

**PUBLICATION PATTERN OF SELECTED OPEN ACCESS LIS  
JOURNALS IN DIRECTORY OF OPEN ACCESS JOURNALS (DOAJ):  
A SCIENTOMETRIC ANALYSIS**

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF DOCTOR OF  
PHILOSOPHY

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MZU REGISTRATION NO.: 1800216

Ph.D. REGISTRATION NO.: MZU/Ph.D./1259 of 03.08.2018



**DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE  
SCHOOL OF ECONOMICS, MANAGEMENT AND  
INFORMATION SCIENCE  
AUGUST 2021**

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BY


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SUBMITTED

IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF THE  
DEGREE OF DOCTOR OF PHILOSOPHY IN LIBRARY AND  
INFORMATION SCIENCE OF MIZORAM UNIVERSITY, AIZAWL

  
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**CERTIFICATE**

This is to certify that **Saumen Das**, Ph.D. Scholar of the Department of Library and Information Science, Mizoram University has written his thesis entitled **“Publication Pattern of Selected Open Access LIS Journals in Directory of Open Access Journals (DOAJ): A Scientometric Analysis”** under my supervision. To the best of my knowledge and belief, the work embodies his original investigation and findings and has not published anywhere. I consider it worthy for the Degree of Doctor of Philosophy (Ph.D.) in Library and Information Science of the Mizoram University.

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## **DECLARATION**

Mizoram University

August 2021

I, **Saumen Das**, 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/Institute.

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



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## ACKNOWLEDGEMENT

At the Outset, I prostrate at the feet the almighty for all his blessings showered on me in the pursuit of my Ph.D.

I wish to place on record my appreciation and indebtedness to my respected supervisor **Dr. Manoj Kumar Verma** for his insightful guidance, and help. I would like to express my heartfelt gratitude to him for guiding me in every aspect till the completion of my Ph.D. thesis.

I owe a profound sense of gratefulness to Head of the Department of Library and Information Science, Mizoram University for his unconditional support, goodwill, and encouragements.

I would like to express my special thanks to **Prof. Pravakar Rath, Prof. S. N. Singh, Prof. R. K. Ngurtinkhuma, Dr. Amit Kumar, Dr. Langaizuali, Dr. F. Chanchinmawia,** and **Dr. Manendra Kumar Singh** of the Department of Library and Information Science, Mizoram University for their morale support and valuable guidance throughout my research work.

I am indeed thankful to my beloved Seniors **Dr. Krishna Brahma, Dr. Ravi Shukla, Mr. Sunil Kumar Yadav, Mr. Sur Chandra Singha** and my colleague **Mr. Dhruba Jyoti Borgohain,** for their constant support and help rendered to me.

My deepest and most special thanks are retained for my dearly loved mother **Smt. Swapna Das** who has literally suffered from my absence during the past few years. My elder brother **Suhit Das** inspiration of my life, and all my family members always supported and helped me throughout the journey. I do acknowledge and appreciate their pure love, sympathy and impatiently look forward to give them back the same, anytime soon. Without their love and support, I would not have been come this far.

I am indebted to respected **Dr. R. K. Mahapatra, Dr. Mithu Anjali Gayan, Mr. Augustine Zimik** and all the family member of Department of Library and Information Science, Tripura University and my senior elder brother **Mr. Nilratan Bhattacharjee** for their help and constant support.

The work presented in the preparation of this thesis would not have been possible without each and every person I have mentioned here, I am thankful for their tremendous advice and support.



Aizawl, Mizoram

**(Saumen Das)**

Dated:

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## LIST OF ABBREVIATIONS

<b>TERM</b>	<b>DESCRIPTION</b>
AGR	Annual growth rate
ALIS	Annals of Library and Information Studies.
APA	American Psychological Association
BOAI	Budapest open access initiative
CAI	Co-authorship Index
CC	Collaborative coefficient
CRL	College and research libraries
CSIR	Council of Scientific and Industrial Research
DC	Degree of collaboration
DOAJ	Directory of open access journal
DOAR	Directory of open access repository
ICT	Information communication technology.
INSDOC	Indian National Scientific Documentation Centre
LIS	Library and Information Science
MCC	Modified collaborative coefficient
NISCAIR	National Institute of Science Communication and Information Resources
NISCOM	National Institute of Science Communication
OA	Open access
RGR	Relative growth rate
SD	Standard Deviation
WWW	World Wide Web

**CHAPTER 1**  
**INTRODUCTION**

## **1.1 Introduction**

Data is important in any scholarly research. Practically all, scholarly journals play an indispensable character in scattering outcomes to study among individuals from different communities dependent on their academic field. It is very significant for an analyst to search for past examination and to assemble it to settle on a shrewd choice concerning the best spot to publish the article. In the educational field, Journal plays a significant role in distributing the output of research amongst the community members of that particular field. To understand a subject and to conduct further study journal articles are considered as the most important part by seeing the previous study, gathering a summary of past study it helps to choose the finest place to publish the study results. Scientific journals signify the most dynamic ways for distributing research outcomes and are generally focused on various academic disciplines or sub-disciplines. Based on the guidelines of a journal, publications may comprise of reports of unique studies, re-analyses of others' studies, and assessments of the literature of a particular field. The terms periodical & serial are most general and refer to all kinds of those resources. The proposed research is shown to analyze the bibliographical data of the two journals namely 'Annals of library and information studies' and 'College and research libraries' through scientometric approaches, which have been identified as the important journal resources in the field of library and information science.

The terms Scientometrics Bibliometrics, Informetrics, and Webometrics came from a mixture or grouping of the terms with science, bibliographic information, and web correspondingly. These terms are similar or identical to each other; in other words, all these thoughts are supplementary or complementary to each other. All these terms are interrelated to measure the generated and collected knowledge; these terms are connected with the study of growth patterns of literature or recorded knowledge (Hood & Wilson, 2001).



## **1.2 Bibliometrics**

The primary meaning of Bibliometrics was coined by Pritchard in 1969. He anticipated this term on the grounds that the factual reference index, the term utilized around that time, had some equivocalness as it could likewise be deciphered as book references on measurements.

Bibliometrics is the branch of the library and information science that deals with the measurement and analysis of scholarly output. Bibliometric indicators measure the scholarly works collection of different organizations, segments, and nations. The indicators also used to recognise the collaborative nature of research, plot scientific research networks and observe the growth of scientific fields. The approaches of Bibliometrics, Informetrics, Scientometrics, and Webometrics are used to examine a growing range of subjects, together with the occurrence scatterings that portray the occurrence of words and idioms in the records (Hood and Wilson, 2001).

Nicholas and Ritchie in their book entitled "Literature on Bibliometrics", "stated that bibliometrics provides information about the structure of knowledge and how it was communicated". Sengupta defined bibliometrics as the "Organization, classification and quantitative evolution of publication patterns of all macro and micro communications along with their authorship by mathematical and statistical calculus." Cole and Eales in 1917, termed it as "statistical analysis", while Hulme in 1917, termed it as "Statistical Bibliography".

## **1.3 Scientometrics**

Scientometric analysis reveal the trend of research. Ideally, such analysis should be performed on ALIS covering a well-defined scientific field.

The Scientometrics has got gratitude in most of the areas. Tague-Sutcliffe (1992) defines Scientometrics as "The study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities including, among others, publication, and so overlaps bibliometrics to some extent".

## 1.4 Source Journals

For the study, two open access journals were considered, one from India and one from the United States of America which are present in the Directory of open access journal (DOAJ). The description of both the journals are given below:

### 1.4.1 *Annals of Library and Information Studies (ALIS)*

National Institute of Science Communication and Information Resources (NISCAIR) came into existence on 30 September 2002 with the merger of National Institute of Science Communication (NISCOM) and Indian National Scientific Documentation Centre (INSDOC). Both NISCOM and INSDOC, the two premier institutes of the Council of Scientific and Industrial Research (CSIR), were devoted to the dissemination and documentation of S&T information.



The screenshot shows the NISCAIR Online Periodicals Repository website. The header features the NISCAIR logo and navigation links. The main content area displays the journal title "Annals of Library and Information Studies (ALIS) : [1440] Community home page" along with its ISSN numbers: 0975-2484 (Online) and 0972-5423 (Print). Below this, there is a table of years from 1991 to 2021, indicating the journal's publication history.

2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
2001	2000	1999	1998	1997	1996	1995	1994	1993	1992
1991	1990	1989	1988	1987	1986	1985	1984	1983	1982

**Figure-1.4.1: Annals of Library and Information Studies (ALIS)**

(Source: <http://nopr.niscair.res.in/handle/123456789/66/>)

Annals of Library and Information studies which completed 66 years of publication in 2020 is the oldest surviving English language primary library and Information science journal published from India. The journal was launched in 1954 by the erstwhile Indian National Scientific Documentation Centre (INSDOC) as Annals of Library science with the Father of Indian Library Science, Dr. SR Ranganathan as its Founder - Editor. In the ten years that he was editor, he wrote as many as 87 research articles for the journal. In 1964, the journal was renamed as Annals of Library

science and Documentation and in 2001 it was given its current name, Annals of Library and Information studies.

### 1.4.2 College and Research Libraries (CRL)

It was established in December 1939 and was published quarterly for its first 18 years, then bi-monthly since 1956. It publishes articles that are intended to help academic librarians build an intellectual framework to serve the needs of collegiate users. The editor-in-chief is Wendi Arant Kaspar (Texas A&M University Policy Sciences and Economics Library). The journal is open access since 2011. The journal is abstracted and indexed in Scopus, Social Science Citation Index, America: History and Life, Academic Search Premier, FRANCIS, PASCAL, EBSCO Education Source, Educational research abstracts (ERA), Information Science and Technology Abstracts, Library and Information Science Abstracts, Library Literature and Information Science, and MLA - Modern Language Association Database.



**Figure- 1.4.2: College and Research libraries journal (C&RL)**

(Source: <https://crl.acrl.org/index.php/crl>)

C&RL is an open-access journal. All contents are freely available immediately to the public without charge. Users are allowed to read, download, copy, distribute, print, search, or link to the full text of all contents. Authors retain their copyright and articles are published under a CC-BY-NC license. (<https://crl.acrl.org/index.php/crl/pages/view/about>)

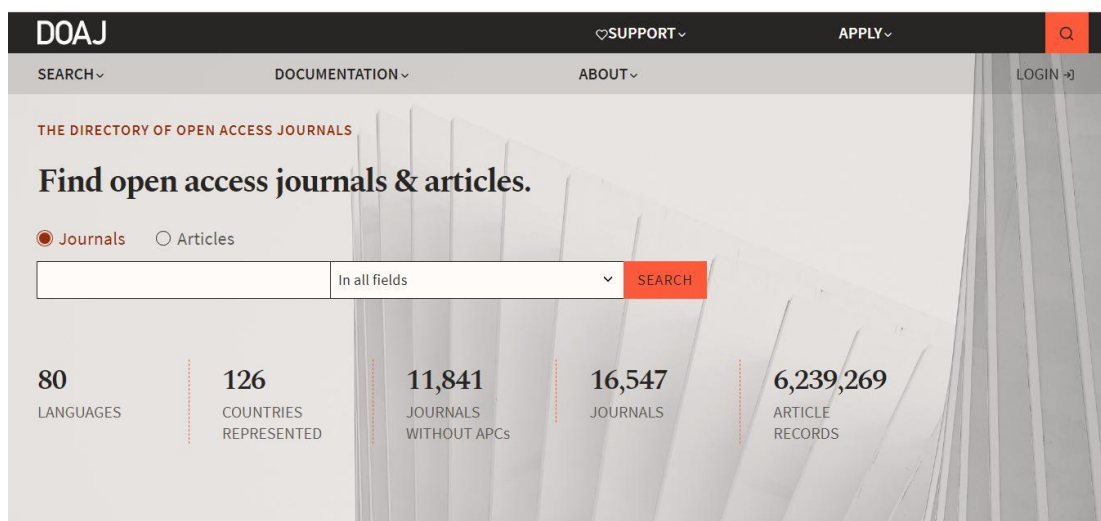
## **1.5 Open Access**

Scholarly publication is experiencing significant deviations due to the enormous rise of open access journals. The open-access journals are extensively growing its field because of massive benefits attained from it. Budapest Open Access Initiative (2002) defines “open access that, open access is the free accessibility of articles on the public domain, authorizing any users to read, copy, print, distribute, search, or link to the full texts of the articles and used them for indexing, convert them as data to software, or practice them for any other legal purposes, without fiscal, lawful, or procedural barriers other than those close from getting access to the internet itself.” Similarly, Association of Research Libraries (2004) defined “open access as any distribution model created with no expectation of direct monetary return and which makes works available online at no cost to the readers.”

Open Access is the progressive method of giving admittance to academic writing which is made conceivable through the Internet. Today everywhere in the world insightful research writing is appropriated online on the Internet in different structures, for nothing out of pocket and free from copyright and permitting limitations by distributors and organizations. Budapest Open Access Initiative (BOAI) was the primary activity to utilize the expression "Open Access". BOAI characterizes open access as "the free accessibility on the public Internet, allowing any clients to peruse, download, duplicate, disperse, print, search, or connection to the full messages of the articles, creep them for ordering, pass them as information to programming, or use them for some other legal reason, without monetary, legitimate, or specialized hindrances other than those indistinguishable from accessing the actual web" (BOAI, 2002). Perhaps the best advantage to open access is that libraries in more modest organizations or monetarily burdened zones around the globe can have more noteworthy admittance to the insightful assets. Open access which provides free admittance to the data content is generally extending its space due to massive advantages gathered from it (Rufai et al., 2011).

According to (Tamizhchelvan & Dhanavandan, 2014), “Open access journals are available online free to the reader, the publishers are willing to provide access to the Internet users. The open-access journals are mostly supported by academic

institutions and research & development institutions or government grants for publishing these journals. Private publishers are publishing them with getting financial support from the authors and supporting from reputed companies or institutions or some of the funding agencies are providing support for the publishing open access journals. The increasing growth of online OA journals in various disciplines is evident in various online directories. Directory of Open Access Journal (DOAJ) is one of the most popular directories among them”.



**Figure- 1.4.3: Directory of Open Access Journal (DOAJ)**

(Source: <https://doaj.org/>)

The DOAJ was launched in 2003 at Lund University, Sweden, under the direction of Lars Bjornshauge. The DOAJ provides access to high-quality open-access peer-reviewed journals. DOAJ aims to increase the visibility and ease of use of open access scientific and scholarly journals, thereby promoting their increased usage and impact. The directory covers journals in all disciplines of knowledge. DOAJ is a community-curated online directory that indexes and provides access to high-quality, open access, peer-reviewed journals. All DOAJ services are free of charge including being indexed. All data is freely available. There are now 16,547 open access journals listed in the DOAJ in 80 languages from 126 countries. As of today (11-06-2020) 62, 39,269 articles are included in the DOAJ. In the field of Library and Information Science (LIS), there are 160 journals and 18,601 articles.

