (Second author) is cited maximum 11 times (1.41%) out of 779 followed by Kannappanavar, B. U. and (Second author) 10 times (1.28%) and Barman R.K and (Second author), Dutta, B. and (Second author), and Mahapatra, R.K. and (Second author) 7 times (0.9%) each and thus, they rank 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10A, Graph-5A, Page 165-168)**

5.6.1 The analysis of cited author distribution with special reference to Journal's Article of Three Authors, **Table-10B** disclosed that, there are a total number of 169 Three authors and the ranking has been mentioned in detail up to 3 where Rehman, S. (Second and Third author) is cited maximum 4 times (2.37%) while, Ford, N. (Second and Third author), Jansen, B. J. (Second and Third author), Nicholas, D. (Second and Third author), Satpathy, S.K. (Second and Third author), Singh, R. K. J. (Second and Third author), Veenapani, S. (Second and Third author), are cited 3 times (1.77%) each and Abdullahi, I. (Second and Third author), Belcher, M. (Second and Third

author), Curry, A. (Second and Third author), Gupta, B.M. (Second and Third author), Karmakar, G. S. (Second and Third author), Khoo, C. (Second and Third author), Mokhtar, I.A. (Second and Third author), Murthy, T.A.V. (Second and Third author), Singh, A. P. (Second and Third author), Tahir, M. (Second and Third author) and Worrall, J.J. (Second and Third author) are cited 2 times (1.18%) each. Thus, it ranks 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10B, Graph-5B, Page 168-171)**

5.6.1 With regard to cited author distribution with special reference to Journal's Article of Four Authors, placed in **Table-10C** reveals that there are a total number of 46 four authors and the ranking has been mention in detail up to 2 where Kadimani, B.S. (With 1st, 2nd & 3rd Author) 3 times (6.52%) ranked 1st position followed by Dempsey, B. J. (With 1st, 2nd & 3rd Author), Gupta, B. M. (With 1st, 2nd & 3rd Author), Huang, J. (With 1st, 2nd & 3rd Author), Mehta, V. (With 1st, 2nd & 3rd Author), Spink, A. (With 1st, 2nd & 3rd Author) and Warwick, C. (With 1st, 2nd & 3rd Author) 2 times each (4.35%) and thus secured 2nd position respectively. Besides, there are 31 Four Authors having one citation frequency each i.e. 31 [67.39% (2.17%each)]. (**Chapter-5, Section 5.6, Table-10C, Graph-5C, Page 171-172)**

5.6.1 The analysis of cited author distribution with special reference to Journal's Article **Table-10D** brings out that, with regard to five authors, there are 17 different Five authors combine i.e. 17 citation frequencies which is placed in one criterion 100% (5.88% each). There are 8 different Six authors combine i.e. 8 citation frequencies which is placed in one criterion 100% (12.5% each). There are 4 different Seven authors combine i.e. 4 citation frequencies which is placed in one criterion

100% (25% each). Likewise, there are 7 different 7+ (more than seven) authors combine i.e. 7 citation frequencies which is placed in one criterion 100% (14.28% each). (**Chapter-5, Section 5.6, Table-10D, Graph-5D, Page 173-174)**

5.6.2 While analyzing the cited author distribution of all documents, Single Author, placed in **Table-10E** revealed that there are a total number of 6073 single authors and in the ranking order placed in detail up to 14, the author Krishan Kumar is cited maximum number of times i.e. 39 times (0.64%) out of 6073 followed by P.S.G Kumar 28 times (0.46%) and S.R Ranganathan 26 (0.43%) and thus, they are placed 1st, 2nd and 3rd in the ranking order respectively. The author's citation depends upon the research output of the authors where the scholars access concerning their research work. (**Chapter-5, Section 5.6, Table-10E, Graph-5E, Page 175-179)**

5.6.2 The analysis of cited author distribution of all documents, Two Authors of **Table-10F** unveils that there are a total number of 2056 Two authors and the ranking has been mentioned in detail up to 7 where Karisidappa, C.R and (Second author) is cited maximum 12 times (0.58%) out of 2056 followed by Kannappanavar, B. U. and (Second author) 10 times (0.5%) and Chowdhury, G.G. and (Second author) 9 times (0.44%) and thus, they rank 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10F, Graph-5F, Page 179-183)**

5.6.2 The analysis of cited author distribution of all documents, Three Authors of **Table-10G** disclosed that, there are a total number of 374 Three authors and the ranking has been mentioned in detail up to 3 where Rehman, S. (Second and Third author) is cited maximum 4 times (1.07%) while, Ford, N. (Second and Third author), Jansen, B. J. (Second and Third author), Nicholas, D. (Second and Third author),

Satpathy, S.K. (Second and Third author), Singh, R. K. J. (Second and Third author), and Veenapani, S. (Second and Third author) are cited 3 times (0.8%) each and Abdullahi, I. (Second and Third author), Bavakutty, M. (Second and Third author), Belcher, M. (Second and Third author), Cohn, J. M. (Second and Third author), Coulter, A. (Second and Third author), Curry, A. (Second and Third author), Gupta, B.M. (Second and Third author), Karmakar, G. S. (Second and Third author), Khoo, C. (Second and Third author), Mokhtar, I.A. (Second and Third author), Murthy, T.A.V. (Second and Third author), Singh, A. P. (Second and Third author), Tahir, M. (Second and Third author) and Worrall, J.J. (Second and Third author) are cited 2 times (0.53%) each. Thus, it ranks 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10G, Graph-5G, Page 183-186)**

5.6.2 Cited author distribution of all documents, More than three Authors of **Table-10H** on analysis found that there are a total number of 366 More than three authors and the ranking has been placed in detail up to 3 where Eysenck, H.J. et. al. is cited maximum 4 times (1.09%) out of 366 while, Gupta, B. M. et.al., Kadimani, B.S. et.al., Padmamma, S. et.al. and Spink, A. et.al. 3 times (0.81%) each and Balasubraniam, et.al., Belkin, N. et.al., Cambazoglu, B. B, et. al., Coleman, James C. et.al., Chandel, A.S. et.al., Debon.et.al., Dempsey, B. J. et.al., Eng, T. R. et. al., Glose, Marry. B. et. al., Eysenbach, G. et. al., Hawking et. al., Hernandez- Borges, A. A. et. al., Huang, J. et. al., Jansen, B. J. et. al., Kent, et. al., Mehta, V. et. al., Ramaiah, L.S. et. al., Tague, J. et. al. and Warwick, C. et. al. are cited 2 times (0.55%) each and thus, it ranks 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10H, Graph-5H, Page 186-188)**

5.6.2 While analyzing cited author distribution of all documents, Organizations as an author, without author (Links alone) and Unidentified **Table-10I** on analysis found that, with regard to Organizations as an author, there are a total number of 751 citation frequencies and the ranking order has been mentioned in detail up to 4. One organization having 4 citations is cited maximum 4 times (0.53%) while, Three organizations having 3 citations 3 times (0.4%) each is cited and Eleven organization having 2 citations 2 times (0.26%) each is cited. Further analysis of the Table reflected that 716 Organization as an Author having 1 citation each constitute 716 citation frequencies (95.33%) i.e. 0.13% each. Likewise, while discussing without author (Links alone), the table again revealed that 16 links are having 2 citations each with a citation frequency 32 (14.75%) i.e. 0.92% each in total out of 217 followed by 185 links are having 1 citation each (85.25%) i.e. 0.51% each. Further, the analysis for unidentified citations shows that 22% of the total number of authors could not be identified; this 22%, the percentage is calculated from the total number of authors' i.e. 12,707. In Table-10**I**, the unidentified citation is not classified due to difficulties in identification for classification. All unidentified citations are placed in one criterion, and therefore, all citations from unidentified authors cited forms 2870 (100%). (**Chapter-5, Section 5.6, Table-10I, Graph-5I, Page 188-190)**

5.7 While analyzing the **Table-11**, it could be found that, the total number of papers (Documents) is 8869 and the total number of Authors (Documents) is 6898. Likewise, the total number of papers (Journals) is 2876 and the total number of authors (Journal) is 1845. With regard to AAPP of all documents (6898/8869) is 0.78 during 1807-2015 and productivity per author is 1.28% i.e., (8869/6898). Author

Productivity of Journal's Author is calculated and AAPP is 0.64 i.e., (1845/2876) and productivity per author is 1.56 i.e. (2876/1845). (**Chapter-5, Section 5.7, Table-11, Page 190-192)**

5.8 **Table-10E & Graph-5E** already depicts author distribution of Single author of all documents. **Table-12** depicts the top 10 list of Prolific Authors. Observation done with more concentration done on the basis of the Universities of North East India, with special reference to the Department of Library and Information Science, There are three (3) Authors which comes under the top 10 list. **Rank 7th of overall, Pravakar Rath, Professor, Department of Library and Information Science, Mizoram University ranked 1st position** i.e. 13 (0.21%) citations followed by **Rank 8th of overall, Narendra Lahkar, Professor, Department of Library and Information Science, Gauhati University holds 2nd position** i.e. 12 (0.2%) citations and Rank **10th of overall, Manoj Kumar Sinha, Professor, Department of Library and Information Science, Assam University holds 3rd position** i.e. 10 (0.16%) citations. (**Chapter-5, Section 5.8, Table-12, Graph-6, Page 192-194)**

5.9 It was observed that the degree of collaboration in all documents citation is calculated as **0.31** and this shows the prevalence solo research in the field. Besides, the degree of collaboration in journals is calculated as **0.36 (Table-13)** and this shows the prevalence solo research in the field. (**Chapter-5, Section 5.9, Table-13, Page 194-195)**

Objectives-4: Ascertain the obsolescence of literature especially in print domain.