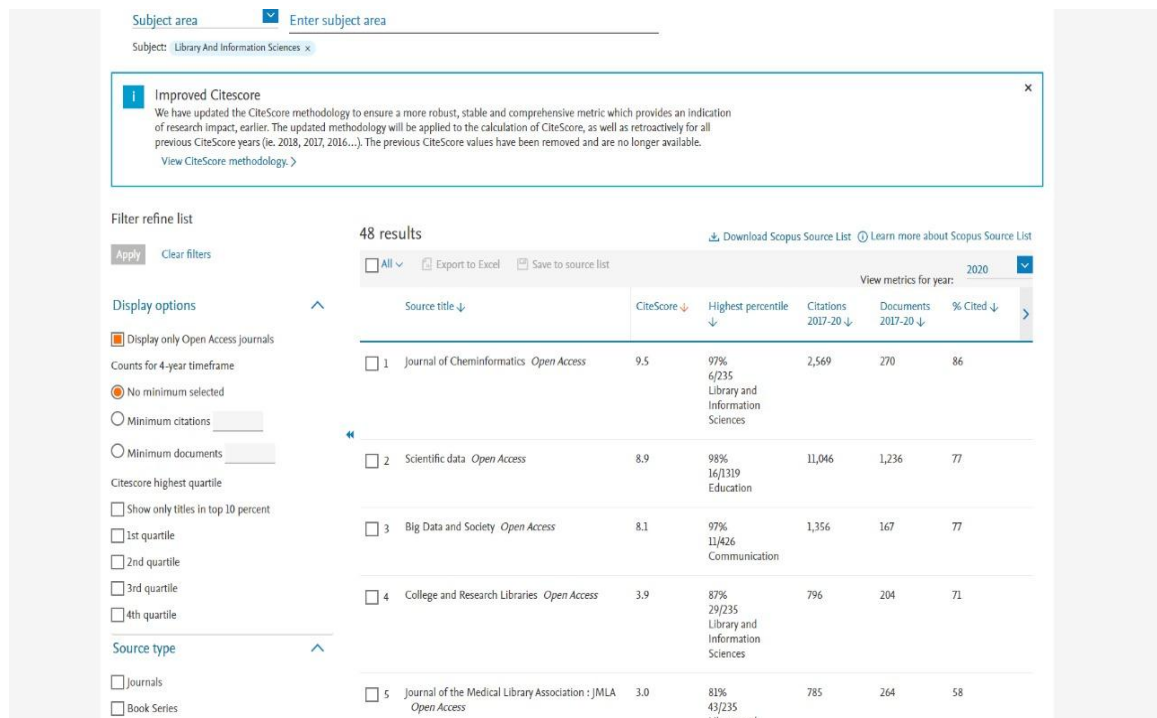
## **1.6 Significance of the study**

The periodicals are the indicators of literature growth in any field of knowledge. They emerge as the main channel for transmitting knowledge. Due to the escalating cost of the periodicals and lack of adequate library budgets the selection of any particular journal for a library should be done more carefully. Therefore, the library authorities are more focused to acquire only quality journals for their researchers. It could be seen clearly that scientometric analysis is an important tool in analyzing any discipline. Scientometric analysis has many applications in the Library and Information science field in identifying the research trends in the subject, core journals, etc., and thereby framing a new subscription policy for tomorrow. The proposed study conceives to examine the publication pattern based on scientometrics aspect in selected journals which is an important area of Library and Information Science research at present. The study will be helpful and provide strengths and weaknesses of publication pattern, subject coverage of articles, Collaboration and Collaborative coefficient, the geographical distribution of published articles, etc., and will be helpful for librarians to plan a better collection development.

## **1.7 Scope and limitations of the study**

The scope of the present study is limited to analyse the publication pattern of two selected open-access LIS journals- "**Annals of Library and Information Studies**" and "**College and Research Libraries**" on the basis of scientometric parameters. The Annals of Library and Information Studies is a Scopus index open access journal of Library and Information Science, published from India since 1954 and many individual studies (Mahapatra, 1994; Kherde, 2003 and Sen, 2014), found this journal was ranked at 1<sup>st</sup> position among the Indian LIS Journal on the basis of different parameters. And "College and Research Libraries", is also a Scopus index first ranked open access journal published from the USA since 1939. In the Scopus database, College and Research Libraries journal is in the 4<sup>th</sup> ranked journal out of 48 listed open-access journal category under the subject of Library and information science but in the core LIS field, it is in the first rank because the first three listed

journals (1. Journal of cheminformatics, 2. Scientific data, and 3. Big data and society) are not belonging to core LIS subject (Source: <https://www.scopus.com/sources.uri> ; Accessed on: 25<sup>th</sup> November 2018 and shown in Figure 1.7.1). The scope of the present study is further limited for the period of 10 years i.e. from the year 2011 to 2020.



**Figure- 1.7.1: Ranking of LIS Open Access Journal in Scopus database**

(Source: <https://www.scopus.com/sources.uri> )

## 1.8 Statement of the problem

Research in any area generates an innovative idea, method, and explanation for a problem. The researcher requires sources of information to conduct research. At this point, sources of information refer to periodicals such as journals, books, and other forms of documents associated with their study field in print form or electronic form. Amongst all the information resources, journals are considered as the more relevant sources of efficient and updated information and used as the primary resource of Information by the majority of the researchers. Which shows that journals are the significant carrier of innovative information and provides reliable information both in print form and in electronic form by providing current innovations, approach, and

analysis. Scientometric analysis of research output is a kind of practice to find the growth and development of published research output in a particular subject domain by using various scientometric indicators. The present study aims at analyzing the research trends and output based on scientrometric tools in the open access journals "**Annals of Library and Information Studies**" and "**College and Research Libraries**". There is several studies have already done on the research productivity of the different journals of different fields. Individually also many researchers conducted on both the journals but none has done any research by taking two top open access journals of Library and Information Science subject in the directory of open access journal from two different countries. In academic and scientific work, the publication is the main source of research output. Therefore, it is through publication the scientists receive professional recognition and esteem as well as promotion, advancement, and funding for further research. After publication only, it can be called research and can be fixed or judged and acknowledged by the scientists in the society. By keeping this view in mind, the researcher intends to undertake the study on "**Publication Pattern of Selected Open Access LIS Journals in Directory of Open Access Journals (DOAJ): A Scientometric Analysis**". This study attempts to analyze the performance of researchers working in the field of science and technology in terms of growth rate, areas of research concentration, author productivity, and authorship pattern.

### **1.9 Objectives of the study**

1. To find out distribution pattern and authors productivity of articles in selected LIS Journals
2. To evaluate the growth of publication and relative growth rate with doubling time of publications.
3. To Analyse the collaboration pattern of authors by using different parameters of collaboration
4. To examine the subject coverage, topic-wise distribution, and geographical distribution of published articles in selected journals



5. To visualize Co-citation analysis and bibliographic coupling of authors as well as published documents
6. To examine the Lotka's Law of scientific productivity on selected journals output

### **1.10 Hypotheses of the study**

In observation of the above objectives, the subsequent hypothesis has been formulated:

#### ***1.10.1 Hypothesis: 1***

H<sub>10</sub>: There is no significant difference in the distribution pattern of articles between selected journals.

H<sub>1a</sub>: Annals of library and information studies journal published less articles than College and research libraries journal.

#### ***1.10.2 Hypothesis: 2***

H<sub>20</sub>: There is no significant difference in the collaborative research between selected journals

H<sub>2a</sub>: Annals of library and Information studies journal has less collaborative research than College and research libraries journal.

### **1.11 Research methodology**

Research led to discover the new visions on a specified branch of a specific discipline. The research methodology comprises a series of routine phases such as recognizing of research technique, methods of data collection, and choosing the right techniques for analysis of the data collected. The study was designed to investigate the Publication Pattern of Selected Open Access LIS Journals in the Directory of Open Access Journals (DOAJ). The Two selected open access journals- Annals of Library and Information Studies and College and Research Libraries Journal were considered for this study and the time frame for the study was taken from 2011 to 2020. And additionally, some more bibliographic data were retrieved from the Scopus database for both the journals of the same period for visualization and

network diagram. The search expression to retrieve the bibliographic data of Annals of library and information was used (TITLE(Annals of Library and Information Studies)), the source ID of ALIS is 09725423 and for the journal College and research libraries, the search expression used was (TITLE(College and research libraries)), the source ID of College and research libraries is 14238. A total of 312 publications and 447 publications were collected from 10 volumes of each source journals ‘Annals of library and information studies’ and ‘college and research libraries’ respectively during the study period year 2011 to 2020. Information about each contribution such as author, author's affiliation, length of contributions, citations, etc., were scanned, checked, and examine carefully. For data analysis and graphical representation of both journals publication MS excel, VOS viewer, and Biblioshiny software were used.

### 1.12 Dataset

Table 1.12 shows the important data extracted from respective source journals website and Scopus database during 2011-2020.

**Table-1.12: Important dataset of the source journals**

<b>Data (From 2011 to 2020)</b>	<b>Annals of library and Information Studies</b>	<b>College and Research libraries</b>
Publication	312	447
Authors	414	927
Contributed countries	21	31
Pages	3659	7825
Cited documents	5969	17910
Cited authors	6907	12691

### 1.13 Formulae used

The following statistical tools and bibliometric indicators have been used in the present study.

**a. Degree of collaboration (DC):** Subramanyam in 1980 propounded the DC, a measure to calculate the proportion of single and multi-author papers and to interpret it as a degree. According to Subramanyam,

$$DC = \frac{Nm}{Ns + Nm}$$

Where,

**Nm** = the number of multi-authored papers

**Ns** = the number of single-author papers

DC varies from 0 when all the papers have a single author to 1 when all the papers have more than one author. It can be simply calculated and can also be easily interpreted.

**b. Collaboration index (CI):** Collaboration Index has been calculated by using the formula given by Lawani in 1980. The Collaboration Index (CI) is the simplest index presently used to explore the literature, which is to be interpreted as the mean number of authors per paper.

$$CI = \frac{\sum_{j=1}^A j f_j}{N}$$

Where,

$f_j$  is the number of J authored papers published in the discipline during a certain period of time

N is the total number of research papers published in a discipline during a certain period of time

**c. Collaborative coefficient**

Ajiferuke et. al. in 1988 put forward the formula for collaboration coefficient (CC) as

$$CC = 1 - \frac{\sum_{j=1}^A \left(\frac{1}{j}\right) f_j}{N}$$

$F_j$  denotes the number of j authored research papers

N denotes the total number of research papers published

k is the greatest number of authors per paper

It is detected by Ajiferuke, that the value of CC will be zero when single-authored papers are dominant. This implication shows that the higher the value of CC, means the higher the probability of multi-authored papers.

***d. Modified collaborative coefficient (MCC)***

CC differentiates single and multiple authors. But it fails to yield 1 for maximal collaboration except when many authors are infinite. It was rectified by Savanur and Srikanth in 2010 by the factor  $(1 - 1/A)$  with CC and enunciated as

$$MCC = (A/A-1)* \left\{ 1 - \frac{\sum_{j=1}^A \left(\frac{1}{j}\right) f_j}{N} \right\}$$

***e. Co-authorship Index (CAI)***

Schubert and Braun in 1986 elaborated CAI for the first time.

$$CAI = \frac{N_{ij}/N_{io}}{N_{oj}/N_{oo}} * 100$$

Where

$N_{ij}$  = Number of publications having j author for a particular block

$N_{io}$  = Total output for the particular block

$N_{oj}$  = Number of papers having j authors for all blocks

$N_{oo}$  = Total number of papers for all authors and all blocks

CAI = 100 The number of publications corresponds to the average within a co-authorship pattern.

CAI >100 The number of publications are higher than the average

CAI <100 The number of publications are lower than the average

***f. Lotkas's law of scientific productivity***

Alfred J. Lotka was a mathematician, a supervisor of mathematical research in the Statistical Bureau of the Metropolitan Life Insurance Company from 1924 to 1933 (Debus, 1968). It was around this time, that his definitive work, later called Lotka's law originated.

Lotka's formula for scientific productivity of authors is as follows:

$$Y=C/X^n$$

Where,

X = Number of Publications

Y = Relative Frequency of Authors with (N) publications

C = Constants depending on the specified field.

The productivity corresponds not to the number of articles published by an author but to its logarithm; it seems that a multiplicative, rather than simply additive, model provides a better fit to this measure or counting method. The exponent  $n$  is often fixed at 2, in which case the law is known as the inverse square law of scientific productivity. However, given that the exponent  $n$  predicts the relative number of authors at each productivity level it would seem useful for calculations.

The degree of conformity or non-conformity of various empirical distributions of Lotka's distribution has been tested by many authors. The studies on the fitness of Lotka's law began systematically was with the work of Pao using the least square method with 48 sets of author's productivity data. In 1985, Pao presented the application process of Lotka's law and again in 1986 she studies it in other scientific fields. Modifications to Pao's procedure were proposed by Nicholls. In the present study, the least square methodology described by Pao (1985) has been used. It can be expressed as:

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

Where N is the number of data pairs considered;

X is the logarithm of x (x=number of articles); and

Y is the logarithm of y (y=number of authors)

The constant C is calculated using the formula:

$$C = \frac{1}{\sum 1/x^n}$$

### ***g. Annual growth of publication***

According to (Arora and Trivedi, 2012), the growth rate is calculated with the help of the following formula:

$$r = \frac{P_1 - P_0}{P_0} \times 100$$

Where, r = Publication growth in percentage

P<sub>0</sub> = Number of publications in the base year

P<sub>1</sub> = Number of publications in the present year

### ***h. Relative Growth Rate and Double Time***

The Relative growth rate is the increase in the number of articles/pages per unit of time. The growth rate of publication has been calculated based on RGR and Dt model, which is developed by Mahapatra in 1985. (Mahapatra, 1985)

The relative growth rate and doubling time is calculated using the following formula:

$$RGR = \frac{W_2 - W_1}{T_2 - T_1}$$

Where,

RGR = Growth Rate over the specific period of the interval,

W<sub>1</sub> = Loge (natural log of the initial number of contributions)

W<sub>2</sub> = Loge (natural log of the final number of contributions)

T<sub>1</sub> = the unit of initial time

T<sub>2</sub> = the unit of the final time

There occurs a straight relationship between the relative growth rate and doubling time. If the number of publications/pages of a topic doubles during a specified period then the Variance between the logarithm of numbers at the start and end of this period must be the logarithm of the number 2. If a natural logarithm is used this

difference has a value of 0.693. Thus the equivalent doubling time for each specific duration of the period for articles can be measured by the following formula.

$$\mathbf{DoublingTime(Dt)} = \frac{0.693}{R}$$

Where,

R= Growth rate.

### **1.14 Software used**

Mainly three software's were used for data analysis and network visualization of data retrieved from respective source journals websites and Scopus database. Specifically for general data analysis MS Excel 2013 software use and visualization and networking, VOS viewer, and Biblioshiny software were used. A general introduction of all the said software's are given below:

#### ***1.14.1 Microsoft Excel 2013***

Microsoft Excel is a software used for data analysis and calculations launched by Microsoft Company. Generally, the software comes in the Microsoft Office package suit. It is called a "spreadsheet." Spreadsheets are used to arrange physical world data into a tabular format. Data can be statistical or alphanumeric (containing letters or numbers). The main advantage of using spreadsheet software is that one can make modifications without difficulty, comprising correcting spelling or values, addition, deletion, formatting of data, and shuffling data. One can also use the spreadsheet to execute specific functions routinely (such as summation, average, and subtraction), and a spreadsheet can keep hold huge amounts of data but there is also a limit. Once a spreadsheet is created, one can easily take the printout as many copies as anyone wants. It can be saved for future modifications or can send it to a person through e-mail. Microsoft Excel is a very commanding calculator. It can calculate different types of calculations required during data analysis and can be represented as maps or charts. Other than calculations there are also many more features that are used by researchers widely for advanced level study also. It is available on both Windows

and Macs. The software may look a little different depending on the version and PC that one is using, but it will work in the same basic ways.