5.16 The analysis of the chronological distributions of the documents placed in **Table-20** shows that, between 1998-2007 there is the highest citation rate i.e. 3776

(44.61%) out of 8464 followed by 1589 citations (18.8%) in between 1988-1997 and 1421 citations (16.8%) during 2008-2015 and thus, keeps 1st, 2nd, 3rd respectively in the ranking order. It is surprising to know that, the number of citations increased from 77 (0.9%) to 213 (2.51%) during 1948-1967 and chronologically, it went on exceeding the number of citations till 2007. Again, it could be pointed out that during the period of 1808-1817, 1828-1837 and 1898-1907 that, there was no citation in the study, which may be due to the fact that either the research output during the period is negligible or the documents are not available in the library or may not be having any research value of the articles either in books or journal. Chronological Distribution of Documents placed in **Table-20** can be assumed that the research importance increases in the light of present trends that are visible from the present study. (**Chapter-5, Section 5.16, Table-20, Graph-13, Page 220-222)**

5.16 The analysis of the chronological distributions of the documents (**Print Domain**) placed in **Table-20A** shows that, between 1998-2007 there is the highest citation rate i.e. 1566 (39.35%) out of 3979 followed by 1031 citations (25.91%) in between 1988-1997 and 469 citations (11.78%) during 1978-1987 and thus, keeps 1st, 2nd, 3rd respectively in the ranking order. It is surprising to know that, the number of citations increased from 60 (1.5%) to 162 (4%) during 1948-1967 and chronologically, it went on exceeding the number of citations till 2007. During the period of 1808-1817, 1828-1837 and 1898-1907 that, there was no citation in the study, which may be due to the fact that the documents are not available for access. Chronological Distribution of Documents (Print Domain) placed in **Table-20A** can be assumed that

the research importance increases in the light of present trends that are visible from the present study. (**Chapter-5, Section 5.16, Table-20A, Graph-13A, Page 223-224)**

Objectives-5: Test the data with Bibliometric laws like Bradford's Law of Scattering, Lotka's Law of Scientific Productivity and Zipf's Law of word occurrence.

Bradford's Law of Scattering

5.18 With regard to application of Bradford's law, the distribution of journals placed in **Table-22 and Table-22A** along with the separate zones in **(Table-22B, Table-22C and Table-22D),** according to the Bradford's predicted zones (on an approximation) are: Zone-1 consists of 11 journals i.e. 936 citations which constitute (32.55%) out of 2876 journals. Zone-2 consists of 26 journals i.e. (33.24%) having 956 citations and Zone-3 consists of 367 journals i.e. (34.21%) having 984 citations and has the highest citations. Taking Bradford's Law of Scattering into account that predicts the increasing productivity of Journals from one zone to the next (in expression 1: n: n^2), the distribution partially complies with Bradford's Law. When 11 = *n*, then 1: *n*: n^4. This does not fit into Bradford's distribution. (**Chapter-5, Section 5.18, Table-22, Table-22A, Graph-15, Table-22B, Graph-15A, Table-22C, Graph-15B, Table-22D, Graph-15C, Page 230-248)**

Lotka's Law of Scientific Productivity

5.17 In the present study, 1845 authors have contributed 2876 articles during the period 1839-2015 as shown in **Table-21**. There are 1361 (47.32%) authors who contributed One (01) article, 278 (19.33%) authors contributed Two (02) articles, 97 (10.12%) authors contributed Three (3) articles, 41 (5.7%) authors contributed Four

(4) articles, 21 (3.65%) authors contributed Five (5) articles, 14 (2.92%) authors contributed Six (6) articles. Further, while 9 (2.19%) contributed Seven (7) articles, the other 9 (2.5%) authors contributed Eight (8) articles and 4 (1.25%) authors contributed 9 articles, 3 (1.04%) and 3 (1.14%) authors each contributed Ten (10) and Eleven (11) articles respectively, 1 (0.42%) 1 (0.45%) and 1 (0.49%) authors each contributed Twelve (12) , Thirteen (13) and Fourteen (14) articles and 2 (1.46%) authors contributed Twenty-one (21) articles. To calculate the value of *n*, data from observed authors is used and is found to be 2.29. It is clear from **Table-21A** that the observed and expected authors are not similar to *n*=2.29 and the difference is 74 numbers of authors. Moreover, the frequency distributions of the author's productivity match the generalized Lotka's Law. (**Chapter-5, Section 5.17, Table-21, Graph-14, Table-21A, Graph-14A, Page 225-230)**

Zipf's Law of word occurrence

5.19 With regard to Zipf's Law of word occurrence based on whole data placed in **Table-23**, the word 'Library' secured 1st position in ranking order with 3409 frequency. The word 'Information' with 2852 frequency, 'Libraries' 1425 frequency, 'New' 1408 frequency followed by 'India' with 1377 frequency, which constitutes 2nd, 3rd, 4th, and 5th in ranking order. (**Chapter-5, Section 5.19, Table-23, Graph-16, Page 249-251)**

5.19 With regard to Zipf's Law (Connection of Word) placed in **Table-23B**, the word 'Of' secured 1st position in ranking order with 115 frequency. The word 'In' with 77 frequency, 'A' 52 frequency, 'And' 50 frequency followed by 'The' with 35

frequency, which constitutes 2nd, 3rd, 4th, and 5th in ranking order respectively. (**Chapter-5, Section 5.19, Table-23B, Graph-16B, Page 253-254)**

5.19 **Table-23A** represents words occurrence of Zipf's law (Based on Theses Title). The word 'Study' secured 1st position in ranking order with 50 frequency. The word 'Libraries' with 35 frequency, 'Library' 30 frequency, 'Information' 28 frequency followed by 'Assam' with 22 frequency, which constitutes 2nd, 3rd, 4th, and 5th in ranking order. (**Chapter-5, Section 5.19, Table-23A, Graph-16A, Page 251-253)**

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CHAPTER 6: CONCLUSION AND SUGGESTION

Chapter Plan

CHAPTER 6
CONCLUSION AND SUGGESTION

6.1 Conclusion

The culmination of one's research contribution to the academic world as a research student is accomplished via the dissertation or thesis. As a result, dissertations or theses were analyzed because they serve as the best representation of the research interests. The bibliographical study of dissertations submitted by Ph.D. scholars, Department of Library and Information Science, in the Universities of North-East India is carried out to better understand the needs of the students and research scholars 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.

The Citation Analysis extends the knowledge about citing behaviour and the characteristics of citations of the scholars. Although the function of citation analysis is much emphasized as a tool for assessing quality 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 assumed that these problems are comparatively diminutive.

Bibliometric studies help researchers to a 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 that has been accomplished in a specific field and where research is still necessitated.

Bibliometric Study of Doctoral Dissertations in Library and Information Science in North East India during 2006-2015 serves as a cutting edge in studying the trends of information patterns within its subject field. The citation analysis statistics give us an idea of how and from, where an information resource are gathered, and provides an insight into the characteristics of the sources of the citations. It has become a viable approach to determine the literature used by the scholar not only in the field of Library and Information Science but also determine the citation behaviour of the scholars of other disciplines. Further, the bibliometric study cannot be confined to any one discipline rather; its domain can be extended on many disciplines. However, there are common problems such as (a) Neglect of standard abbreviation (b) Authors using initials mixed with full names, (c) Field variations of citation amounts or purposes, (d) Fluctuation of influence and (e) 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, and universities.

6.2 Suggestions

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

❶ Due to information deficient, the library requires subscribing to the databases especially including relevant electronic resources to become information-rich to incorporate the data by the scholar for sustainable research.

❷ Citation analysis happens to be a practical tool to determine the need-based collections of the user and accordingly, information-rich the library requires developing the user-centric collection development in print form and substantial electronic resources to support learning and research.

❸ The present study is confined to a specific discipline still than the user needs can be extended to other subjects for strengthening the library with need-based resources.

❹ Bibliographical errors when citing a document such as spelling mistakes of an author, negligence of standard abbreviation, wrong year of publication, wrong titles, wrong journal-title 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 the evaluation of a journal or author's impact factor, therefore care should be taken when citing references.

❺ Further, the library requires in developing the e-journals having a high impact factor for the sustainability of research value.