#### ***1.14.2 VOS viewer***

VOS viewer is a computer program, which is used in the present study for representing the network visualization maps such as co-authorship with authors, countries, institutions, and co-occurrences of keywords in Journals. VOS viewer offers an easy-to-use instrument that is entirely concentrated on the visualization of bibliometric networks. It delivers distance-based mapping of bibliometric networks. In general, the VOS viewer shows only the nodes in a bibliometric network and does not show the edges among the nodes. In the visualizations providing by the VOS viewer, the distance among the nodes roughly indicates the connection of the nodes. VOS viewer is specifically appropriate for visualizing bigger networks. Due to its much concentration on visualization, VOS viewer deals with fewer functionality for analyzing bibliometric networks. VOS viewers have some special text mining features. In a bibliometric network, there are frequently huge differences between nodes in the number of edges connected with other nodes. Common nodes, for example, represents highly cited periodicals or highly productive investigators, may have numerous orders of scale more connected than their less popular colleagues. In the analysis of networks, one generally executes a normalization for these variances between nodes. VOS viewer by default relates with the association strength normalization Van Eck and Waltman (2009).

VOS viewer can create overlay visualizations. In the overlay visualization, the color of a node specifies a certain character of the node. For example, nodes may signify journals and the color of a node may specify the frequency of times a journal has been cited. Van Eck, Waltman, Van Raan, Klautz, and Peul (2013).

Another visualization offered by VOS viewer is the density visualization. In this visualization, colors indicate the distribution of the nodes in the two-dimensional space in the visualization. The density visualization lets one directly recognize dense areas in which various nodes are positioned adjacent to each other. Van Eck and Waltman (2010)



### ***1.14.3 Biblioshiny***

Biblioshiny is a shiny app that provides a web interface for bibliometrix. It supports researchers in the easy practice of the main features of bibliometrix: Data importing and alteration to data frame collection, Data collecting using Dimensions, PubMed and Scopus APIs collection, Data filtering, and many other features can be used. It can help a researcher to visualize the data.

Analytics and Plots for three different level metrics:

- Sources
- Authors
- Documents

Analysis of three structures of Knowledge:

- Conceptual Structure
- Intellectual Structure

### **1.15 Chapter's Scheme**

The present study has been divided into the following chapters:

#### **CHAPTER 1 – INTRODUCTION**

The first chapter introduces the topic of research and provides a brief description of the introduction, Bibliometrics, scientometrics, need and significance of the study, statement of the problem, objectives of the study, methodology, formula used, software used, and organization of the chapters.

#### **CHAPTER 2 - REVIEW OF LITERATURE**

The second chapter gives the sights of various types of Scientometrics and bibliometrics related areas and delivers certain solid ideas for the present study. The reviews of the study are presented in the following heading such as Study based on General Bibliometrics and Scientometrics studies, Studies based on Authorship Pattern, Studies based on Authorship Pattern, Studies on collaboration pattern, Studies on the single journal, Studies on Global research, Studies on VOS viewer and biblioshiny. The study is further arranged in ascending chronological order. Though,

this chapter deals with the studies on Scientometrics and bibliometrics to provide the researcher with a better understanding of the previous studies that happened on this topic and how this study could be improved.

### **CHAPTER 3 – SCINTOMETRICS: AN OVERVIEW**

This chapter provides definitions and examples of Scientometrics and uses of basic Scientometric terms in the field of information science and provides a framework for connecting new findings to preceding findings in the relevant field. There the concept of metrics and parameters used in scientometric studies were discussed broadly.

### **CHAPTER 4 – OPEN ACCESS INITIATIVES**

Chapter 4 provides a broad idea about Open access, open access initiatives by India, and world perspective. The advantage and characteristics of open access were deliberated. The information about open access journals with special regards to library and information science discipline were also discussed

### **CHAPTER 5 - DATA ANALYSIS AND INTERPRETATION**

Chapter 5 deals with the analysis and interpretation of the data. It portrays the Visualisation of the data and provides the summary of major findings. The researcher has presented findings based on the observation from the data analysis by using software like MS excel, VOS viewer and Biblioshiny app.

### **CHAPTER 6 - MAJOR FINDINGS, CONCLUSION, AND SUGGESTION**

Chapter 6 deals with the outcomes of the study and if there is any suggestion to improve the research, future research was discussed.

At the end of the thesis, bibliography and appendices have been given. The bibliography is given as per the rules provided by the APA style manual, 6th ed. (American Psychological Association, 2010)

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**CHAPTER 2**  
**REVIEW OF LITERATURE**

## **2.1 Introduction**

It is very significant for a researcher to understand the past studies carried out by different scientists or researchers in the same field to move forward with his or her study. The past studies provide a path towards the present or future studies of the alike fields. The literature of the past studies on a particular topic gives an idea regarding the topic of what is already done and what needs to be done furthermore. It aids to understand the gap in a particular research topic. A review of the literature is a crucial part of academic & research activities. The review is a careful examination of a body of literature pointing towards the answer to the research question. It brings out the latest and existing knowledge of a research area and enables a researcher to perceive clearly what has already been done and what remains to be done. A review of past studies helps to eliminate the repetition of the research of the same topic. Scientometrics is one of the major topics of research in the field of Library and information science with established theories and laws and many types of research were conducted by many researchers across the globe and quite sufficient literature are available in different forms like books, research articles, review articles, dissertation, and thesis, etc. So, it is not very difficult to find the related literature on that topic to conduct a study on this. The literature was primarily downloaded from Shodhganga, the official electronic thesis and dissertation reservoir of India. Many theses from the topic of scientometrics and bibliometrics were downloaded from that reservoir and studied thoroughly to understand the different concepts about that topic. Instead of this, the relevant literature was also downloaded from different open access journals namely Annals of library and information studies, Library philosophy and practice, Desidoc journal of library and information technology, Collnet Journal of Scientometrics and Information Management, Journal of Scientometrics Research, Scientometrics, etc. Some of the literature was also downloaded from the researcher's self-archive gateway such as research gate, academia.edu., google scholar, etc. In this chapter, the collected literature was categorized based on their core topic such as general bibliometrics/scientometrics studies, authorship patterns, open access, national and global studies, etc., and arranged in chronological order. For this study total of 60 literature were reviewed entailing 42 journals articles; 2

books; 3 Theses; 13 web pages and the review of related literature are divided into 7 subheadings as listed below:

## **2.2 Studies based on the concept of Bibliometrics and Scientometrics**

Perez, L.M. et.al (2020) in their study “A bibliometric diagnosis and Analysis about smart cities” states the concept of bibliometrics. According to him “A bibliometric study offers a statistical description of scientific production. It tries to extract as much information as possible from the studied data set to offer researchers a complete and organized vision of the multidisciplinary scientific production of the subject matter studied. A bibliometric study allows knowledge of the figures of scientific production. These figures could be used to obtain from the various utilities, e.g., the identification and assessment of lines of research from expert researchers, from the most developed countries, or from the pioneers and the emerging ones in the subject, as well as the levels of citations and their evolution over time, etc.”

Chellappandi and Vijayakumar (2018) in their study state that “the next generation of research in LIS field is depending upon the web and Information based analysis with the latest development in the different metric analysis of bibliometrics, informatics, Scientometric, webometrics, and Altmetrics. The scientific approach to prove the results of productivity to enhance the research and development with qualitative analysis is possible by library professionals to encourage the faculty members and research scholars through the results and impact factor of their work in all the disciplines of the study in the higher academic institutions.”

Cooper, I. (2015) states the concept of bibliometrics and scientometrics, According to him "Bibliometrics are mostly used to measure the influence or impact of research articles. Bibliometric methods estimate how much influence or impact a selected research article has on future research. It usually does this by counting the number of times the article is cited after it is published.

A related field is scientometrics. (A journal by that name is published by Springer.) Scientometrics involves larger concepts, such as the impact of an entire research program or a field of science. It may include an impact on economics, cultural



patterns, and/or policy decisions. If an institute has sponsored a study or discovery, the institute can examine how the article or discovery led to other articles or discoveries, or other effects. This can help the sponsoring institute understand the impact of the work is paid for."

Vinkler (2008) in his book, explained various aspects of scientometric indicators like practical and realistic quantitative methods for evaluating scientific publication activities of individuals, groups, nations, and journals. The author represented the theoretical concept and application prospects of scientometric impact pointers along with numerous new representations, concepts, and tools. The target onlookers for the book comprises researchers and supervisors, experts in scientometrics, professors, and science strategy creators at all levels. The book provides basic and advanced knowledge on evaluative scientometrics to researchers, librarians, and scientists as well. Especially the book deals with approaches applicable in the practice of quantitative aspects of the impact of scientific outputs by the means of citation indicators.

Meadows (2005) conducted a study describing the thought of bibliometrics and its application to the library and information science field since the 1970s. He had mainly emphasized two facets. The first facet was the application of quantitative indicators and their practice and the second was the qualitative indicator to carry out the citation studies in social science and science research. He pointed out the limitations to be considered while using bibliometric studies in practical perspectives.

Padhi and Garg (2004) carried out a study to investigate the perception of Librametry and the expansion of librametry to bibliometrics, scientimetrics, and informetrics. The paper is also deliberate about the uses of bibliometrics and scientometrics. The scientific output formed by the organizations of a country, to a great extent, reflects the organizational science policy as well as national concerns and priorities.

Ungern-Sternberg (1998) explained the application of bibliometrics in libraries through applying bibliometric research, an index terms words-based database which are present in the titles of documents, authors, and sources or geographical or time distributions. He observed that the bibliometric research can be applied to any of the subject fields under the library's collection and the contribution by scientists in the field. In the collection development Planning, implementation, and assessment procedures were involved. The highly applied bibliometrics methods were co-citation study, bibliographic coupling, and co-word analysis. The highly used software for the analysis, BIBMAP can be used for clustering the co-cited journals.

### **2.3 Studies based on open access**

Arrizabalaga, O. et.al (2020) conducted a study "Open access of COVID-19 related publications in the first quarter of 2020: a preliminary study based in PubMed." For the study, they have analyzed 5.611 articles published in pub med on COVID-19. And stated that "This is a much higher amount for 4 months compared to those found for SARS CoV-1 and MERS during the first year of their first outbreaks (337 and 125 articles, respectively). Regarding the levels of openness, 97.4% of the SARS CoV-2 papers are freely available; similar rates were found for the other coronaviruses. Deeper analysis showed that (i) 68.3% of articles belong to an undefined Bronze category; (ii) 72.1% of all OA papers don't carry a specific license and in all cases where there is, half of them do not meet Open Access standards; (iii) there is a large proportion that presents a copy in a repository, in most cases in PMC, where this trend is also observed."

Das (2018) contributed a short communication "Delhi declaration on Open Access 2018: an overview". According to him "Delhi declaration on Open Access will strengthen the national and institutional OA policies, already undertaken by the Department of Science and Technology (DST), Department of Biotechnology (DBT), Council of Scientific and Industrial Research (CSIR), and few other national agencies, by making the OA resources widely available. India's Ministry of Human

Resource Development (MHRD) has to be the largest supporter of the creation of OA resources and OA infrastructure across the country. MHRD-supported Shodhganga has become one of the largest and most resourceful repositories of theses and dissertations in the world. The Declaration also envisages a developmental framework for the South-South cooperation in promoting OA and country-specific OA action plans where the OA ideas need a faster implementation framework."

Nashipudi Ravi (2015) states that Open archive self-archiving states to self-depositing, the knowledge that writers make their study productivities accessible by dispensing a free of cost online form to an institutional repository. The repositories are digital archives, which are generally managed by libraries.

Chauhan (2012) assessed open access e-journals in LIS accessible on the Directory of Open Access Journals (DOAJ). The DOAJ delivers access to reputed Open access journals. It is an active source of information for the current day. No substitute portal can provide such quality information of journals and accessibility of journals as like as DOAJ. This paper put an effort to make understand students, academicians, researchers about freely accessible full text and superiority of scientific and academic journals in Library and information science obtainable on DOAJ.

Sivakumaran and Jeyapragash (2012) studied the open access journals which are registered in DOAJ (Directory of Open Access Journals) under the Library and Information Science. The objective of the study was to examine the open access journals published in several years, languages, countries, and multidisciplinary fields. It was observed that during 1996-2005, the mainstream of journals is contributed by the USA, the highest number of journals was published in English language and fewer numbers of journals were published in multilingual languages. It was suggested that developing countries like India should make aware of the contributor to publish their articles in open access journals.

Chakravarty and Mahajan (2011) state that Open access journals deliver online access to full-text contents of academic, peer-reviewed journals. Open access journals are categorized in two different types - one, exists in electronic form only and the other exists in both electronic as well as print forms viz. Current Science journal. In the former type, the journals are published in consistent intervals on the web that does not publish any print-on-paper version. In the latter type, the journals are published in both print-on-paper forms and disseminated to the users. Similar stuff of print-on-paper is available to the researchers free of cost in the online form.

Mukherjee (2008) in his study Open Access scholarly publishing in Library and information science observed that most open access journals are available in English languages and recommended that the authors should submit their research publications in Institutional Repositories and to make them freely accessible. He also assumed that LIS journals in the open access domain would be published in a growing trend by other nations in the future.

#### **2.4 General Bibliometric and Scientometric studies**

Alamelu (2017) conducted a scientometric study of library and information science journals- Annals of Library and Information Studies (ALIS) and DESIDOC Journal of Library and information technology (DJLIT). He found that a total of 371 and 542 publications were published individually in both the journals ALIS and DJLIT during the period of study. The highest 43 (11.59%) publications were published in the year 2010 and the lowest 26 (7.01%) publications were published in the year 2006 by Annals of library and information studies journal. And by DESIDOC Journal of Library and information technology published the highest 65 (11.99%) publications in the year 2012 and the lowest 18(3.32%) publications in the year 2006. In the ALIS journal two authored publications were found to be highest with 170 (45.82%) publications and similarly in DJLIT journal also two authored publications were also dominating over others having 225 (41.51%) publications. From the study, it was observed that in both journals, the author was inclined towards collaborative research with others. ALIS published 91(24.53%) papers in ICT and E-Resource depth subject and DJLIT published 95(17.53%) papers from the domain of Library and

Information Science, Information Literacy, and ICT. In ALIS there were a total of 6981 citations appended and the highest citation appended in the year 2010 having 990 (14.18%) citations, and from DJLIT journal it was counted that a total of 7210 citations appended and most citations appended in the year 2013 having 973 (13.50%) citations. From the study, it is visibly recognized that journals are the most preferred type of the cited document for contributors in both journals.