❻ Other bibliometric techniques and applications of mathematical formula such as Bibliometrics indexing techniques and web application of bibliometrics have not been carried out so far. Future research may be considered in the direction.

6.3 Scope for further research

Bibliometric study visualizes the situation prevails in the institution. The current study used the Ph.D dissertation records from 4 (four) universities of North East India, during 2006-2015. While doing research to complete this thesis, there are many research scholars who have finished their degree from time to time, therefore this type of study in Bibliometrics needs to be carried out in future. The

study can be extends to not only North East Region but also Central and State Universities of all India. Based on the present study, similar studies such as, Website citation studies, author performance, various subjects in Library and Information Science field, Obsolescence of the literature, Place and Publisher of the publication differentiating National and International, core list of Journals in Print and electronic domain, link analysis on the basis of retrieved and manual data and other studies also can be carried out for further research. The editors contribute in the documents in providing the useful information in the volume, which is equally important like author for analysis, is not analyzed in thesis will also be another scope for further research.

APPENDIX 1

A PROFILE VISIT TO 4 UNIVERSITIES

1. ASSAM UNIVERSITY, SILCHAR

(Data Collection time period: 3 days, i.e. 31st August to 2nd September, 2015)

Entrance of Assam University (01.09.2015)

2. GAUHATI UNIVERSITY, GUWAHATI

(Data Collection time period: 1 and Half months, i.e. 15th September to 15th November, 2015. Here, in between these dates, the scholar pays a visit to NEHU and went back to Gauhati University)

Gauhati University Library (22.09.2015)

3. MANIPUR UNIVERSITY, IMPHAL

(Data Collection time period: 10 Days, i.e. 18th November to 28th November, 2015)

Manipur University Library (20.11.2015)

4. NORTH EASTERN HILL UNIVERSITY (NEHU), SHILLONG

(Data collection time period: - 20 Days, i.e. 28th September to 7th October, 2015 & Second Visit 5th September, 2017 to 15th September, 2017)

1st Visit: Deptt. of LIS, NEHU (28.09.2015)

2nd Visit: NEHU Central Library Entrance (05.09.2017)

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EDUCATIONAL QUALIFICATIONS AND AWARD OF FELLOWSHIP

1.	National Fellowship for Higher Education of ST Students (NFST), 2016-17	: Ministry of Tribal Affairs, New Delhi
2.	UGC MZU Fellowship, w.e.f 13.08.2015	: Mizoram University, Aizawl
3.	UGC NET – June, 2015	: UGC, New Delhi
4.	UGC NET – December, 2014	: UGC, New Delhi
5.	Master of Philosophy (M.Phil)	: Mizoram University, Aizawl
6.	Master in Library and Information Science	: Mizoram University, Aizawl
7.	Bachelor of Arts [Hons. (Economics)]	: St. Mary's College, Shillong, Meghalaya
8.	Higher Secondary School Leaving Certificate (HSSLC)	: Mizoram Board of School Education, Mizoram
9.	High School Leaving Certificate (HSLC)	: Mizoram Board of School Education, Mizoram

RESEARCH INTEREST:

1. Bibliometrics
2. Citation Analysis
3. Information Literacy
4. Information Seeking Behaviour
5. Webometrics

(S.LALREMPUII)

LIST OF PUBLICATIONS

Journal Publications

1. Citation Analysis of M.Phil Dissertations in Library and Information Science**.** *Librarian***,** *22*(1), (7-24), 2015. (UGC Approved)

2. Application of Bibliometric Laws in Doctoral Theses of Library and Information Science in the Universities of North East India. *Journal of Indian Library Association, 55*(4), (47-58), October-December 2019.

Conference Publication

1. Research Evaluation of Doctoral Theses in Library and Information Science in Universities of North-East India: A Bibliometric Analysis. In International Conference on **"Bridging the Digital Divide – Role of Libraries & Information Centers with Special reference to North Eastern Region",** 5th -6th of September, 2018, organized by Shillong College Central Library in collaboration with IQAC, Shillong College, Shillong, Meghalaya.

List of Workshop/ Seminar/ Conference attended:-

1. Seminar on "**Revitalization on Academic Libraries in Mizoram: Issues and Challenges"** held on 4th May, 2015 organized by Department of Library & Information Science, Alumni Association, Mizoram University.
2. Short term course on "**Digital Library and e-resource Management"** held on 17th -22nd August, 2015, organized by University Grants Commission, Human Resource Development Centre, Mizoram University.
3. International Conference on "**Library Services in Knowledge Society: Innovative, Value Added Services and Best Practices"** held on 1st – 3rd March, 2017 organized by the Department of Library & Information Science, Mizoram

University, Aizawl in collaboration with NEC, Shillong; IGNCA, New Delhi; ICSSR, New Delhi; RRRLF, Kolkata and INFLIBNET Centre, Ahmedabad.

4. National Workshop-cum-training Program on "**Bibliometrics and Research Output Analysis"** held on 11th – 13th April, 2017 jointly organized by Department of Library and Information Science, Mizoram University, Tanhril, Aizawl and INFLIBNET Centre, Gandhinagar, Gujarat.

PARTICULARS OF THE CANDIDATE

NAME OF THE CANDIDATE	: S. LALREMPUII
DEGREE	: Ph.D
DEPARTMENT	: LIBRARY AND INFORMATION SCIENCE
TITLE OF THE THESIS	: BIBLIOMETRIC STUDY OF DOCTORAL DISSERTATIONS IN LIBRARY AND INFORMATION SCIENCE IN NORTH EAST INDIA DURING 2006-2015
DATE OF ADMISSION	: 19.08.2014
APPROVAL OF THE RESEARCH PROPOSAL	
1. DRC	: 16.04. 2015
2. BOARD OF STUDIES (BOS)	: 08.05.2015
3. SCHOOL BOARD	: 22.05.2015
REGISTRATION NO. & DATE	: MZU/PHD/749 OF 22.05.2015
EXTENSION (IF ANY)	: NO

(HEAD)
DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE
MIZORAM UNIVERSITY, AIZAWL.

1. Introduction

Bibliometrics is a recognized component in Library and Information Science research. It commenced at the beginning, a simple mechanism of counting to assess and quantify the growth of the subject which, however, is being used at present as a major component of various science indicators, assessing of scientific output, selection of journals for the libraries, forecasting the research potential of a particular branch of study and so on. To find out the trends and growth of the literature, Bibliometric studies can be applied to every branch of study. The source for collection of data selection is very significant in such studies that are used to recognize the patterns of publication, authorship, and secondary journal coverage to get an intuition into the growth of knowledge on that topic. This helps in developing the organization of information resources which is essential for effective and efficient use. Bibliometrics is sophisticated as well as complicated and has a national, international, and interdisciplinary character. It is a fast-developing area in information science, which is defined as a discipline that examines critically the properties and behaviour of information.

Bibliometrics is the consequential effect of proliferation of literature due to growth of knowledge, spread of liberal education, innumerable research projects, and emergence of inter-disciplinary subjects, democratization of Knowledge, large number of authors, establishment of good number of academic institutions, development of machine printing and machine-made papers, and Impetus of research that shifted from solo to team.

2. LIS Discipline in North East India- A Brief Approach to PhD Programme.

There are altogether 5 Central Universities, 1 State University and 6 State Private University in North East imparting PhD programme in Library and Information Science (LIS) subject. Table-1 below reveals details of the research outputs of the Department of Library and Information Science of various universities offering Ph.D. programme till 2015.

Table-1: Research Output Status of the Department of Library and Information Science in North East India

Sl. No.	Name of the University	State	Location	Status	DLIS	Year of Estd. of the Dept.	No. of Ph.D. Awarded as on 2015
1.	Apex Professional University	Arunachal Pradesh	Pasighat	State Private	✓	2013	-
2.	Arunachal University of Studies	Arunachal Pradesh	Namsai	State Private	✓	2012	-
3.	Assam University	Assam	Silchar	Central	✓	2009	-
4.	C. M. Jha (CMJ) University	Meghalaya	Jorabat	State Private	✓	2009	-
5.	Gauhati University	Assam	Guwahati	State	✓	1966	39
6.	Manipur University	Manipur	Imphal	Central	✓	1986	17
7.	Mizoram University	Mizoram	Aizawl	Central	✓	2002	12
8.	NEHU	Meghalay	Shillong	Central	✓	1985	15

		a					
9.	North East Frontier Technical University	Arunachal Pradesh	Aalo	State Private	✓	2014	-
10.	Sangai International University	Manipur	Churachandpur	State Private	✓	2015	-
11.	Tripura University	Tripura	Agartala	Central	✓	2016	-
12.	University of Science and Technology Meghalaya	Meghalaya	Ri-Bhoi	State Private	✓	2011	-
Total							**83**

(Source: Survey Data)

3. Significance and Scope of the Study

It is an emerging area to determine the strength and weaknesses of the literature while using the various sources of information by the students, research scholars and the faculties while preparing their assignments, term papers, projects, theses and dissertations including research publications. It involves an evaluation process about the use of literature in the process. This also adds substantial value for the libraries to develop the user-oriented collections and weeding out the passive documents. The libraries in the process are able to project the most wanted literature to its patrons.