Parameshwar (2016) conducted a bibliometric study on the literature published on citation analysis of IASLIC bulletin during 2006-2015 through Indian citation index database. A total of 204 papers were considered from 39 issues of 10 volumes. The year-wise distribution of papers and citations show that the highest number of papers were published in the year 2010 with 25(12.25%) counts, the lowest number of papers were published in the year 2015 with 13(6.37%) counts. A total of 66 citations were found during 2006-2015, in which the highest 15 citations were found in the year 2007 and the years 2014 and 2015 were recorded with no citations. The average citation per article and h-index was observed 0.325 and 3 respectively. The authorship pattern reveals that single-authored publications were highly contributed having 46.08% followed by two authored publications and three authored publications with 44.12% and 9.80% respectively. In the year-wise reference citation analysis, it was observed that the highest 51.96% of the publications references range from 1 to 10 and the lowest 47.06% publications reference ranges from 6 to 10. In the authors' contribution 'Jena Puspanjali' has been recognized as the most prolific author having 2.45% contributions to the source journal. In document type-wise distribution, IASLIC bulletin published the highest 95.59% publications are in the form of articles. India has contributed the highest number of publications with 96.57% and in which 'Jadavpur University is the top institution with 5.88% publications. Top cited article analysis specifies that the highest of the articles are from the field of bibliometric/scientometric research.

Betageri (2015) conducted a bibliometric study of the Journal of Dairying, Foods and Home Sciences. In his study, he tried to find some specifics about the publications of the said journal. The required data were collected from the journal's website. The study was restricted within the timeframe year 2003 to 2012. During the study period

total of 536 papers were acquired and found that the growth of publications is inconsistent during the particular period. In the authorship pattern, double-authored publications were dominating over others. In category-wise distribution, publications under food grains were in the top having 23% of the total publications. In the total publications, 5327 cited references were observed. More than half (52%) of the total publications were ranges from page 1 to 4 and the remaining were more than of it.

Kamble et al. (2015) have studied Hematology research productivity during 2004-2014. The data was retrieved from the Web of Science database. A total of 250310 publications were collected for the study during the study period of 10 years. The USA has contributed the highest publications with 93701(37.43%) publications. English is the leading language on hematology research with 248432(99.24%) publications. Journal is the most preferred way of communication of many research publications. The study has shown that the highest 49.3352% publications are Meeting abstract followed by articles with 87603(34.99%) counts. 'Harvard University' has contributed the highest number of publications with 4422(1.77%) counts on hematology research. The author 'Martinelli G' has contributed the highest 778(0.31%) papers on hematology research.

Dash and Parida (2014) conducted an investigation of medical journals over citations. The authors have considered two medical journals in their research specifically 'Indian Journal of Cancer' and 'Journal of Communicable Diseases' within the time frame 2001-2010. The growth of research in the Journal of Communicable Diseases has been marginally steady however the growth of research in the Indian Journal of Cancer is inconsistent. The journal diffusion factor was observed as 0.196 for a couple of years in 2004 and 0.184 for three years in 2004 and the impact factor has been determined as 0.235 in 2004 for the Indian Journal of Cancer.

The two pointers Journal Diffusion Factor and Impact Factor uncovered the growing pattern of references during the study time frame. Be that as it may, the pace of increment for the Journal of Communicable Diseases has not exactly Indian Journal of Cancer. Immediacy index has been expanded during 2007-2010 in the Indian

Journal of Cancer. Though, Immediacy Index of Journal of Communicable Diseases just accessible in the years 2006 & 2010. The correlation of two journals' impact factors has been imagined in impact factor analysis, wherein Indian Journal of Cancer occupied the highest impact factor than Journal of Communicable Diseases. Topographical scattering of citations demonstrates the association of cited authors from several nations, whereas Journal of Communicable Diseases included authors from 84 nations and Indian Journal of Cancer included authors from 73 nations engaged in citation procedure. The highest number of (279) citations were gotten from India by Indian Journal of Cancer and Journal of Communicable Diseases likewise gotten the highest number of (367) citations were from India. Similarly. Likewise, the most extreme number of distributions of the two journals were from India.

Swain et al. (2014) have examined the research productivity of the "Business Economic" journal during the year 2008 to 2013. The required data were collected from the Scopus database. The analysis primarily covered the nature of contributions, size of articles, authorship design, the affiliation of organizations, keyword distribution, topographical distributions, and degree of collaboration, prolific authors, citation sources, and the number of citations appended from different databases. In their analysis, they found that 76.47% of publications were in the form of articles. The mean length of the publications published in the journal ranges between 8 to 10 pages. The highest number of publications in the journal were from single author contributions which were 68.45% of the total publications. The degree of collaboration was observed at 0.315. The keyword 'financial crisis' was recognized as utmost frequently looked at with 18 counts. The highest number of contributions was observed from the U.S.A having 90.91%. . The author 'Gross, A.C' has contributed the highest number of 8 publications among all other contributors. The article 'Porter's model of generic competitive' has got the maximum number of citations. The citation received during the later period of study was found to be decreasing.

Gunasekaran and Arunachalam (2011) conducted a bibliometric study of research papers published by Indian researchers in the year 2009. The data were collected

from the web of science and Scopus both databases and imported into MS Excel for data analysis. A total of 836 open access journals were found to be indexed and were selected for the data analysis. Nine other journals were listed in the Scopus database were also selected for the study. It was observed that a few 24 journals with 70 papers were from India having an impact factor of more than 1.000 and 18 journals have 100 papers from India and these 18 journals consist of 50.69% of India's total open access journal output. It was seen that the proportion of open access to the total number of journals reduced with an impact factor.

Balakrishnan (2010) conducted a diverse method to assess the research productivity of gender existing in the selected conference proceedings of the continents. The research efficiency was evaluated in terms of countrywide and individual wise. The indicators like author, organization, and topographical regions are used to recognize the associations and connections between the performers of national and global structures of scientific production. Single authored publications were the highest among all and the top continent to contribute the highest number of publications in Europe in the domain of gender in Information communication technology. Gender and structural growth are the highest publications with 191 articles. Out of the 24 countries, the USA and UK have contributed the highest number of publications.

Suriya (2010) conducted a study on the data relevant to the subject sociology which were downloaded from the JCCC database. It was observed that America has contributed the highest and Australia has contributed the lowest out of the total 8067 papers. The growth rate was calculated and found that there was a continuous growth during 1997-2009. In the subject-wise distribution of contributions, he found the main themes like macro, organizational sociology, social constructivism, human ecology, social networks. The journals were arranged based on the number of contributions to validate Bradford's law of scattering. The arranged journals were classified into three zones. The first zone comprises 23 journals, the second zone comprises 92 journals and the third zone comprises 861 journals. The study of Bradford's expression on the grouping of core journals was seen as 1:4:37.



## **2.5 Studies based on Authorship and Collaboration Pattern**

“Collaboration is a way to gain and sustain access to recognition in professional communities; it may act as a social regulator” Beaver and Rosen (1978).

The number of author's contributions to academic publications in terms of authorship pattern is an important part of any bibliometric or scientometric study.

Shukla and Verma (2019) in their article highlight the significance of different bibliometric parameters in the Journal of MIS Quarterly from (2013-2017) in which a total of 260 publications were published from the marked period of study in the particular journal. The article examines the authorship pattern, distribution of articles, authors productivity, the degree of collaboration, and Lotka's law of scientific productivity and found that the highest 111 contributions by three authors, followed by two authors with 73 contributions. Out of a total of 260 articles, 60 (23.08%) research papers were published in the year 2017. The publication average of each author and average degree of collaboration was 0.34 and 0.95 respectively. During the period of study, Lotka's law of scientific productivity found that the numbers of authors observed are somehow different from the numbers of authors expected.

Shukla and Verma (2019) analyzed the mapping of publication patterns of the Journal of Knowledge and Communication Management during 2011-2017. For the study, they have considered a total of 92 articles published in the journal. They analyzed the authorship pattern, distribution of publications, most prolific authors, authors' productivity, the degree of collaboration. They found that the highest number of publications is 47 (51.08%) contributed by double authors, followed by single author with 33, (35.86%) publications. India ranked first place with 91 (90.09%) publications. K.M. Shibu was the most productive author with 5 (17.85%) publications. The author productivity demonstrates that a total of 165 authors contributed 92 articles with an average of 0.55 publications per author.

Mondal and Jana (2018) studied the collaboration and authorship trend in the top Indian LIS journals. In that paper, they have considered articles in leading LIS

journals during the years 2012-2017. The study evaluated the collaborative authorship pattern by using different parameters and found that two-authored articles are dominating with (48%) in LIS publications and the multi-authorship pattern received the highest average citation in collaboration. It was also found that the maximum collaboration occurs in intra-institutional and inter-institutions within state level and concluded that the LIS schools are also considered inter-departmental collaboration to produce added quality works for developing and advanced research.

Shukla et.al (2018) conducted a study on authorship pattern and collaboration coefficient of International Journal of Information Dissemination and Technology (IJIDT) during 2011-2017. For the study, they have considered a total of 333 articles and found that the highest 21.02% of publications were published in the year 2016. It was also observed that the relative growth rate (RGR) was declining whereas the doubling time (Dt) was inclining during the study period. The mean collaboration coefficient (CC) and collaboration index (CI) have been noted 0.37 and 1.97 respectively and the maximum 217 publications were co-authorship index although 115 publications were contributed by a single author during the period of study.

Shukla and Verma (2018) conducted a bibliometric analysis of the Journal of Library Herald from 2008 to 2017. For the study, they have considered a total of 222 articles published in the journal. They analyzed the authorship pattern, distribution of publications, most prolific authors, authors' productivity, the degree of collaboration. They found that 97 (43.68%) articles were written by single authors, followed by double authors having 87 (39.18%) articles. Dr. K P Singh was the most prolific author with the highest number of articles with 11 (31.43%) articles, followed by B K Sen has had 6 (17.14%) articles during the period of study.

Verma and Shukla (2018) analyzed the research publications trends of the Journal of Advances in Library and Information Science during 2012-2016 using various bibliometric tools such as authorship pattern, reference appended, topographical distribution, etc. The study found that the highest number of publications (62) was

published in 2015 out of a total of 251 publications. The majority of publications were contributed in collaborative form. In the state-wise contribution of publications, Tamilnadu has contributed the highest 71.31% contributions trailed by Karnataka and Andhra Pradesh. Author S. Gopalakrishnan from Tamilnadu has contributed the highest number of publications (15) followed by M. Nagarajan (12) and S.Mohamed Esmail (10). A total of 2360 references was appended by authors in their research articles.

Singh (2017) studied the authorship pattern and collaboration coefficient of Biotechnology research for sixteen years (2001-2016) in India. The Source of the database was used Scopus and a total of 18918 articles were collected. By using five scientometric tools for the analysis he found that the average number of authors per article was 4.92, collaboration coefficient was 0.63 for the study period in India. Single authored papers were less in comparison with the multi-authored articles. The relative growth rate was decreased and the corresponding doubling time was gradually enflamed. The mainstream of the researchers was co-operative research rather than individual research. The average activity index of India was 91.78 during the study and the highest activity index was found in the year 2016 with 180.3 while the lowest was found in the year 2001 with 42.38.

Biradar and Tasadad (2015) studied authorship and collaborative pattern of subject economics. They observed that single authors' papers are dominating on multiple authors. Collaborative Index ranged between 1.80 to 2.29. The degree of collaboration was found highest (0.58) in the year 200-2014.

Jeyasekar and Saravan (2015) tried to comprehend the collaboration arrangement in forensic science researched published from India. Total 2096 data were retrieved from Scopus for the study. VOS viewer and Pajek software were used for visualization and data analysis. International collaboration Index for India was found at 7.68 and the highest affinity Index affinity rate of 34.16.

Naheem and Shibu (2015) investigated a study on Authorship Patterns and Collaborative Research in the Journal of Knowledge and Communication

Management from (2011-2014). In which an aggregate of 46 articles was distributed in the journal and the examination look at and tracked down that the most noteworthy 22 articles (47.83%) were distributed by single writers, the normal number of writers each article of the general commitment is 1.67.

Garg and Dwivedi (2014) assessed the collaboration pattern in the discipline of Japanese encephalitis. For that evaluation, they have considered 2074 articles listed by the Science Citation Index distributed by different countries on the topic of Japanese encephalitis during 1991-2010. It was discovered that Japanese encephalitis is a profoundly collective control concerning the co-origin list and the coordinated effort coefficient for various nations. Around 66% were written in coordinated effort from absolute distributed articles during the time of the study. The home-grown coordinated effort was extremely high which is 478 (23%) out of the relative multitude of distributed articles and 478 (23%) was with worldwide cooperation. The USA is the most working together country among all the nations. The examination additionally demonstrates that coordinated effort was expanded multiple times during 2001-2010 when contrasted with 1991-2000. The most elevated six foundations from India were profoundly synergistic among all the 17 organizations and Liverpool University had the most elevated global cooperation.

Siamaki et al. (2014) in an analysis on collaboration and co-authorship patterns in library and information science concentrates in Iran between the years 2005-2009. All out 942 articles were distributed in Iranian library and information science journals during the examination time frame out of which 506 (53.70%) articles were distributed by single authors and 436 (46.30%) were collective between at least two authors. It found that the average collaboration coefficient was 0.23 during the time of the study. The most noteworthy collaboration coefficient was 1.92 writers per article was found in the year 2008. During the examination, it was discovered that the national journal of librarianship and information organization has a high level among all the journals during the investigation.

Heidari and Safavi (2013) conducted a study for the collaborative coefficient of articles distributed in the Iranian Journal of pathology during 2006-2012. It was

discovered that an absolute of 288 articles with 1078 authors were distributed during the time of the study. The normal number of the author was  $3.75 \pm 1.65$  and the highest articles were composed by three writers. The collaboration coefficient was higher in the year 2008 and the average cooperation coefficient was 0.69 during the examination. It found that the joint effort design was high during the examination time frame.

Heydari and Safavi (2012) analyzed the collaborative coefficient of article writers in the journal of exploration in clinical sciences from 2007 to 2011. The investigation was a cross-sectional concentrate on the exploration society and it incorporated all the articles distributed during the examination time frame which was distributed in the journal of examination in clinical sciences. Complete 250 articles were distributed by the 1020 writers and the average number of writers for each article was  $4.08 \pm 1.94$ . From the absolute creator, female creators were 35.39% during the investigation. The average collaborative coefficient was 0.71.

Jena et al. (2012) carried out the study on seven volumes of the Electronic library published during the years 2003 to 2009 collected from Emerald management Extra (EMX) that constituted 42 issues and a total number of 417 articles with 7442 citations. The study analyzed bibliographical forms, types of articles, authorship patterns, the geographical distribution of contributors, chronological distribution of citations, and length of articles and ranking of journals. Concerning authorship pattern, the single-authored articles are highest (47.24%) followed by joint authored articles (34.72%) These two categories constitute 82.01% which shows that the contributors are keen on writing articles individually or jointly as a choice. As per Bradford's law of scattering, it is observed that 18 journals are core journals that are mainly used by researchers.