The study finds its significance further in the areas pertaining to:

i) Forms of documents used by the scholars,

ii) Authors central to publications,

iii) Year of publication, and

(iv) Place of publication.

Substantial numbers of Bibliometric studies have been carried out both at global and national levels in Social Science in general and Library and Information Science in particular, and the results of such studies have been tested with various Bibliometric laws. This is a sporadic attempt of the scholar to carry out Bibliometrics as a research topic of the Ph.D. theses in Library & Information Science of Universities of North East India as no work has yet been done in this area and as such, this is first of its kind. Further, this will bridge the research gap.

It is almost remanded of its virgin field of research by studying the implication of the three laws, i.e., Lotka's Law, Bradford's Law, and Zipf's Law. The present work is limited to the Ph.D. awarded from 2006 to 2015 by Gauhati University, Manipur University, Mizoram University, and North Eastern Hill University in North East. Mention may be made that, a total number of 83 Ph. D has been awarded by different universities having 12,707 citations, were tabulated into 8 different categories for analysis and the retrieved documents comes to 1,01,656 data which is the total population of the study. As the study is limited to the year 2015, Gauhati University, Manipur University, Mizoram University, and North Eastern Hill University in North East will be covered under study.

The details of the research output leading to Ph.D. in Library and Information Science under different universities from 2006 to 2015 is explicitly discussed year wise in Table-3.

Table-3: Research outputs in Library and Information Science from 2006 to 2015

Sl. No	Name of the Scholar	Title of the Research Topic	Name of the Supervisor	Year	Name of the university
1	A.Takatemsu Imchen	A study of the public library system as community information centers in Nagaland: Realities and challenges	Prof. N. N Sharma	2006	Gauhati University
2	Anu Hazarika	A study on organization and services of libraries in research and training program in financial institutions of North East India	Prof. Narendra Lahkar	2006	Gauhati University
3	Sanjay Kumar Singh	A study of the impact of Information Technology on the effective management of library operations with special reference to Assam	Prof. A Buragohain	2006	Gauhati University
4	Gurumayum Padma Devi	Women Professionals in Libraries: A Case study of Manipur	Dr. R. Lahiri	2006	Manipur University
5	Mukesh Saikia	Time and cost analysis of Technical Services in Indian Libraries	Prof. A.S. Chandel	2006	NEHU
6	Dhrubajit Das	Document description and	Prof. Narendra Lahkar	2007	Gauhati University

		their practices in university libraries in northeast India: A study			
7	Haricharan Das	Reflection of Rural information in leading Newspapers of Assam: A Critical Study	Prof. N. N Sharma	2007	Gauhati University
8	Hemanta Kumar Barman	Feasibility of library software packages for library automation in Higher Educational Institutions of Assam: A critical study	Prof. A Buragohain	2007	Gauhati University
9	A. Alem W. Longchar	Agricultural information communication and adoption of innovative practices in Nagaland a case study of Dimapur district	Dr. Moses M. Naga	2007	NEHU
10	Medalda Challam	Effectiveness of College Libraries: A Case study of Meghalaya	Prof A.S. Chandel	2007	NEHU
11	Neelam Sharma	Job performance evaluation of library personnel in university library system a study of libraries of Chandigarh, Himachal Pradesh, Haryana and Punjab	Prof. A.S. Chandel	2007	NEHU
12	Bibhuti Choudhuri	Information needs and Information-seeking behavior of users in major science and technology libraries of NE region with	Prof. R.K Barman	2008	Gauhati University

		special reference to Assam			
13	Bikika Laloo	Retrieving information on the socio-economic and socio-cultural conditions of northeast India using different internet search engines	Prof. Narendra Lahkar	2008	Gauhati University
14	Md. Mahtab Hussein	Public Libraries in a multicultural society and their role in promoting solid harmony: A critical study with reference to Assam	Prof. N. N Sharma	2008	Gauhati University
15	Mukut Sarma	Prospects of Application of Information Technology in Academic Libraries in Assam	Prof. A Buragohain	2008	Gauhati University
16	Ramvir Singh Yadav	Impact of Academic Libraries in the development of human resources: with special reference to Arunachal Pradesh and Nagaland (colleges and Universities) 1971 to 1999	Prof. A Buragohain	2008	Gauhati University
17	Smiriti Rekha Baruah	A Critical study of the growth of Tea Literature with special reference to India from 1970-2002	Prof. A Buragohain	2008	Gauhati University
18	Arambam Birajit Singh	Knowledge retrieval methods of Libraries: A study of Manipur	Dr. Th. Madhuri Devi	2008	Manipur University
19	Lairenlakpam	Community	Dr. Th.	2008	Manipur

	Shanta Meitei	Information Needs in Rural Manipur	Purnima Devi		University
20	Rajkumar Joteen Singh	The Information and Library Network Programme: A Case Study of Manipur	Dr. Th. Madhuri Devi	2008	Manipur University
21	R.K.Ngurtinkhuma	An Assessment of the Role of State and District Libraries for the Socio-Cultural and Educational Development of Mizoram	Prof. Pravakar Rath	2008	Mizoram University
22	George P.V Plathottam	Press and its social responsibility in Northeast India a content analysis	Dr.P. Hangsing, Prof. A.S. Chandel	2008	NEHU
23	Lalremsiami	Role of village Libraries in development: A case study in Mizoram	Dr.P. Hangsing, Prof A.S. Chandel, Joint Supervisor	2008	NEHU
24	Mary A.F.	Television as a medium of information for social change: A study of Meghalaya	Dr.P.Hangsing, Prof A.S. Chandel, Joint Supervisor	2008	NEHU
25	Gyandeep Saikia	Impact of user education on academic libraries in Assam: A study on strategic management of resources and services	Prof. R.K Barman	2009	Gauhati University
26	Nabajyoti Das	Deviance in Academic Libraries: A sociological Study with reference to Assam	Prof. N. N Sharma	2009	Gauhati University
27	S. Kannan	The public library system in Bhutan: A systematic approach	Prof. Narendra Lahkar	2009	Gauhati University

		for future developments			
28	Sanjib Kumar Deka	Search engines and their search performance in retrieving internet resources: An evaluative study	Prof. Narendra Lahkar	2009	Gauhati University
29	Sarita Bhattacharjee	Information seeking behaviour of degree students of general colleges of Barak valley	Prof. N. N Sharma	2009	Gauhati University
30	Chanambam Tanuja Devi	Library Economics in Manipur	Dr. Th. Madhuri Devi	2009	Manipur University
31	Laishram Nandakumar Singh	Sports Information System of Manipur: A Critical Analysis	Dr. Th. Khomdon Singh	2009	Manipur University
32	Sanjeev	Strategic Developmental Plan for Adoption of Information and Communication Technology (ICT) in the College Libraries of Mizoram	Prof. Pravakar Rath	2009	Mizoram University
33	M. Maltesh	Digitization of Buddhist Manuscripts in Arunachal Pradesh	Prof. Narendra Lahkar	2010	Gauhati University
34	Sumana Chakrabarty	Use of Internet Services in the University Libraries of Assam: An Evaluative Study	Prof. A Buragohain	2010	Gauhati University
35	Akhilesh Kumar Singh Yadav	A Study of Curriculum Requirements towards improving IT Skills of Library Professionals	Dr. S.N.Singh	2010	Mizoram University
36	Ajay Kumar	Use of Information Sources by Social Scientists: A Comparative Study of Banaras Hindu	Dr. S.N.Singh	2010	Mizoram University

		University and Mizoram University.			
37	Lalngaizuali	Library and Information Science Education in North East Region: A Critical Study	Prof. Pravakar Rath	2010	Mizoram University
38	Kishor Sarma	Prospects of Library Marketing in North East India: a study	Prof. Narendra Lahkar	2011	Gauhati University
39	Arambam Hileima Devi	A comparative study of staff management in different types of Libraries in Manipur	Dr. Th. Purnima Devi	2011	Manipur University
40	Naorem Vidyavati Devi	Information seeking behavior of Political leaders in Manipur	Dr. Th. Madhuri Devi	2011	Manipur University
41	Lalbiaksanga Hnamte	An Assessment of the Services of College Libraries in the Context of Changing Information Scenario with Special Reference to Mizoram.	Dr. R.N.Mishra	2011	Mizoram University
42	S. Ravi Kumar	Women's Health Information based on Web Resources: An Analysis	Dr. S.N.Singh	2011	Mizoram University
43	Badan Barman	Web Resources in Library and Information Science: a Managerial Approach	Prof. Narendra Lahkar	2012	Gauhati University
44	Dipen Deka	Digital resources management with reference to Indian university libraries	Prof. Narendra Lahkar	2012	Gauhati University
45	Niraj Barua	Prospects of human resource development in the libraries of	Prof. R.K Barman	2012	Gauhati University

		institutions of higher education in North East India with special reference to library automation a critical study			
46	Sanatan Deka	The working and functioning of the Assam Legislative Assembly Library and its use and impact on legislators and administrators: A critical study	Prof. N.N Sharma	2012	Gauhati University
47	Shashilemla Ao	A study on Growth and Development of Literature in Naga Languages	Prof. Narendra Lahkar	2012	Gauhati University
48	Utpal Sarma	Information needs and information-seeking behaviour of urban community and its satisfaction by the public library system	Prof. A Buragohain	2012	Gauhati University
49	Salam Chanu Veenapani	Growth and Development of Libraries in Manipur: A Critical study	Dr. Th. Khomdon Singh	2012	Manipur University
50	Sarangthem Bembem	Information seeking Behavior in Digital Environment: A study of the social scientist of Manipur	Dr. Ch. Ibohal Singh	2012	Manipur University
51	C Lawmzuala	A Study of an Integrated Library Network and Consortium of Central University Libraries in the North East Region	Dr. R.N.Mishra	2012	Mizoram University

52	Mazeal Ampareen Lyngdoh	Influence of media on Public opinion during the period of Social interest: A study of Meghalaya	Dr. Moses M. Naga, Dr. P. Hangsing	2012	NEHU
53	Sanjoy Kumar Barman	Audio-Visual Materials and their Management and Preservation in Television Media Organisations: A Case Study of the Library of Guwahati Doordarshan Kendra.	Prof. A Buragohain	2013	Gauhati University
54	Tarini Goswami	Growth of research output in science and technology institutes in Assam and the role of libraries	Prof. Narendra Lahkar	2013	Gauhati University
55	Utpal Das	A critical study of preservation techniques for Sanchi manuscripts of Assam	Prof. A Buragohain	2013	Gauhati University
56	Lallaisangzuali	A Study on Use of Electronic Resources for Teaching and Research by Faculty Members of Mizoram University	Prof. Pravakar Rath	2013	Mizoram University
57	Lalthanmawii Sailo	Human Resource Development of Central University Libraries in the North East Region: A Study of North-Eastern Hill University (NEHU), Assam University (AU) and Mizoram University (MZU)	Prof. Pravakar Rath	2013	Mizoram University
58	Maya Moyee	Information	Prof. Pravakar	2013	Mizoram

	Narzary	Literacy for College Libraries with Special Reference to Lower Assam: A Study	Rath		University
59	Rupali Goswami	Information system for Credit Development in Indian Commercial Banks: A case study	Prof. Moses M. Naga, Prof. N.M. Panda, Joint Supervisor	2013	NEHU
60	Amal Kumar Mondal	Citation pattern of doctoral dissertations in physics submitted to the Gauhati university Guwahati 1993 2000	Prof. R.K Barman	2014	Gauhati University
61	Apurba Jyoti Majumder	Use of web-based resources in engineering college libraries of Assam: An empirical study	Prof. Narendra Lahkar	2014	Gauhati University
62	Bhupendra Nath Samra	Collection development in the libraries of technical institutions in Assam: A study in the context of emerging ICT	Prof. R.K Barman	2014	Gauhati University
63	Gouri Sankar Karmakar	Use of online resources among research scholars in social sciences in university libraries of Assam	Prof. Narendra Lahkar	2014	Gauhati University
64	Pallavi Gogoi	Documentation of Information resources in Women's studies centers of India with reference to North-East India	Prof. N.N Sharma	2014	Gauhati University
65	Ranjanjyoti Sarmah	The role of Library Professionals for effective use of	Prof. N.N Sharma	2014	Gauhati University

		library resources in the present context: A study with reference to the university libraries of Assam			
66	Ayekpam Ithoi Devi	Role of Personal Collections in promoting Intellectual Heritage in Manipur	Dr. Th. Madhuri Devi	2014	Manipur University
67	Bobby Phuritsabam	Library and Information Science Education in Indian Universities	Prof. Th. Purnima Devi	2014	Manipur University
68	Khwairakpam Babita Devi	Influence of Multimedia Technology on Reading Habit in Manipur	Dr. Ch. Ibohal Singh	2014	Manipur University
69	Khwairakpam Surachand Singh	Collection Development: An analytical study of the Academic Libraries in Manipur	Prof. Th. Purnima Devi	2014	Manipur University
70	Lamkhogen Vaiphei	Problems and Prospects of Library Automation in Manipur	Dr. Ch. Ibohal Singh	2014	Manipur University
71	Memori Sagolsem	Knowledge Commission and Public Library Network: A study of Manipur State	Prof. Th. Purnima Devi	2014	Manipur University
72	Zomuana Joute	Resource Generation and Mobilization in College Libraries in Mizoram	Prof. Pravakar Rath	2014	Mizoram University
73	Bobby Goswami Baruah	The relevance of library and information science education in the Indian job market: A study of Indian universities and	Dr. P. Hangsing	2014	NEHU

		corporate libraries			
74	Jacqueline Jeane Thabah	Structuring Competency Model for Library Professionals	Dr.P. Hangsing	2014	NEHU
75	Mangkhollen Singson	Pricing models and usage of e-journal in a consortia environment: A case study of UGC Infonet	Dr. P. Hangsing	2014	NEHU
76	Manoj Rana	Personality traits and job satisfaction: A study of Library Professionals of North- East India	Dr. Moses M. Naga	2014	NEHU
77	Dalimi Devi	Library services in medical and paramedical colleges in Assam analytical study	Prof. N. N Sharma	2015	Gauhati University
78	Nirmal Ranjan Mazumdar	Management of Manuscript collection in Assam in Digital Era: A practical approach using ICT tools	S.K Singh	2015	Gauhati University
79	Prasanta Kumar Deka	Prospects of Coordinating Sarba Shiksha Abhijan and rural libraries for social development in Assam with special reference to Kamrup District	Prof. N. N Sharma	2015	Gauhati University
80	Zabeen Ahmed	LIS education in the Universities of India: A study on the course contents with reference to universities of NE India	Prof. Narendra Lahkar	2015	Gauhati University
81	Sangrang Brahma	Problems and Prospects of Library	Dr. Ch. Ibohal Singh	2015	Manipur University

		Automation in Bodoland Territorial Council Area, Assam			
82	Firstborn Roy Sumer	A comparative study of the standards of selected open Sources Digital Library Software	Dr.P. Hangsing	2015	NEHU
83	Pansngiat Passah	Participation of Library Professionals in Professional Development Activities from 2000 to 2010: A comparative study of the University and IIT Libraries in India	Dr.Bikika Laloo	2015	NEHU

(*Source: Survey Data)*

4. Research design

4.1 Statement of the problem

Citation analysis of dissertations and ranking of journals is useful in determining information sources that are vital for students, research scholars, faculties and the library as well in a given subject area. It also helps the library in judicious budget planning for collection of user-centric resources in a crucial budget constraint. This is an intermittent attempt by the scholar to come up with a solution to the ever-increasing literature used by the scholars in library and information science pursuing Ph.D. The problems associated with the present study are mentioned below:

⇨ Inappropriate use of Bibliometric indices in the bibliography.

⇨ Unscientific arrangement of bibliography in the theses.

- ⇨ Absence of approved style manual.
- ⇨ Inappropriate documenting of bibliography components like author, year, place, publisher, etc.

4.2 Objectives of the study

The objectives of the present study are to:

1. Find out the core list and ranking of journals both print and electronic central to Library and Information Science.
2. Preparing link analysis of the cited electronic journals used by the scholars in their dissertations after confirmation through Web of Science, Scopus and Google Scholar databases.
3. Recognize the core authors and/or group of authors in the Library and Information Science.
4. Ascertain the obsolescence of literature especially in the print domain.
5. Taste the data with Bibliometric laws like Bradford's Law of Scattering, Lotka's Law of Scientific Productivity and Zipf's Law of word occurrence.

4.3 Research Methodology

Data relating to the present study has been collected from a total number of 83 Ph.D. theses during 2006-2015 from the Department of Library and Information Science of 4 Universities (both state and central) of North East India namely, Gauhati University, Manipur University, Mizoram University, and North Eastern Hill University. Other Universities are left out on account of the theses submitted is not available with regard to the period of the study. The bibliographical references cited at the end of each thesis have been taken as the source of data for the study. The present study contains a total sample size of 12707

citations out of 83 Ph.D. theses. The scholar has taken appropriate measures in photocopying all references (bibliographies) appended at the end of each thesis covered under study and were recorded in the card catalogue measuring 3”x5” for scientific arrangement. The data comprising both print and electronic were scientifically analysed with regard to (i) Forms of documents/literatures such as, Books, Journals, Reports, Conference Proceedings, and Newspapers etc. (ii) Authorship pattern, (iii) Name of the publisher, and (iv) Place of publication of the documents/literatures. Supplemented with graphical representation, the data for each component was tabulated for analysis to draw the inferences. Apart from this, other results were derived which include a) authors central to the publication, b) most preferred form of documents, c) core literature on the subject, d) obsolescence of literature, etc. Further, the data were tested to confirm the various Laws of Bibliometrics such as Lotka’s Law of Productivity, Bradford’s Law of Scattering of Journals and Zipf’s Law of Word Occurrence. The scholar adopts suitable statistical technique to analyze the data to draw inferences.