Savanur and Srikanth (2010) characterize collaborative coefficient which was another estimation for estimating level collaboration in the field of research. In this research, they proposed a basic alteration of the collaboration coefficient which was

modified collaboration coefficient co-efficient, and examine numerous numerical estimations for collaboration coefficient. It likewise proposed that whenever modified collaboration coefficient watches out for 1 then the level of cooperation gets greatest and collaboration is 100%.

Halder and Suvra (2009) evaluated the publications of *the IASLIC bulletin* published during 2003 - 2007. The volumes 48-52 having 20 issues were taken into consideration for the study. A total of 126 publications were taken where it was observed that the highest 28 publications were published in volumes 49 and 50 each. The lowest 22 publications were found in volume 52. From the total 126 publications, the single-authored contribution was 73, two authored publications were 40, three authored publications were 10, and only 3 publications were contributed by more than three authors. All the volumes have appended a total 1086 of references. Out of which volume 50 appended the maximum number of references and volume 52 appended the minimum number of references.

Gupta and Karisiddappa (2004) conducted a study on collaborative research in theoretical population genetics during 1901- 1980. The study was conducted on a total of 7,877 publications, where it was found that single-authored publications were highest with 5,476(69.51%) publications followed by double authored publications with 1816 publications and triple authored publications with 443 publications. Lotka's law and two additional statistical prospect distributions situation was also exposed. The significant collaborative publications in this area as a fraction of the total contribution indicated systematic growth through time.

Koganuramath et al. (2002) conducted a bibliometric study of 663 papers distributed by the social scientist of Tata Institute of Social Sciences during 1990-2000 in different domains in the social sciences were examined for authorship pattern and collaboration. The outcomes demonstrate that the collaborative co-efficient of 613 single-authored publications was 92.46 percent, trailed by double authored publications having 6.33 percent (42 publications). The highest collaborative coefficient (0.13) was observed during 1996-1997. The most contributed authors

were: Murli Desai, Sarthy Acharya, Lakshmi Lingam, I.U.B. Reddy, Kailash, Shalini Bharat, and Chhaya Datar. The top journals that contributed to TISS papers were: Indian Journal of Social Work having 98 publications, followed by Economic and Political Weekly having 26 publications, Perspective of Social work having 7 publications, and All India Institute of Local Self Government having 5 publications.

## **2.6 Single journal bibliometric and scientometric studies**

Thangamani and Planiappan (2018) led a study entitled “A Bibliometric Analysis of the Journal “Scientometrics” (2008-2017): A Study based on Web of Science”. During the study of ten years, it was observed that a total of 2814 literature were published from the source journal. The year-wise publication growth was in increasing order. Maximum of the publications were contributed by two authors. 'Glanze W' was identified as the most prolific author. The collaboration among the contributors was found to be high. In document-wise distribution, articles were found to be highest and China is the leading contributor. The Katholieke University Leuven contributed the highest number of publications having 112 (4%) publications out of total publications. The word 'Science' was found most repeatedly occurred word in the journal.

Vijayakumar and Gomathi (2018) did a study on The Journal of Chemical Science publication output, for purpose of study, data were collected from the database of Web of Science from the year 2010 to 2014. A total of 1421 articles were collected and has been observed that the highest number of 329 (23.15%) articles were published in 2014 and the lowest number of 247(18.79%) articles were published in the year 2011. It is also found that out of total publications, 272 publications were more than ten authored publications. There are a total of 913 authors who contributed 1421 articles within the period of study. 'Sokhna C' has been recognized as the most prolific author has 14 publications and 321 global citation scores. In the geographical distribution, the USA has contributed the highest number of contributions having 399 (28.1%) in the source journal.

Yadav et al. (2018) conducted a bibliometric analysis of the 'Library Philosophy and Practice' during the year 2008-2017. They observed that a total of 1478 pieces of literature were published during the period of study. Out of total publications, 197 (13.33%) publications were published in the year 2011, which recorded the highest publication of any particular year during the study period. The annual growth of publication was observed as both positive and negative. The lowest growth rate was recorded in the year 2017 with a growth rate of 39.86%, followed by in the year 2011 with 26.28%. The mean annual growth was observed as 77(15.17%). A total of 1478 papers were written by 2791 authors' contributions. Single authored papers were dominating over others having the highest 580(39.24%) papers, followed by two authored papers having 574 (38.84%) papers. The average degree of collaboration was observed as 0.61 during the period of study. Lotka's law applied and verified for testing of authors' productivity of the source journal. In the geographical distribution of contribution, Nigeria identified as the highest contributed country having 630 (42.23%) publications, followed by India having 360(24.13%) publications. A total of 34907 references were appended in 1478 articles in which the highest number of 5619 references were observed in the year 2017 in 193 articles. 824 articles appended less than 20 references and 468 articles appended 21-40 references which have been accepted as standard reference patterns used by the source journal.

Gogoi and Barooah (2016) have examined 3058 literature published in Indian Journal of Chemistry, Section B for the year 2013, 12 issues of volume 52b were considered for the study. The data was collected from the Indian Journal of Chemistry, Section B, and all the issues of volume 52b. In March, the highest 331(10.82%) publications were published and least 164(5.36%) publications were published in December. The authorship pattern of citations signifies that two authored contributions have highly appeared with the maximum number of 704 (23.02%) articles. It was observed that 2880(94.18%) publications were from outside India and only 178(5.82%) publications were published from India. Journals are the most used reference source with 2794(91.37%) records used in their scholarly work. 50% of total citations were distributed in the years 2000 to 2009 having 1538 records. The journal 'Tetrahedron Lett' was recognized as the utmost cited journal



with 237(8.48%) records. Bradford's law of scattering has been applied and verified. Ranking of the top-cited Indian journals listed, in which 'Indian J Chem, Section B' has ranked in the top position with 119(72.56%) records.

Rajev and Joseph (2016) have conducted a study entitled 'A Bibliometric Analysis on Malaysian Journal of Library and Information Science'. The duration of the study was from 2007 to 2013. It was observed that an average of 20.30 articles was published per year and the growth of publications was tremendously increasing. Most of the journal articles were having 11-20 pages. Seeing the Range of references per article it was found that the highest 30 and lowest 10 references appended in the article. A maximum of the articles was contributed under the subject group 'Information Seeking Behavior of the User'. Two authored papers were dominating over others. Malaysian researchers have actively contributed to the MJLIS. The mainstream contributors are professionals and scholars of the Library and Information Science field.

Krishnan and Raja (2015) investigated the scholarly articles distributed in the 'Journal of Optics' during the period 2007-2013. It was found that a total of 254 publications was published. The maximum number of articles published was 43(17%) in the year 2012 and the minimum number of articles published was 24(10%) in the year 2010. The growth of literature was varying over time. The relative growth rate and doubling time were observed as 0.693 and 1 respectively. The study shows that the relative growth rate has been reduced from 3.526 to 0.693 and the doubling time has been augmented from 0.196 to 1. The authorship pattern replicates that three author's articles were dominating having 71(28%) articles and two authors' articles having 55(22%) articles out of a total number of articles. The degree of collaboration was observed between the range from 0.840 to 0.892 and the average degree of collaboration value was 0.866. The steady increase in collaboration shows the commonness of group effort between the authors. In the reference distribution, it was found that articles were highly (42.4%) appended in reference followed by books having 32.9% and conference proceedings having 9.3%.

Tezpur University secured the place the most contributed institution having 26 (17.1%) contributions in the journal of Optics.

Khan (2015) displayed the outcomes that signify the publication pattern of articles published in Annals of Library and Information Studies from the year 2004 to 2013. The data were collected from the journal website. There are ten volumes of forty issues, each volume having four issues that have been taken for analysis. A total of 323 articles founded, out of which the highest 43(13.31%) articles were published in the year 2010 and the lowest 22(6.81%) articles were published in the year 2004. The average publication per year was 32 articles. In document type-wise distribution highest contribution was research articles having 93.81%. It shows that the journal provides a maximum preference for scholarly research articles. In the authorship pattern, it was observed that collaborative authors' contributions were highest in ALIS with the frequency of 203(37.15%) contributions, whereas single author contribution is 120 (37.15%). Geographical distributions signified that out of total contribution, 282(87.31%) publications were contributed from India, and a few 41(12.69%) contributions were contributed from the rest of the world. Journals were highly used as citation sources by the contributors having the highest citations 3300(58.28%). Length of the publications shows that the maximum of the articles was having a page length range of 6-10 pages.

Verma et.al (2015) analyzed the publications of Library Philosophy and Practice (e-journal) for the period 2005 to 2014. A total of 1177 papers were analyzed during the study period. According to him "The highest number of 198(17.00%) articles were published in 2011 and the least number of 35(3.00%) papers were published in 2006. The progress of publications was increasing consistently. Nearly half of the total publications were contributed by single authors with 568(48%) counts, followed by two authors were contributed 421(36%) articles, three authors were contributed 152(13%) papers and more than three authors were contributed 36(3%) papers. The authorship pattern shows the least trend of collaboration among the authors in Library Philosophy and Practice. The degree of collaboration has determined the range from 0.21 to 0.59. The average degree of collaboration has been calculated as

0.51. The highest number of 175 papers were published subject belongs to 'Library Services' which the subject placed in the first rank, followed by 132 articles belongs to 'Acquisition & Collection development' which the subject ranked in the second position. Country-wise distributions show that the major contributed countries to Library Philosophy and Practice wherein Nigeria has recognized the dominant country to highly contributed with 433(37%) papers, followed by India has contributed with 267(23%) papers".

John and Saravanan (2014) analyzed a scientometric study on the journal 'Digital Investigation'. It was found that 568 articles were published during the study period. There were 5748 citations received in the study time. The relative growth rate was observed as 0.36 during the first half and reduced to 0.15 during the last half period. The doubling time was observed at 2.00 in the first half and 4.49 in the last half period. The degree of collaboration was found as 0.46. The h-index score was detected as 39 and the g-index score was 59.

Mamdapur et.al (2013) has conducted a scientometric study of college and research libraries from 1997 to 2011 and observed that contributions of articles to each volume of the source journal are approximately steady having an average of 32 articles published each year. Single authored articles were dominating over the double and multi-authored paper. The mean degree of collaboration was found to be 0.57 and the average author per article was found to be 1.88 for 479 papers. Lotka's law was tested and confers the value of  $n=3.22$ . A total of 12893 citations have been appended in 479 papers during the period of study. Journals (59.95 percent) were the top form of reference sources used by contributors followed by books (17.32%), webpages (7.44%), and reports (3.95%). Deborah D Blecic and Stephen E Wiberley have jointly topped the ranked list of most prolific authors having 6 articles each. The source journal College & Research Libraries has topped the list of journals having 1311(16.96%) citations. In geographical distribution, the USA has contributed the highest number of publications having 93.24% followed by Canada and China.

Panda et. al. (2013) in their published article entitled 'The Journal of Information Literacy: a bibliometric study' found that 131 articles were published during their study period from 2007-2012. The findings showed that there has been observed a variation in the publication growth. Single author publications were dominating over multiple authors. During the citation analysis, it was found that a total number of 1627 citations were appended in the 131 publications and the average citations per publication were 12. In the case of page-wise distribution highest (47.32%), publications were having a page range from 1-5. The highest (71.75%) publications were contributed from 'UK'. Leading publications were articles and research studies followed by book reviews, conference proceedings, and projects.

Rattan and Gupta (2012) analyzed the research productivity of the journal 'Malaysian Journal of Library and Information Science' during 2007-2011. The research was primarily based on the author's collaboration, number of literature published, topographical scattering of authors, the arrangement of references, etc. The outcomes displayed that there is a growing trend globally in the research output and the mainstream of the publications were from Malaysia. The study indicated that out of a total of 100 publications, single authors' contributions were 27 (27%) while the remaining 73 (73%) publications were from joint authors. It was found that a maximum number of the contributors were from Malaysia. The highest no of references was appended from journal articles having 62.54% of the total references appended. The most prolific author A. N. Zainab has contributed the highest number of 13 articles. Total 2894 references were appended by 100 authors for their publications in this journal.

Deshmukh (2011) conducted research on *Annals of Library and Information Studies* during 1997- 2010. A total of total 326 publications were collected for the study, where it was found that a total number of 4141 citations were received from 1997 to 2010. Out of this, 54.34% of citations are from journals, 17.47% are from books, 12.25% are from web resources. The study demonstrates that the number of citations was growing from later to the early period. It was also observed that the journal half-life period was 9.

Verma et al. (2007) analyzed 131 publications in *Annals of Library & Information Studies* published during 1999-2005. They have examined year-wise publications, institution-wise, state-wise distribution of publications, authorship pattern-wise distribution, citation analysis, and length of the publications, etc., and found that the maximum of the publications of the journal is a single author contribution. In state-wise distribution, it was observed that the highest no of publications was from New Delhi. Total 1456 citations were received from 131 publications and observed that journal articles were the most cited documents, *Annals of Library and Information Studies* is the journal that has received the highest number of citations.

Mete and Deshmukh (1996) conducted a citation analysis of the journal *Annals of Library Science and Documentation* during 1984-1993. They found that a total of 1824 citations were received from 202 articles published during the study and the journal articles are the most cited documents. The journal ALIS has got the highest number of citations. The half-life of Library and information science literature was calculated to be 8 and 12 years for journals and books respectively.

## **2.7 Global bibliometric and scientometric studies**

Sweileh et al. (2017) have studied the worldwide research output of mobile health during the period 2006- 2016. The data were obtained from the Scopus database for the study. VOS viewer visualization software was used for data visualization. Different bibliometric indicators were used to analyze Publications growth, citation analysis, and research productivity. A total of 5465 documents were analyzed, where it was observed that the highest 76.7% publications were research articles followed by document types were review articles with 9.6% of publications. The average publication per year was observed as 496 during the period of study. The highest 1095(20.0%) publications were published in the year 2016 and the lowest 155(2.8%) publications were published in the year 2006. The analysis visibly shows that the growth of publications has increased during the period of study. The maximum number of citations per paper was published in the year 2009 with 21.2 citations per document and minimum citations per paper was published in the year 2016 with 0.8

citations per document. The yearly growth rate had dropped from 0.8 to 0.2 and the doubling time has been improved from 0.9 to 3.5. The RGR and DT showed the exponential growth of m-health publications. It was observed that 4638(84.95%) publications were contributed collaboratively and only 827(15.1%) publications were contributed by single authors. The authorship pattern indicates that the occurrence of group research or degree of research cooperation among the contributors. Geographical scattering of publications tells that 'USA' has recognized as a most prolific country with 1926(35.2%) records followed by the UK and Australia. Journals with the lowest productivity having 20 publications were listed where 'Journal of Medical Internet Research' got first place with 193(3.5%) contributions on m-health research.