5. Chapter Organization

The present study has divided into the following chapters:

Chapter 1:- Introduction

It introduces LIS Discipline in North East, India, Early approaches to Bibliometrics, Historical Perspectives of Bibliometrics, Laws of Bibliometrics, Bibliometric Indicator, Citation database and commonly used indexing techniques, Database, Journal Citation Reports (JCR), Types of Bibliometrics, Web application of

Bibliometrics, Significance and Scope of the study, Review of Literature and Research Design of the study.

Chapter 2:- Library and Information Science (LIS) Research

It deliberated on Meaning of Research, LIS Education and Research –International, National and North East Region (NER).

Chapter 3:- Citation Analysis: Concepts

It described on Historical Development of Citation Analysis, Needs, Scope and Purpose and Importance of Citation Analysis, Key Citation Indexes, Citation Procedures, A range of other measures which complement the impact factor, List of tools for conducting Citation Analysis, Bibliometrics, Scientometrics and Web-Based Metrics.

Chapter 4:- Bibliometric Laws and Indexing

It focuses on Theoretical outlook of Bibliometric laws, Bibliometric Indicator, Major components of ISI published Indexes, Commonly used Indexing techniques.

Chapter 5:- Data Analysis and Findings

It emphasizes Establishment of the Department of Library and Information Science in North East India and Research output, Year-wise Research, Cited forms of Documents, Authorship Pattern, Authors Distribution, Author Productivity, Top 10 List of Prolific Authors from all citations, Degree of Collaboration: Single Vs. Multiple Authors, Bibliographical References used in Ph.D. Theses Summary & Average Citation per Thesis, Citation of Website, Website Citation Frequencies, Categorization of Journals, Cited Articles from Journals, Ranking of Journals,

Chronological distribution of Documents, Application of Lotka's Law of Scientific productivity, Application of Bradford's Law of Scattering, Application of Zipf's Law of Word Occurrence, Link Analysis, Subject-wise distribution of documents, Categorization of Places, Ranking of top cited places, Ranking of Publishers and Findings.

Chapter 6:- Conclusions & Suggestion

It presents a summary of the entire study and suggestions for improvement in collection development to support learning and research in the field of Library & Information Science.

At the end, the scholar has submitted a comprehensive list of bibliography arranged according APA style manual.

6. Findings of The Study

Objectives-1: Find out the core list and ranking of journals both print and electronic central to Library and Information Science.

5.13 Categorization of Journals placed in **Table-17** after analysis reflects that there are 343 international (84.9%) journals and national journals 61 (15.1%). Further, out of 2876 citations in total from both the types of journals, 1874 citations (65.16%) are having International status while, 1002 citations are having national status which constitute 34.84%. This visualizes that, the scholars are more prone to cite the journals emanated from outside rather home. This is primarily due to the availability of international journals through consortia in the libraries. (**Chapter-5, Section 5.13, Table-17, Graph-10, Page 184-185)**

5.14 With regard to cited articles from the journals placed in **Table-18** reflects that the highly cited rate is 135 times (4.7%), followed by 111 times (3.86%) and 97 times (3.37%) which constitute 1st, 2nd and 3rd in ranking order. Further, 91 times (3.16%), 84 times (2.92%), 82 times (2.85%), 75 times (2.61%) 68 for 2 journals (2.37%) each, 66 times (2.3%), and 59 times (2.05%). The scholars also have cited 393 journals of 1940 times' altogether has been placed and analyzed, which shows the importance of the research articles of the journals. (**Chapter-5, Section 5.14, Table-18, Graph-11, Page 185-187)**

5.15 While analyzing the ranking of journals placed in **Table-19** it was observed that, out of a total number of 2876 citations from 404 journals as already discussed (**Table-17**) while, ILA Bulletin stands at the apex for having been maximum 135 (4.7%) citations and thus keeps 1st position in the ranking order, DESIDOC Journal of library and information technology is at the 2nd position in the ranking order for having 111 citations (3.86%) and Annals of Library & Information Studies (Annals of Library Science & Documentation) in the 3rd position for having 97 citations (3.37%). (**Chapter-5, Section 5.15, Table-19, Graph-12, Page 188-195)**

5.15 The top 10 rankings of International Journals placed in **Table-19A** and the top 10 rankings of National Journals placed in **Table-19B**, it could be found out that, the national journal status is high as compared to international journals. This is due to the fact that the scholars have cited a maximum of 68 (2.36%) citations the international journals, while they have cited maximum 135 (4.7%) citations national journals. Besides, the number of Journals, the number of citation

frequency and the number of percentage, International Journal leads in the three (3) criteria. Out of top 10, in the overall ranking, 8 numbers of journals are the National including one International journal in the ranking order of 8. The other 2 number of Journals out of top 10 are the international. This visualized that, the scholar gets an easy access to national journal compared to International Journals. This also coupled with constraints by the international journals in getting the articles through open source. (**Chapter-5, Section 5.15, Table-19A, Graph-12A, Table-19B, Graph-12B, Page 195-198)**

5.15 While analyzing both **Table-19C** and **Table-19D** showing the top 5 journals of both print and electronic above respectively it was deduced that, compared to electronic journals, larger number of citation frequency goes to Printed Journals namely, ILA Bulletin 135 (4.7%) citations out of 2876 and thus occupy 1st in ranking order while, DESIDOC Journal of Library and Information Technology 111 (3.86%) citations in 2nd ranking order followed by Annals of Library and Information Studies 97 (3.37%) citations in 3rd rank. The top 5 electronic journals in the ranking order however, comprise the Electronic Library in rank order 1 for having been cited 59 (2.05%) citations followed by ASLIB Proceedings 49 (1.7%) citations in ranking order 2 (Overall ranking No.14), Library & Archival Security 44 (1.53%) citations in ranking order 3 (Overall ranking No.15). It can be assumed that Printed Journals are having more citation frequency comparing to Electronic Journals. The reason behind this is that Printed Journals are reader-friendly and easy-accessible and comfortable for being subscribed by the libraries under survey

as compared to Electronic Journals. (**Chapter-5, Section 5.15, Table-19C, Graph-12C, Table-19D, Graph-12D, Page 198-201)**

Objectives-2: Preparing link analysis of the cited electronic journals used by the scholars in their dissertations after confirmation through Web of Science, Scopus and Google Scholar databases.

5.20 While analyzing the Link analysis placed in **Table-24** it is found that the total number of all journal articles after verification with the three databases reached 82 where coding is given according to the serial number. Further, the individual analysis of the databases placed on the table revealed that, the availability of major chunk of articles i.e, 80 (97.56%) out of 82 are from Google Scholar databases while, it is 68 (82.92%) out of 82 in Scopus and 19 (23.17%) out of 82 in Web of Science databases and thus, Google Scholar, Scopus, and Web of Science occupy 1st, 2^{nd,} and 3rd in ranking order respectively. The journal articles which are commonly available in all three databases namely Google Scholar, Scopus, and Web of science are 16. There are 53 Journals which appeared in two databases. However, the combination of two databases differs from one another. The combination of Google Scholar and Scopus databases includes 50 Journal's Articles. The combination of Google Scholar and Web of Science databases includes 3 Journal's Article. There is no combination of Scopus and Web of Science databases alone. The availability of Journal's Article in one database alone includes 13 in total, where Google Scholar database have11 articles and Scopus database alone has 2 articles. It is surprising to know that the availability of Journal's article alone in Web of Science Databases remains zero. A graphical

representation in Graph- 16 has been shown to get a clear picture of the link analysis. (**Chapter-5, Section 5.20, Table-24, Graph-17, Page 231-242)**

Objectives-3: Recognize the core authors and/or group of authors in Library and Information Science.