Zafrunnisha and Sunil (2017) carried out a bibliometric analysis of the International Journal of Library and Information Studies. They have collected the data from Ulrich's Periodical Directory. It was observed that there were 23 (53.49%) articles published by two authorship mode and was dominating over others whereas single-authored papers were only 14(32.56%). Most of the references were appended from journal articles having 199 (52.93%) citations followed by website links having 41(10.90%) citations, books having 37 (9.84%) citations, seminar/conference proceedings having 22(5.85%) citations, e-resources having 21 (5.59%) citations and some other sources have appended less than 5%. Out of the total citations, 99(49.75%) citations were from single-authored papers. The degree of collaboration has observed as 0.50 and the mean number of authors per paper was 1.71. Annals of Library and Information Studies have greatly counted in as a citation source having 25 citations in the International Journal of Library and Information Studies. Distribution of citation analysis based on Subject-category presented that the highest number of 171(85.93%) citations was appended from the subject library and information science followed by the subject computer science having 7(3.52%) citations and from others it was less than 5 citations. According to geographical distribution, India got the top rank produced with 85(42.71%) cited journal followed by the UK in second place with 42(21.11%) cited journal and the USA with 34(17.09%). The rest of the world produced less than 15% of the cited journal.

Ji et al. (2014) in their article "A bibliometric analysis of research on Antarctica during 1993-2012" considered the yearly distribution growth, cited reference, number of authors per article, number of references, worldwide collaboration, geological dispersion, top 25 most contributed nations and top 25 authors keywords. The study observed that research in the Antarctic has been consistent development and dynamic cooperation, with the number of articles and references, has expanded. An aggregate of 137 nations have been added to Antarctica research, among these all out nations the USA has been distinguished as the most productive country on the planet. The keyword analysis shows that the pattern of the most active research area in Antarctica.

Tella and Aisha (2014) studied the productivity output of 'African Journal of Library, Archives and Information Science' within a period of 13 years from 2000 to 2012. For the analysis, 218 articles were considered. It was observed that the highest number of 21(9.63%) publications were published in the year 2002 and the lowest number of 13(5.96%) articles were published in each of the years 2011 and 2012. There has been a variation occurred in the growth of publication during the period of study. It was observed that sing authored publications were dominating over others with a total of 126(57.8%). The topic 'Information Retrieval' has been identified as the top researched topic in the source journal having 31(14.2%) publications. The maximum of the publications in the source journal seemed the length of a page from 6 to 10 pages in 86(39.4%) publications. There were 3645 citations were identified from 218 articles during the period of study, out of total citations, the highest number of 451(12.3%) citations have observed in the year 2009 and the lowest number of 113(3.10%) citations have observed in the year 2001. Regarding the distribution of publications, it was found that the highest 108(49.5%) publications were theoretical publications. The bibliographic arrangement of the cited works tells that journal is the most prominent form having 1512(42.2%) publications used the journal as the cited source. Status of authors listed based on their productivity, where M.A.Tiamiyu and A.A.Ojedokun identified as the most prolific authors having 6 publications of each and 'Nigeria' ranked in the top position with 44.3% of the total output.

Lv. et al. (2011) have studied the bibliometric trend analysis in global graphene research. The data for the purpose were collected from different Index databases maintained by Thomson Reuter from 1991 to 2010. This paper shows that the maximum documents were in the form of journal articles with 7523(86.20%) followed by conference proceedings papers with 626(7.17%). The progress of graphene research publications quickly increased from 1991 to 2010. The papers which were cited more than 100 times were listed for the study. The occurrence of Keywords analysis shows that the word 'graphene' became the most used keyword which is present in 3330 (36.30%) publications followed by 'carbon nanotubes' present in 3033 (36.30%) publications. The number of contributors' affiliations showed that 740 (67.27%) conference proceeding publications were contributed by the same organization. It is recognized that graphene research has mainly belonged to the subject Physics and material science.

Tsay and Shu (2011) examined the bibliometric characteristic of the *Journal of documentation* in their article. The data were collected from references of each article of *Journal of Documentation* during 1998 and 2008. They observed that "there were 354 papers with total 14,174 references in 11 selected years and the average number of references cited was 40 per issue. This study revealed that journal articles were the most cited documents followed by books and book chapters, electronic resources, and conference proceedings. The three main classes of cited journals in *Journal of Documentation* papers are library science, science, and social science. The three highly cited subjects of library and Information science journals encompass searching, information work and online information retrieval”.

Anwar (1999) conducted a study of 251 items contributed by 64 Pakistani LIS professionals retrieved from *LISA-PLUS*. According to him “The works of seven foreign collaborated authors were excluded from the analysis. Out of 64 librarians, only five (7.8%) are females who contributed only 12 items. Among 251 writings, LIS Education and manpower, IT applications received the most citations. Topics such as resource sharing, standards, collection evaluation, information needs, and



library education received very little attention. Of the 251 items 24 consist of papers in conference proceedings, 5 book parts, 3 theses, 5 books. 56.8 % of the journal literature is claimed by the *Pakistan Library Bulletin*. Very limited collaboration is found between Pakistani and foreign writers”.

## **2.8 Studies based on co-citation, co-word analysis, and visualization**

Aibar, L.F. et.al (2019) conducted a study “A Bibliometric and Visualization Analysis of Socially Responsible Funds” During 1988-2018. The study was conducted on 209 research articles retrieved from two databases Scopus and web of science. They visualize the data using VOS viewer software. The study found that in co-citation network analysis of authors, the highly co-cited authors in terms of citation and total link strength are Bauer, Statman, otten Koedik. The top-cited journals were the Journal of Business Ethics and the Journal of Finance. The most common fields publishing topics related to socially responsible funds were “Economics, Econometrics and Finance” in Scopus and “Business and Finance” in WOS.

Sevukan and Sankar (2019) suitably reported the result of their study “Application of author bibliographic coupling analysis and author keywords ranking in identifying research fronts of Indian Neurosciences research.” According to them “It was found that the research on ‘Epilepsy’ and ‘Parkinson’s disease was highly productive with high growth rate. Research in the field of ‘Depression’, though became prominent in recent years it was found to have a high growth rate. Findings also hinted at a substantial increase in the two other research areas namely Schizophrenia and Tremor. Dementia and Tremor were found to correspond to neuroscience disorders with a high incidence rate in India. The study's findings not limited to the above are worth considering while framing national level mental health policies to enhance neuroscience research quality and neurological health care system in India.”

Wanying, Jin, & Kun (2018) in their study discovered the relations among the various ranking metrics, that includes one frequency-based and six network-based metrics, to comprehend the impact of network structural design on ranking themes on co-word networks. And also claimed that coreness is ideal for classifying keywords.

Xi Y. et.al (2017) in their study “Bibliometrics of social media research: A co-citation and co-word analysis” states that "A total of 406 publications related to social media between 2007 and 2016 were identified from 16 business and hospitality/tourism journals. Co-citation analysis identified Word-of-Mouth as the major theoretical foundation of social media research in business, while the hospitality/tourism field presented a diverse theoretical foundation. The study then employed co-word analysis to identify the evolution of research themes over time in both fields. The comparison of social media research between the two fields highlighted four similarities, including the growth of research over time, the term "social media" gaining popularity, the new trend of social networking sites, and managerial applications as a research focus. Finally, the study called for a future research agenda on social media research in the hospitality/tourism field."

## **2.9 Conclusion**

Documents on different disciplines of metrics studies in the field of library and information science were conducted in this chapter. It was found from the review that the number of records considered for the studies has grown exponentially. Early studies found single authors to be dominating the research scene while recent studies found co-authored papers to dominate different literature. A total of 50 documents in the field of scientometrics and bibliometrics was reviewed from different sources. It was observed that a lot of studies were done on different journals and sources journals also but up to the latest year, there was no study on source journals. For most of the studies, bibliographic databases Scopus and Web of science were used to retrieve the bibliographic data.

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**CHAPTER 3**  
**OPEN ACCESS INITIATIVES**

*“As more and more people reach the Internet by mobile phone, we should make sure users are getting the open access they believe they're paying for.”*

*Chellie Pingree*

### **3.1 Introduction**

The concept of open access (OA) that opened new dimensions in the information communication cycle has been widely accepted all over the world. Open access, which provides free access to the information content. When Internet has come into our life, continuously it has started to make deviations in every facet of our society and redesigns scholarly communication in many different ways. According to Chan (2004) “scholarly communication and publishing are gradually taking place in the electronic environment. With a growing proposition of the scholarly record now existing only in digital format, serious and pressing issues regarding access and preservation are being raised that are central to future scholarship.” On the other hand, “the exponential growth of scholarly literature has put a severe hindrance on their accessibility, and the libraries, particularly in developing countries are vexed with the problem of providing access to the vast amount of literature. In addition, the increase in the prices of academic journals by their publishers has posed a major threat to libraries that support academic researcher's research activities.” Now a days maximum journals are publishing in electronically and are indexing in various databases. Due to subscription use, librarians and researchers' are facing problems in licensing and access of the materials. Therefore in the words of Ramachandran (2004) ”even though the bundling includes a very large number of indifferent and low-impact journals, institutions around the world, including many in India, have entered into such agreements to gain access to a large number of journals. But the price rise in these bundling schemes seems to have outpaced inflation.”

“The global research communication and dissemination system has been transforming with the coming of the Open Access (OA) movement. It is the most vital component of the research lifecycle. In the recent past, the most common

method of scholarly communication was the write-up of the findings of research works in books or articles published in journals. But with the advent of the Internet and other ICT applications, there is a major shift of scholarly communication from books and published articles to open access journals. The world today is witnessing a substantial increase in scholarly communication and scientific publications mainly occur due to the advances of new technologies and the internet. The advent of the Internet and electronic publishing has resulted in unprecedented possibilities for the dissemination and exchange of information.” (Kanjilal, 2015).

The term “Open Access” was first initiated by Budapest Open Access Initiatives (BOAI). “The Bethesda Statement on Open Access Publishing” and “the Berlin Declaration on Open Access to knowledge” are the two leading statements in the Science and Humanities.

The expansion of online open access journals in different disciplines is clear from different online catalogs and the Directory of Open Access Journal is perhaps the most famous online directory among the different online indexes. In 2003, the DOAJ was started at Lund University, Sweden with an expectation to build the visibility and simplicity of utilizing logical and insightful journals at open access, in this manner advancing their expanded use and effect.

### **3.2 Open Access: Meaning and Definitions**

According to Budapest Open Access Initiatives (BOAI) "Open access, it implies free accessibility on the public Internet, allowing any clients to peruse, download, duplicate, disperse, print, search, or connection to the full information of these articles, slither them for ordering, pass them as information to programming, or use them for some other legal reason, without monetary, lawful, or specialized boundaries other than those indivisible from accessing the actual Internet."

Harnad (2008) has portrayed open access (OA) as, "Data, which is free, quick, perpetual, full-text, on-line and available". He proposes three primary 27 avocations of open access: "to expand the take-up, utilization, applications and effect of the research yield of the university; to quantify and compensate the take-up, use, applications and effect of the examination yield of the university (research measurements) and; to gather, oversee and exhibit a perpetual record of the exploration yield and effect of the university".

Suber (2010) portrays, "Open-access writing is advanced, on the web, complimentary, and liberated from most copyright and permitting limitations". Suber likewise expresses that "open access substances are not confined distinctly to peer-reviewed research articles; they can be in any designs from writings and information to programming, sound, video, and multi-media. Albeit the OA development centers around peer-reviewed research articles and their preprints, OA can likewise apply to non-insightful content, similar to music, films, and books, regardless of whether these are not the focal point of most OA activists."

### **3.3 Emergence and development of Open Access Initiatives**

"The empowering data and correspondence advancements (ICTs) just as the baffling Journal costs have provoked the academic local area to devise an elective academic distributing framework whose point is to accomplish a more extensive circulation of academic substance without cost or other copyright limitations to end clients. The arising scholarly communication model is known as open access." (Dulle et al., 2010). In the first decade of the 21st century, numerous events denoted the rise of OA publications as a significant method of scholarly communications. For OA developments numerous partners approached the institutions. A portion of the establishments that arose during this decade is to be specific, Public Library of Science (PLOS), Bio Med Central (BMC) – distributors of friend audited OA journals, "the Scholarly Publishing and Academic Resources Coalition (SPARC)", and "Open Access Academic Publishers Association (OASPA)." In particular, "the

Budapest, Berlin, and Bethesda (BBB) OA presentations or explanations got endorsed by the academic networks, especially by the financing organizations, research committees, learned societies, foundations, universities, and researchers for the OA spread of public subsidized exploration.” (Kaur and Chia, 2009).

### ***3.3.1 Budapest Open Access Initiatives (BOAI)***

In December 2001, the Open Society Institute (OSI) assembled a gathering in Budapest, to examine approaches to quicken progress in the worldwide exertion to make research articles in all scholastic fields openly accessible on the Internet. In this meeting, the members addressed numerous perspectives and had insight into large numbers of the progressing activities that make up the open-access development. They investigated the most viable and reasonable methodologies for serving the interests of exploration, analysts, and the establishments and social orders that help research. The outcome is the Budapest Open Access Initiative. Budapest Open Access Initiatives (BOAI) was the first to utilize the term "open access". By open access it implies free accessibility on the public Internet, allowing any clients to peruse, download, duplicate, circulate, print, search, or associate without limit writings of these articles, slither them for ordering, pass them as information to software, or use them for some other legitimate reason, without monetary, lawful, or specialized boundaries other than those indivisible from accessing the actual Internet. The lone imperative on generation and appropriation, and the solitary job for copyright in this space, ought to be to give creators power over the trustworthiness of their work and the option to be appropriately recognized and referred to (BOAI).

**Budapest Open Access Initiative**

**Home**  
**BOAI15**  
[Toward the Internet of the Mind](#)  
**BOAI10**  
[Translations](#)  
**Background**  
[Read the original BOAI declaration](#)  
[Translations](#)  
[FAQ](#)  
[View signatures](#)  
[Sign the the original BOAI](#)  
**BOAI Forum**  
**Resources**  
[What you can do to help](#)  
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**Budapest Open Access Initiative**

In response to the growing demand to make research free and available to anyone with a computer and an internet connection, a diverse coalition has issued [new guidelines](#) that could usher in huge advances in the sciences, medicine, and health.

The recommendations were developed by [leaders of the Open Access movement](#), which has worked for the past decade to provide the public with unrestricted, free access to scholarly research—much of which is publicly funded. Making the research publicly available to everyone—free of charge and without most copyright and licensing restrictions—will accelerate scientific research efforts and allow authors to reach a larger number of readers.

The recommendations are the result of a meeting organized by the Open Society Foundations to mark the [tenth anniversary](#) of [Budapest Open Access Initiative](#), which first defined Open Access. The recommendations include the development of Open Access policies in institutions of higher education and in funding agencies, the open licensing of scholarly works, the development of infrastructure such as Open Access repositories and creating standards of professional conduct for Open Access publishing. The recommendations also establish a new goal of achieving Open Access as the default method for distributing new peer-reviewed research in every field and in every country within ten years' time.

[Translations of the recommendations](#) have already been made in several languages, with more to follow.

For more on the recommendations, please see the [press release](#) as well as a [blog post](#) by Peter Suber which provides additional background on the Open Access movement.