5.5 While analyzing the data placed in **Table-9** of the authorship pattern of journal's article, it was revealed that the contribution of articles by a Single author is significantly more which comes to 1846 (64.2%) out of 2876 followed by Two (Joint) authors 779 which forms 27.08% and 169 by three authors that constitute 5.87%. The analysis, further revealed that, among 8 groups, single author, Two (joint) authors, and three authors rank First, Second and Third position respectively while four authors, five authors, six authors, seven authors and more than seven authors are insignificant. This may be due to the fact that the contribution of article by many authors is difficult. (**Chapter-5, Section 5.5, Table-9, Graph-4, Page 141-142)**

5.5 While analyzing the authorship pattern placed in **Table-9A**, it was revealed that the contribution of documents by a Single author is significantly more which comes to 6073 (48%) out of 12707 followed by Two (Joint) authors 2056 which forms 16%, 751 number of organizations as an authors that constitute 6%. The analysis further revealed that, among 6 groups, single author, Two (joint) authors, and organizations as an author rank First, Second and Third position respectively while three authors and more than three authors and without author (links alone) are insignificant. This may be due to the fact that the contribution of

documents by many authors is lacking in bringing out their research publications. (**Chapter-5, Section 5.5, Table-9A, Graph-4A, Page 142-144)**

5.6.1 While analyzing the cited author distribution with special reference to Journal's Article placed in **Table-10** revealed that there are a total number of 1846 single authors and in the ranking order placed in detail up to 10, the authors Danny Sullivan and T.D. Wilson is cited maximum number of times i.e. 21 times (1.14%) out of 1846 followed by P.B. Mangla 14 times (0.76%) and Maurice B. Line 13 (0.7%) and thus, they are placed 1st, 2nd and 3rd in the ranking order respectively. The author's citation depends upon the research output of the authors where the scholars access concerning their research work. (**Chapter-5, Section 5.6, Table-10, Graph-5, Page 144-147)**

5.6.1 The analysis of cited author distribution with special reference to Journal's Article of Two Authors, **Table-10A** unveils that there are a total number of 779 Two authors and the ranking has been mentioned in detail up to 5 where Karisidappa, C.R and (Second author) is cited maximum 11 times (1.41%) out of 779 followed by Kannappanavar, B. U. and (Second author) 10 times (1.28%) and Barman R.K and (Second author), Dutta, B. and (Second author), and Mahapatra, R.K. and (Second author) 7 times (0.9%) each and thus, they rank 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10A, Graph-5A, Page 148-151)**

5.6.1 The analysis of cited author distribution with special reference to Journal's Article of Three Authors, **Table-10B** disclosed that, there are a total number of 169 Three authors and the ranking has been mentioned in detail up to 3 where Rehman, S. (Second and Third author) is cited maximum 4 times (2.37%) while, Ford, N.

(Second and Third author), Jansen, B. J. (Second and Third author), Nicholas, D. (Second and Third author), Satpathy, S.K. (Second and Third author), Singh, R. K. J. (Second and Third author), Veenapani, S. (Second and Third author), are cited 3 times (1.77%) each and Abdullahi, I. (Second and Third author), Belcher, M. (Second and Third author), Curry, A. (Second and Third author), Gupta, B.M. (Second and Third author), Karmakar, G. S. (Second and Third author), Khoo, C. (Second and Third author), Mokhtar, I.A. (Second and Third author), Murthy, T.A.V. (Second and Third author), Singh, A. P. (Second and Third author), Tahir, M. (Second and Third author) and Worrall, J.J. (Second and Third author) are cited 2 times (1.18%) each. Thus, it ranks 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10B, Graph-5B, Page 151-154)**

5.6.1 With regard to cited author distribution with special reference to Journal's Article of Four Authors, placed in **Table-10C** reveals that there are a total number of 46 four authors and the ranking has been mention in detail up to 2 where Kadimani, B.S. (With 1st, 2nd & 3rd Author) 3 times (6.52%) ranked 1st position followed by Dempsey, B. J. (With 1st, 2nd & 3rd Author), Gupta, B. M. (With 1st, 2nd & 3rd Author), Huang, J. (With 1st, 2nd & 3rd Author), Mehta, V. (With 1st, 2nd & 3rd Author), Spink, A. (With 1st, 2nd & 3rd Author) and Warwick, C. (With 1st, 2nd & 3rd Author) 2 times each (4.35%) and thus secured 2nd position respectively. Besides, there are 31 Four Authors having one citation frequency each i.e. 31 [67.39% (2.17%each)]. (**Chapter-5, Section 5.6, Table-10C, Graph-5C, Page 154-155)**

5.6.1 The analysis of cited author distribution with special reference to Journal's Article **Table-10D** brings out that, with regard to five authors, there are 17 different

Five authors combine i.e. 17 citation frequencies which is placed in one criterion 100% (5.88% each). There are 8 different Six authors combine i.e. 8 citation frequencies which is placed in one criterion 100% (12.5% each). There are 4 different Seven authors combine i.e. 4 citation frequencies which is placed in one criterion 100% (25% each). Likewise, there are 7 different 7+ (more than seven) authors combine i.e. 7 citation frequencies which is placed in one criterion 100% (14.28% each). (**Chapter-5, Section 5.6, Table-10D, Graph-5D, Page 155-157)**

5.6.2 While analyzing the cited author distribution of all documents, Single Author, placed in **Table-10E** revealed that there are a total number of 6073 single authors and in the ranking order placed in detail up to 14, the author Krishan Kumar is cited maximum number of times i.e. 39 times (0.64%) out of 6073 followed by P.S.G Kumar 28 times (0.46%) and S.R Ranganathan 26 (0.43%) and thus, they are placed 1st, 2nd and 3rd in the ranking order respectively. The author's citation depends upon the research output of the authors where the scholars access concerning their research work. (**Chapter-5, Section 5.6, Table-10E, Graph-5E, Page 157-162)**

5.6.2 The analysis of cited author distribution of all documents, Two Authors of **Table-10F** unveils that there are a total number of 2056 Two authors and the ranking has been mentioned in detail up to 7 where Karisidappa, C.R and (Second author) is cited maximum 12 times (0.58%) out of 2056 followed by Kannappanavar, B. U. and (Second author) 10 times (0.5%) and Chowdhury, G.G. and (Second author) 9 times (0.44%) and thus, they rank 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10F, Graph-5F, Page 162-166)**

5.6.2 The analysis of cited author distribution of all documents, Three Authors of **Table-10G** disclosed that, there are a total number of 374 Three authors and the ranking has been mentioned in detail up to 3 where Rehman, S. (Second and Third author) is cited maximum 4 times (1.07%) while, Ford, N. (Second and Third author), Jansen, B. J. (Second and Third author), Nicholas, D. (Second and Third author), Satpathy, S.K. (Second and Third author), Singh, R. K. J. (Second and Third author), and Veenapani, S. (Second and Third author) are cited 3 times (0.8%) each and Abdullahi, I. (Second and Third author), Bavakutty, M. (Second and Third author), Belcher, M. (Second and Third author), Cohn, J. M. (Second and Third author), Coulter, A. (Second and Third author), Curry, A. (Second and Third author), Gupta, B.M. (Second and Third author), Karmakar, G. S. (Second and Third author), Khoo, C. (Second and Third author), Mokhtar, I.A. (Second and Third author), Murthy, T.A.V. (Second and Third author), Singh, A. P. (Second and Third author), Tahir, M. (Second and Third author) and Worrall, J.J. (Second and Third author) are cited 2 times (0.53%) each. Thus, it ranks 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10G, Graph-5G, Page 166-169)**

5.6.2 **C**ited author distribution of all documents, More than three Authors of **Table-10H** on analysis found that there are a total number of 366 More than three authors and the ranking has been placed in detail up to 3 where Eysenck, H.J. et. al. is cited maximum 4 times (1.09%) out of 366 while, Gupta, B. M. et.al., Kadimani, B.S. et.al., Padmamma, S. et.al. and Spink, A. et.al. 3 times (0.81%) each and Balasubraniam, et.al., Belkin, N. et.al., Cambazoglu, B. B, et. al., Coleman, James C. et.al., Chandel, A.S. et.al., Debon.et.al., Dempsey, B. J. et.al., Eng, T. R. et. al.,

Glose, Marry. B. et. al., Eysenbach, G. et. al., Hawking et. al., Hernandez- Borges, A. A. et. al., Huang, J. et. al., Jansen, B. J. et. al., Kent, et. al., Mehta, V. et. al., Ramaiah, L.S. et. al., Tague, J. et. al. and Warwick, C. et. al. are cited 2 times (0.55%) each and thus, it ranks 1st, 2nd, and 3rd respectively. (**Chapter-5, Section 5.6, Table-10H, Graph-5H, Page 169-171)**

5.6.2 While analyzing cited author distribution of all documents, Organizations as an author, without author (Links alone) and Unidentified **Table-10I** on analysis found that, with regard to Organizations as an author, there are a total number of 751 citation frequencies and the ranking order has been mentioned in detail up to 4. One organization having 4 citations is cited maximum 4 times (0.53%) while, Three organizations having 3 citations 3 times (0.4%) each is cited and Eleven organization having 2 citations 2 times (0.26%) each is cited. Further analysis of the Table reflected that 716 Organization as an Author having 1 citation each constitute 716 citation frequencies (95.33%) i.e. 0.13% each. Likewise, while discussing without author (Links alone), the table again revealed that 16 links are having 2 citations each with a citation frequency 32 (14.75%) i.e. 0.92% each in total out of 217 followed by 185 links are having 1 citation each (85.25%) i.e. 0.51% each. Further, the analysis for unidentified citations shows that 22% of the total number of authors could not be identified; this 22%, the percentage is calculated from the total number of authors' i.e. 12,707. In Table-10**I**, the unidentified citation is not classified due to difficulties in identification for classification. All unidentified citations are placed in one criterion, and therefore,

all citations from unidentified authors cited forms 2870 (100%). (**Chapter-5, Section 5.6, Table-10I, Graph-5I, Page 171-173)**