**Figure-3.3.1: Budapest Open Access Initiatives (BOAI)**

(Source- <https://www.budapestopenaccessinitiative.org/>)

### 3.3.2 The Bethesda statement on Open Access publishing

A conference was held in the month of April 2003 at the Howard Hughes Medical Foundation in Chevy Chase, Maryland. It brought about the "Bethesda Statement on Open Access Publishing", which kept on advancing steady progress of open access publishing. The vital part of the Bethesda Statement says that “author(s) and copyright holder(s) grant(s) to all clients a free, permanent, around the world, ceaseless right of admittance to, also a permit to duplicate, use, convey, send and show the work openly and to make also, convey subordinate works, in any computerized mode for any dependable reason, A total form of the work what not supplemental materials, including a duplicate of the consent as expressed above, in a reasonable standard electronic organization is saved quickly upon beginning distribution, in any event, one online storehouse that is upheld by a scholastic establishment, academic culture, government office, or other grounded association that looks to empower open access, unlimited dispersion, interoperability, and long haul documenting.”



### ***3.3.3 The Berlin declaration (2003)***

In 2003, the Berlin revelation characterizes open access as a complete wellspring of human information and social legacy that has been affirmed by scientific researchers and expressed that "Our central goal of scattering information is possibly half complete if the data isn't made broadly and promptly accessible to society. Additional opportunities of information scattering through the traditional structure, as well as an inexorably through the open-access worldview using the Internet, must be upheld".

## **3.4 Ways of Open Access**

Open Access can be conveyed in the following three ways:

### ***3.4.1 Open Access publishing (Gold Road)***

The Open Access publication implies that creators publish their articles in journals that are full content, peer-looked into however are open access for users. Their expenses are shrouded in a distinctive path from conventional journals, generally through publication charges. These expenses can be covered by research awards or from the contributors' organizations. This sort of distribution is offered by open access journals and by "half breed" journals. It guarantees that articles are quickly accessible in open access mode when they are online. Open access publication is likewise called Gold Road Open Access. Open access publication, the end-users aren't charged to get too academic substance. All things being equal, different subsidizing methodologies, for example, direct creator charges, institutional participation to support all or a piece of creator charges, financing organization of creator expenses, awards to open access distributors, and institutional sponsorships are utilized to take care of the expenses for distribution and dissemination of OA content with the expectation of complimentary access by the end-users.

### **3.4.2 Self Archiving (Green Road)**

“In 1994, OA self-archiving was officially suggested by Stevan Harnad. Though, self-archiving was previously being completed by computer scientists in their native FTP archives in the ‘80s, far along harvested into *Citeseer*. High-energy scientists were self-archiving in *arXiv* ever since 1991. Open archive self-archiving states to self-depositing, the knowledge that writers make their study productivities accessible by dispensing a free of cost online form to an institutional repository. The repositories are digital archives, which are generally managed by libraries.” (Nashipudi & Ravi, 2015).

### **3.4.3 Hybrid road**

It is also from time to time called Paid Open Access, which denotes subscription journals with open access to specific literature generally when a cost is paid to the issuer or journal by the writer, the author's group, or the study funder. “Several universities or public libraries have funding offered for hybrid journal periodicals or occasionally funding is inscribed into grant requests for open access in hybrid periodicals, however, these are not mutual instances. Several examples of hybrid open access are Open Access by Taylor & Francis, Online Open by Wiley, or Sage Open by Sage. For the complete list one can visit Issuers with paid choices for Open Access from SHERPA/RoMEO.” (Joshi et al., 2012).

## **3.5 Characteristics & advantages of Open Access**

"Open Access" has begun in recent years as a foremost development in the world of academic communication. It may have the prospective to significantly change the publishing environment and change the traditions in which everybody accesses research documents, mainly academic journals. This section will take a look at the characteristics of Open Access (or OA) as well as the advantages of open access. The characteristics and advantages of open access are given below:

### ***3.5.1 Characteristics of Open Access***

1. Academic periodicals are freely available and accessible online through the Internet.
2. Academic publications can be freely accumulated by the researcher for review of related literature.
3. Better visibility and user-friendliness, and thus influence the scholarly effort.
4. It is unrestricted from the copyright and licensing limitations.
5. Highly effective archiving and accessibility of scholarly research.

### ***3.5.2 Advantages of Open Access***

The main advantage of open access is that the documents are accessible to users from anywhere irrespective of affiliation with a subscribed organization. Some of the advantages are pointed below:

1. Extensive open access could make it possible to eradicate duplication of research works.
2. Open access could escalate public responsibility.
3. Open access upsurges teamwork of investigators worldwide.
4. Open access could create meta-analyses of outcomes much simply.
5. Open access de-fragments science works because it is creating seamless, comprehensive searching possible.
6. It could make fast understanding of unresolved scientific questions.
7. Open access ends the gaps to access knowledge, allowing all investigators to try and see the complete representation.
8. Open access facilitates building databases and knowledge-bases, efficiently and competently to re-use distributed outcomes to make to see the whole representation.

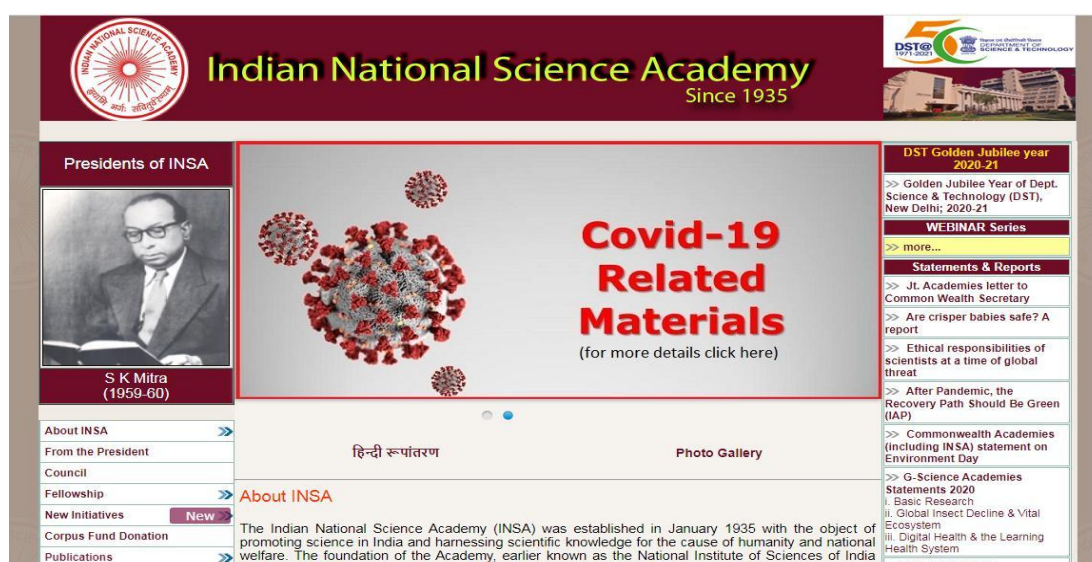
### **3.6 Open Access initiatives in India**

In India, less access to international periodicals and the truncated visibility of research publications are the main difficulties facing Indian scientists. Open Access is observed as an explanation to answer this. India's challenge is to respond to the information movement and to progress accessibility and thereby the effect of Indian

study. Rajshekar (2003) described that "India's challenge is to reciprocate the information flow and expand access and thereby the effect of Indian research. To meet this challenge and to create a national R&D resource base, an open-access method in line with the Budapest Open Access Initiative is being promoted." Many Indian R&D organizations, important scientific research organizations (such as Indian Institute of Science, IITs, ISI, organizations under the CSIR and Indian Council of Medical Research, etc.) are now participating in the open access movement by starting institutional and digital repositories to deliver universal access to their research publications. Numerous Indian publishers have now adopted the open-access idea for the electronic forms of their journals. Unlike certain open-access journals in other nations, in which contributors pay to publish their articles, Indian open-access journals adopt government contributions and subscriptions to their print form to cover publishing expenses. Some of the Indian initiatives are as follows:

### 3.6.1 Indian National Science Academy (INSA)

INSA a scientific school financed by the Government of India. It was founded in 1935. Presently, INSA published 3 prominent peer-reviewed journals, arranges conferences, and conveys out proceedings and monographs.



**Figure-3.6.1: Indian National Science Academy (INSA)**

(Source: www.insaindia.res.in)

### 3.6.2 The Indian Academy of Sciences (IAS)

IAS is a scientific school supported by the Government of India. It was founded in 1934 and now the School publishes science journals in numerous fields. All periodicals are open access and full-text writings are accessible in PDF form on the source journal's website. All the publications in the latest issues of those periodicals are born-digital. The Academy journals are collaboratively published with Springer and Nature since 2007 and 2015 respectively.

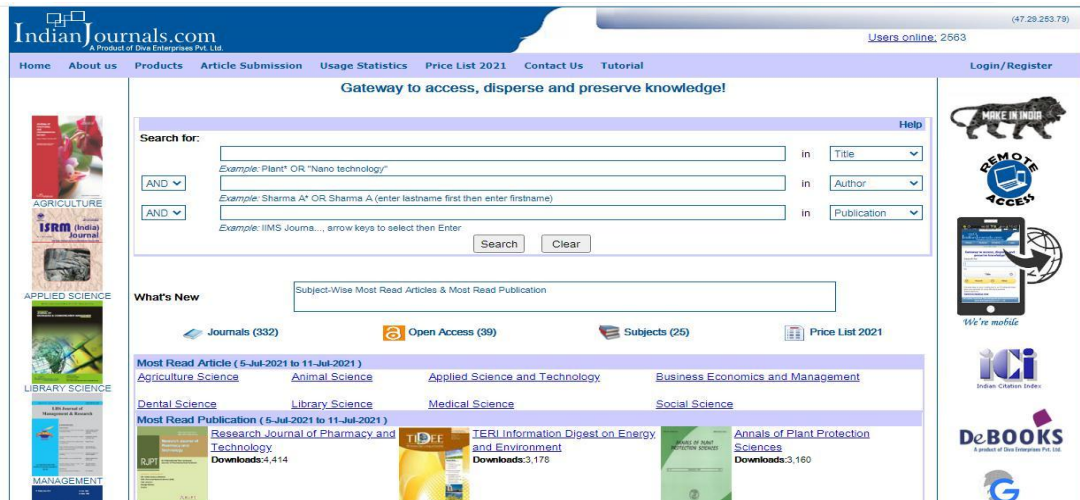
The screenshot displays the Indian Academy of Sciences website. The header includes the IAS logo and navigation links: HOME, ABOUT IAS, FELLOWSHIP, JOURNALS, PUBLICATIONS, INITIATIVES, and EVENTS. The main content area features a large blue banner for the "32ND MID YEAR MEETING 2021" held on 4, 11, 18, 25 June and 3 July. Below the banner, it lists activities for 2 July: a public lecture by Prof. Abhijit Banerjee, a symposium on pollinators and seed dispersers, and a panel discussion on academic freedom. To the right, a schedule lists talks from 14:00 to 15:55 h, including an introductory address by Ramesh M. Borges and K. R. Shivanna, and talks on reproductive biology, fruit crops, and gene flow. A section titled "ARTICLES REPOSITORY" lists recent articles of general interest authored by fellows and associates, updated on 12 July 2021. Social media icons for YouTube, Twitter, Facebook, and LinkedIn are also visible.

**Figure-3.6.2: The Indian Academy of Sciences (IAS)**

(Source: <https://www.ias.ac.in/>)

### 3.6.3 Indian Journals

It delivers single frame access to multidisciplinary Indian Journals issued by diverse academic groups and institutes. It offers accessibility to thirty-nine (39) open access journals and periodicals. This journal gateway furthermore makes it available to access paid-based content.



**Figure-3.6.3: Indian Journals**

(Source: <https://indianjournals.com>)

### 3.6.4 The Kamla-Raj Enterprises

It is a Delhi-originated publisher recognized in 1933. It has published more than 15 print peer-review academic journals specifically in the fields of humanities and they are also obtainable in electronically in open access environment.



**Figure-3.6.4: The Kamla-Raj Enterprises**

(Source: <http://www.krepublishers.com/KRE-New-J/>)

### 3.6.5 The Indian MEDLARS Centre

It has introduced two distinctive projects with funding from the Indian Council of Medical Research. The first one is **MEDIND@NIC** is an open access initiative of the National Informatics Centre that facilitates open access to 38 Indian biomedical journals which are full-text in nature. An additional project, **INDMED@NIC** that catalogues 100 biomedical journals of India since 1985. The INDMED bibliographic database is accessible online.

### 3.6.6 Medknow Publications Private Limited

It was originated by Wolters Kluwer in December 2011, is a publisher that provides free online access to good-quality peer-reviewed academic research journals in India, and was continuously growing its journal collection, spreading its publishing cooperation's with China, the Middle East, and other many developed markets. Nowadays, it offers publication facilities to over 489 medical journals in more than 40 special domains.

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Medknow provides publishing services for peer-reviewed, online and print-plus-online journals in medicine on behalf of learned societies and associations with a focus on emerging markets. With a promise to provide solutions for the scientific publishing community, Medknow's mission is to help medical societies disseminate research, thus supporting the transformation of research into knowledge. Medknow operates the Open access (OA) model of publishing services, providing unrestricted online access to peer-reviewed scholarly research. Medknow was acquired by Wolters Kluwer in December 2011, and has continued to grow its journal portfolio, extending its publishing partnerships in China, the Middle East, and other growth markets. Today, Medknow provides publishing services to over 400 medical society journals in over 40 specialties.

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*J Indian Soc Periodontol* 2021/25/4

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- Visit Manuscript submission site

#### Medknow statistically

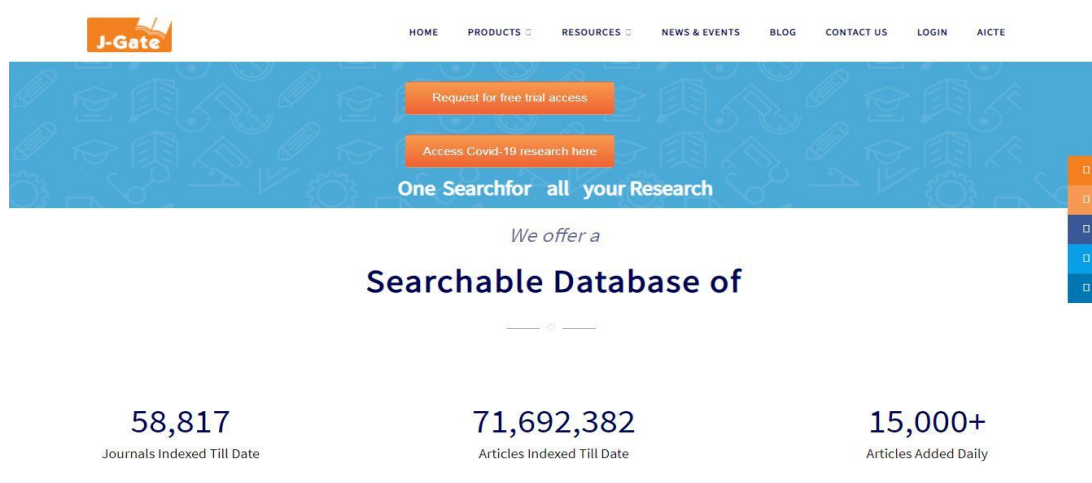
489	Total journals
451	Total associations / societies
286,096	Total articles
279,073	Full text articles

**Figure-3.6.5: Medknow Publications Private Limited**

(Source: <https://www.medknow.com/>)

### 3.6.7 J-Gate Informatics (India) Limited

It has started in 2001 by Informatics India Limited is an automated gateway to worldwide e-journal literature. . It helps in online subscription to journals, online document delivery services, storing, and other associated facilities. It offers continuous access to different journal articles present in web published by 58,817 Publishers. It currently has a huge database of journal publications, indexed from 71,692,382 e-journals connected to full text in publisher's websites.