5.7 While analyzing the **Table-11**, it could be found that, the total number of papers (Documents) is 8869 and the total number of Authors (Documents) is 6898. Likewise, the total number of papers (Journals) is 2876 and the total number of authors (Journal) is 1845. With regard to AAPP of all documents (6898/8869) is 0.78 during 1807-2015 and productivity per author is 1.28% i.e., (8869/6898). Author Productivity of Journal's Author is calculated and AAPP is 0.64 i.e., (1845/2876) and productivity per author is 1.56 i.e. (2876/1845). (**Chapter-5, Section 5.7, Table-11, Page 173-174)**

5.8 **Table-10E & Graph-5E** already depicts author distribution of Single author of all documents. **Table-12** depicts the top 10 list of Prolific Authors. Observation done with more concentration done on the basis of the Universities of North East India, with special reference to the Department of Library and Information Science, There are three (3) Authors which comes under the top 10 list. **Rank 7th of overall, Pravakar Rath, Professor, Department of Library and Information Science, Mizoram University ranked 1st position** i.e. 13 (0.21%) citations followed by **Rank 8th of overall, Narendra Lahkar, Professor, Department of Library and Information Science, Gauhati University holds 2nd position** i.e. 12 (0.2%) citations and Rank **10th of overall, Manoj Kumar Sinha, Professor, Department of Library and Information Science, Assam University holds 3rd position** i.e. 10 (0.16%) citations. (**Chapter-5, Section 5.8, Table-12, Graph-6, Page 174-176)**

5.9 It was observed that the degree of collaboration in all documents citation is calculated as **0.31** and this shows the prevalence solo research in the field. Besides, the degree of collaboration in journals is calculated as **0.36 (Table-13)** and this shows the prevalence solo research in the field. (**Chapter-5, Section 5.9, Table-13, Page 177-178)**

Objectives-4: Ascertain the obsolescence of literature especially in print domain.

5.16 The analysis of the chronological distributions of the documents placed in **Table-20** shows that, between 1998-2007 there is the highest citation rate i.e. 3776 (44.61%) out of 8464 followed by 1589 citations (18.8%) in between 1988-1997 and 1421 citations (16.8%) during 2008-2015 and thus, keeps 1st, 2nd, 3rd respectively in the ranking order. It is surprising to know that, the number of citations increased from 77 (0.9%) to 213 (2.51%) during 1948-1967 and chronologically, it went on exceeding the number of citations till 2007. Again, it could be pointed out that during the period of 1808-1817, 1828-1837 and 1898-1907 that, there was no citation in the study, which may be due to the fact that either the research output during the period is negligible or the documents are not available in the library or may not be having any research value of the articles either in books or journal. Chronological Distribution of Documents placed in **Table-20** can be assumed that the research importance increases in the light of present trends that are visible from the present study. (**Chapter-5, Section 5.16, Table-20, Graph-13, Page 201-203)**

5.16 The analysis of the chronological distributions of the documents (**Print Domain**) placed in **Table-20A** shows that, between 1998-2007 there is the

highest citation rate i.e. 1566 (39.35%) out of 3979 followed by 1031 citations (25.91%) in between 1988-1997 and 469 citations (11.78%) during 1978-1987 and thus, keeps 1st, 2nd, 3rd respectively in the ranking order. It is surprising to know that, the number of citations increased from 60 (1.5%) to 162 (4%) during 1948-1967 and chronologically, it went on exceeding the number of citations till 2007. During the period of 1808-1817, 1828-1837 and 1898-1907 that, there was no citation in the study, which may be due to the fact that the documents are not available for access. Chronological Distribution of Documents (Print Domain) placed in **Table-20A** can be assumed that the research importance increases in the light of present trends that are visible from the present study. (**Chapter-5, Section 5.16, Table-20A, Graph-13A, Page 203-204)**

Objectives-5: Test the data with Bibliometric laws like Bradford's Law of Scattering, Lotka's Law of Scientific Productivity and Zipf's Law of word occurrence.

Bradford's Law of Scattering

5.18 With regard to application of Bradford's law, the distribution of journals placed in **Table-22 and Table-22A** along with the separate zones in **(Table-22B, Table-22C and Table-22D),** according to the Bradford's predicted zones (on an approximation) are: Zone-1 consists of 11 journals i.e. 936 citations which constitute (32.55%) out of 2876 journals. Zone-2 consists of 26 journals i.e. (33.24%) having 956 citations and Zone-3 consists of 367 journals i.e. (34.21%) having 984 citations and has the highest citations. Taking Bradford's Law of Scattering into account that predicts the increasing productivity of Journals from

one zone to the next (in expression 1: n: n^2), the distribution partially complies with Bradford's Law. When 11 = *n*, then 1: *n*: n^4. This does not fit into Bradford's distribution. (**Chapter-5, Section 5.18, Table-22, Table-22A, Graph-15, Table-22B, Graph-15A, Table-22C, Graph-15B, Table-22D, Graph-15C, Page 210-226)**

Lotka's Law of Scientific Productivity

5.17 In the present study, 1845 authors have contributed 2876 articles during the period 1839-2015 as shown in **Table-21**. There are 1361 (47.32%) authors who contributed One (01) article, 278 (19.33%) authors contributed Two (02) articles, 97 (10.12%) authors contributed Three (3) articles, 41 (5.7%) authors contributed Four (4) articles, 21 (3.65%) authors contributed Five (5) articles, 14 (2.92%) authors contributed Six (6) articles. Further, while 9 (2.19%) contributed Seven (7) articles, the other 9 (2.5%) authors contributed Eight (8) articles and 4 (1.25%) authors contributed 9 articles, 3 (1.04%) and 3 (1.14%) authors each contributed Ten (10) and Eleven (11) articles respectively, 1 (0.42%) 1 (0.45%) and 1 (0.49%) authors each contributed Twelve (12) , Thirteen (13) and Fourteen (14) articles and 2 (1.46%) authors contributed Twenty-one (21) articles. To calculate the value of *n*, data from observed authors is used and is found to be 2.29. It is clear from **Table-21A** that the observed and expected authors are not similar to *n*=2.29 and the difference is 74 numbers of authors. Moreover, the frequency distributions of the author's productivity match the generalized Lotka's Law. (**Chapter-5, Section 5.17, Table-21, Graph-14, Table-21A, Graph-14A, Page 205-210)**

Zipf's Law of word occurrence

5.19 With regard to Zipf's Law of word occurrence based on whole data placed in **Table-23**, the word 'Library' secured 1st position in ranking order with 3409 frequency. The word 'Information' with 2852 frequency, 'Libraries' 1425 frequency, 'New' 1408 frequency followed by 'India' with 1377 frequency, which constitutes 2nd, 3rd, 4th, and 5th in ranking order. (**Chapter-5, Section 5.19, Table-23, Graph-16, Page 227-228)**

5.19 With regard to Zipf's Law (Connection of Word) placed in **Table-23B**, the word 'Of' secured 1st position in ranking order with 115 frequency. The word 'In' with 77 frequency, 'A' 52 frequency, 'And' 50 frequency followed by 'The' with 35 frequency, which constitutes 2nd, 3rd, 4th, and 5th in ranking order respectively. (**Chapter-5, Section 5.19, Table-23B, Graph-16B, Page 230-231)**

5.19 **Table-23A** represents words occurrence of Zipf's law (Based on Theses Title). The word 'Study' secured 1st position in ranking order with 50 frequency. The word 'Libraries' with 35 frequency, 'Library' 30 frequency, 'Information' 28 frequency followed by 'Assam' with 22 frequency, which constitutes 2nd, 3rd, 4th, and 5th in ranking order. (**Chapter-5, Section 5.19, Table-23A, Graph-16A, Page 228-230)**

7. Suggestions

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

❶ Due to information deficient, the library requires subscribing to the databases especially including relevant electronic resources to become information-rich to incorporate the data by the scholar for sustainable research.

❷ Citation analysis happens to be a practical tool to determine the need-based collections of the user and accordingly, information-rich the library requires developing the user-centric collection development in print form and substantial electronic resources to support learning and research.

❸ The present study is confined to a specific discipline still than the user needs can be extended to other subjects for strengthening the library with need-based resources.

❹ Bibliographical errors when citing a document such as spelling mistakes of an author, negligence of standard abbreviation, wrong year of publication, wrong titles, wrong journal-title 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 the evaluation of a journal or author's impact factor, therefore care should be taken when citing references.

❺ Further, the library requires in developing the e-journals having a high impact factor for the sustainability of research value.

❻ Other bibliometric techniques and applications of mathematical formula such as Bibliometrics indexing techniques and web application of bibliometrics have not been carried out so far. Future research may be considered in the direction.