**Figure-3.6.6: J-Gate Informatics (India) Limited**

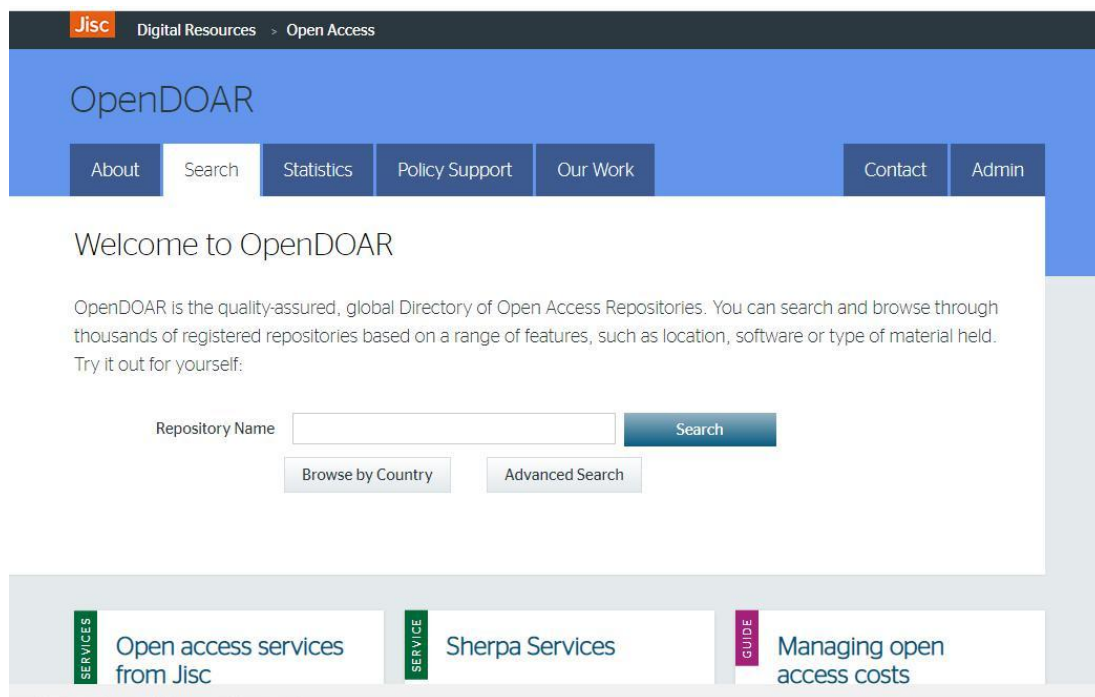
(Source: <https://jgateplus.com>)

### 3.7 Directory of open access repository

Directory of Open Access Repositories (DOAR) is a United Kingdom-based website run by the University of Nottingham and was developed jointly with Lund University. It has started its services in 2005 which lists academic open access repositories and can be searched by different aspects like Country, content, and other measures. It is the largest open-access directory that permits direct submission to the directory. In its database, it has included 5525 repositories (up to September 2020) from more than 30 countries. Whereas from United States of America 910 and India 98 repositories are included. Among all the repositories, maximum are in the English language (3692). Based on the subject, multidisciplinary subject repositories (3362)



are highest followed by Health and medicine (541). Dspace (39%) is the most preferred software platform followed by Eprints (11%) for the repositories.



**Figure-3.7 Directory of open access repository**

(Source: <https://v2.sherpa.ac.uk/opendoar/>)

### **3.7.1 Open Access institutional repositories in India**

The *e-prints repository* is the first institutional Repository was effectively employed in India managed by National Center for Science Information (NCSI). The repository includes research productivities by the Indian Institute of Science, IISc, Bangalore. The repository is managed by National Center for Science Information (NCSI. Another effort of IISc, is the “*ETD@IISc*” that contains institutes documents of theses and dissertations

*Librarian’s Digital Library (LDL)* is a digital library that archives and e-journals in the field of Library and Information Science. It also include *E-LIS* and *DLIST* can be accessed independently through INFLIBNET. Approximately 264 Universities, Colleges, and R&D Organisations are diagonally connected over National network of

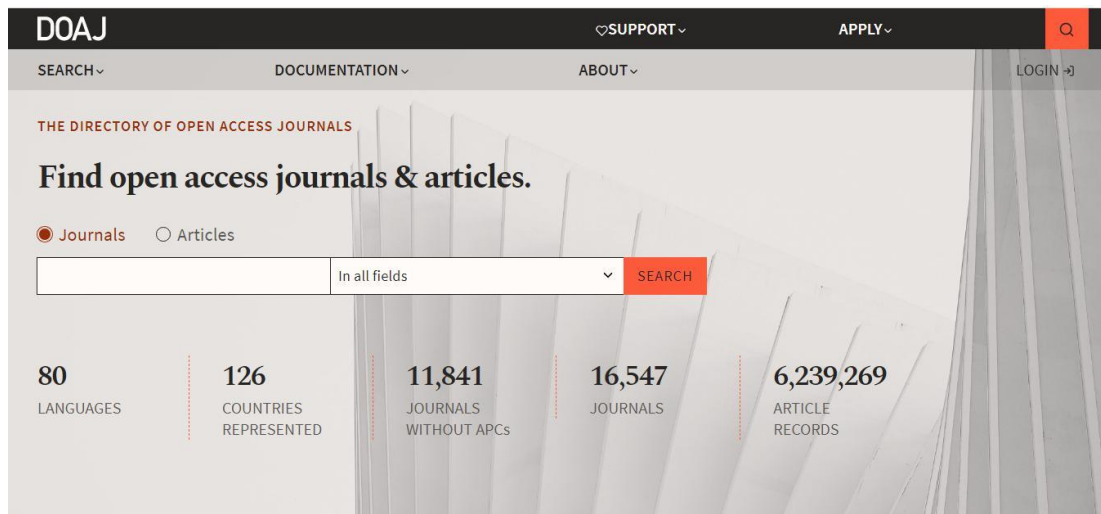
libraries through INFLIBNET to modernize the library. IR@INFLIBNET is an open access archive repository that archives publications, CALIBER and PLANNER conference proceedings, training content and other academic literature. Indian Medlars Centre (IMC) is another subject precise repository that provides information to the Indian Medical community.

### **3.8 Open Access journals**

“Open access journals deliver online access to full-text contents of academic, peer-reviewed journals. Open access journals are categorized in two different types - one, exists in electronic form only and the other exists in both electronic as well as print forms viz. Current Science journal. In the former type, the journals are published in consistent intervals on the web that does not publish any print-on-paper version. In the later type, the journals are published in both print-on-paper forms and disseminated to the users. Similar kinds of stuff of print-on-paper are available to the researchers free of cost in the online form.”(Chakravarty & Mahajan, 2011; Laksoo et al., 2011).

#### ***3.8.1 Directory of Open Access Journals (DOAJ)***

In 2002, the first Nordic Conference on academic communication was directed to the establishment of the Directory of Open Access Journals which was started in 2003 at Lund University, Sweden, by Lars Bjornshauge. DOAJ, a not-for-profit society managed by Organisation Services for Open Access C.I.C. (Community Interest Company) centered in the United Kingdom. The Directory of Open Access Journals is an online directory that offers accessibility to top-quality open access peer-reviewed journals. If any journal requests to get connected in DOAJ collection then the journal needs to get registered in DOAJ staff according to the Library of Congress Classification System. The journal is directly searchable and noticeable in DOAJ after registration.



**Figure-3.8: Directory of Open Access Journal (DOAJ)**

(Source: <https://doaj.org/>)

### ***3.8.2 Aim of DOAJ***

DOAJ intends to upsurge the discernibility and comfortability of the use of open access technical and academic journals, thus supporting their augmented practice and effect. The DOAJ aims to complete and covers completely open access scientific and academic periodicals in all subjects of knowledge. Simply, the DOAJ aims to become a "one-stop-shop" for end-users of open access journals. A journal present in the directory needs to exercise peer-review or journalistic quality control. Journal can report main outcomes of research or summaries of research outcomes to an academic group. A journal must publish at different time breaks, normally more than once in a year having each volume, issues numbered successively. A journal in DOAJ usually comprises research publications or other literature.

### ***3.8.3 The coverage presented by the DOAJ contains***

All scientific and scholarly topics. Scientific and scholarly journals that published study or review articles of full-text literature from management, administration, commercial, and non-profit private organizations which mainly mark researchers and scholars. Periodicals whose content is practical research-based are available in full

text in all languages and can be accessed from everywhere through the internet (Khillare, 2014; Tamizhchelvan & Dhanavandan, 2014).

The DOAJ was launched in 2003 at Lund University, Sweden, under the direction of Lars Bjornshauge. The DOAJ provides access to high-quality open-access peer-reviewed journals. DOAJ aims to increase the visibility and ease of use of open access scientific and scholarly journals, thereby promoting their increased usage and impact. The directory covers journals in all disciplines of knowledge. DOAJ is a community-curated online directory that indexes and provides access to high-quality, open access, peer-reviewed journals. All DOAJ services are free of charge including being indexed. All data is freely available. There are now 16,460 open access journals listed in the DOAJ in 80 languages from 126 countries. As of today (31-05-2020) 61, 95,417 articles are included in the DOAJ. In the field of Library and Information Science (LIS), there are 160 journals and 18,601 articles.

### **3.9 Open Access LIS journals from India**

Open access LIS journals provide online access to full-text contents of academic, peer-reviewed LIS journals. There are many more open access LIS journals published from India which provide online or print versions of the articles freely to the users. Some of the open access LIS journals published from India are given below:

#### ***3.9.1 Annals of Library and Information Studies (ALIS)***

National Institute of Science Communication and Information Resources (NISCAIR) came into existence on 30 September 2002 with the merger of the National Institute of Science Communication (NISCOM) and Indian National Scientific Documentation Centre (INSDOC). Both NISCOM and INSDOC, the two premier institutes of the Council of Scientific and Industrial Research (CSIR), were devoted to the dissemination and documentation of S&T information.

Annals of Library and Information studies which completed 64 years of publication in 2017 is the oldest surviving English language primary library and Information

science journal published from India. The journal was launched in 1954 by the erstwhile Indian National Scientific Documentation Centre (INSDOC) as Annals of Library science with the Father of Indian Library Science, Dr. SR Ranganathan as its Founder - Editor. In the ten years that he was editor, he wrote as many as 87 research articles for the journal. In 1964, the journal was renamed as Annals of Library science and Documentation and in 2001 it was given its current name, Annals of Library and Information studies.

The screenshot shows the NISCAIR Online Periodicals Repository website. The main header is green with the text "NISCAIR Online Periodicals Repository". Below the header, there is a navigation bar with "Home", "Browse", and "Help" links. A search box labeled "Search NOPR" and a "Sign on to" link are also present. The main content area features a green banner with "NOPR / NISCAIR PUBLICATIONS / Research Journals". Below this, the title "Annals of Library and Information Studies (ALIS) : [1440] Community home page" is displayed. A small thumbnail of the journal cover is shown. Below the title, there is a table with the following information:

QUARTERLY	ISSN: 0975-2404 (Online)
	ISSN: 0972-5423 (Print)

Below the table, there are links for "Introduction | Editorial Board | Instructions to Authors | Subscription Details". A link for "Online submission of articles- Now submit manuscripts online to ALIS" is also present. At the bottom, there is a grid of years from 1991 to 2021, arranged in three rows and ten columns.

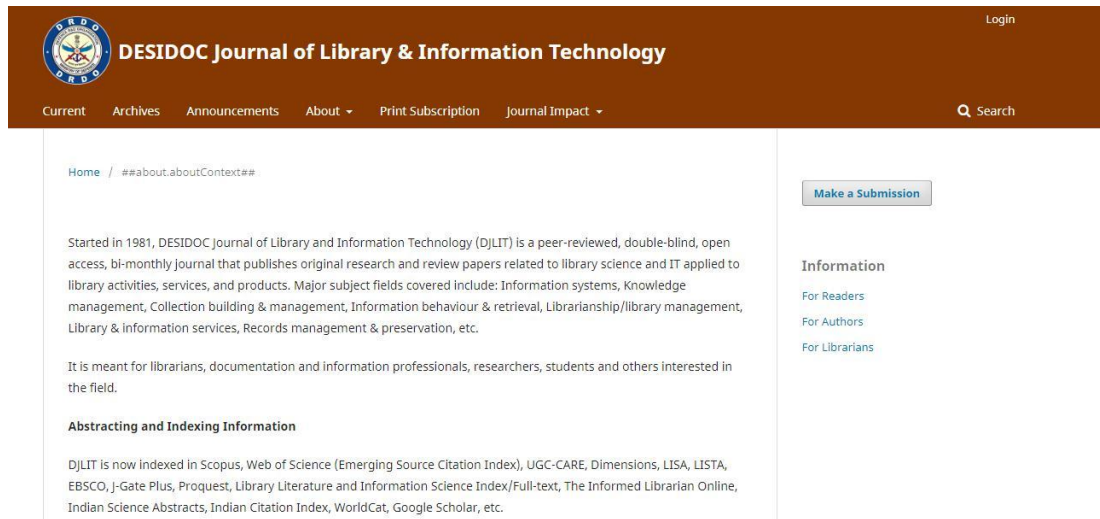
**Figure-3.9.1: Annals of Library and Information Studies**

(Source: <http://nopr.niscair.res.in/handle/123456789/66/> )

### 3.9.2 DESIDOC Journal of Library and Information Technology

DESIDOC Journal of Library and Information Technology (DJLIT) is a more than 30 years old journal. It was previously identified as DESIDOC Bulletin of Information Technology (DBIT). DJLIT is one of the top journals in the field of Library Science journals in India, published by Defense Science Documentation Centre (DESIDOC), DRDO, GOI, New Delhi since 1981 on a bimonthly basis. Each volume comprises six issues. It publishes innovative original study and review papers connected to information technology applied to library actions, services, and

products. The journal is relishing wide distribution both at national and international levels. (Source: <http://publications.drdo.gov.in/ojs/index.php/djlit/index>. Accessed on October 7, 2020).



**Figure-3.9.2: DESIDOC Journal of Library and Information Technology**

(Source: <https://publications.drdo.gov.in>)

### ***3.9.3 International Journal of Information Dissemination and Technology***

International Journal of Information Dissemination and Technology (IJIDT) is a quarterly peer-reviewed journal published by Maharishi Markandeshwar University, Mullana, Ambala. The intention behind presenting this journal is to emerge the models and approaches relevant to generate, manage and distribute the information and knowledge appropriate to the necessity and need of the teachers, professionals, researchers, and information experts. To achieve the academic requirements of professionals on all facades because of its individual and glorious research publications contributed by the well-known personalities and eminent intellects who are the skilled judge of national and international status. (Source: <http://www.ijidt.com/index.php/ijidt/index>. Accessed on October 8, 2020).

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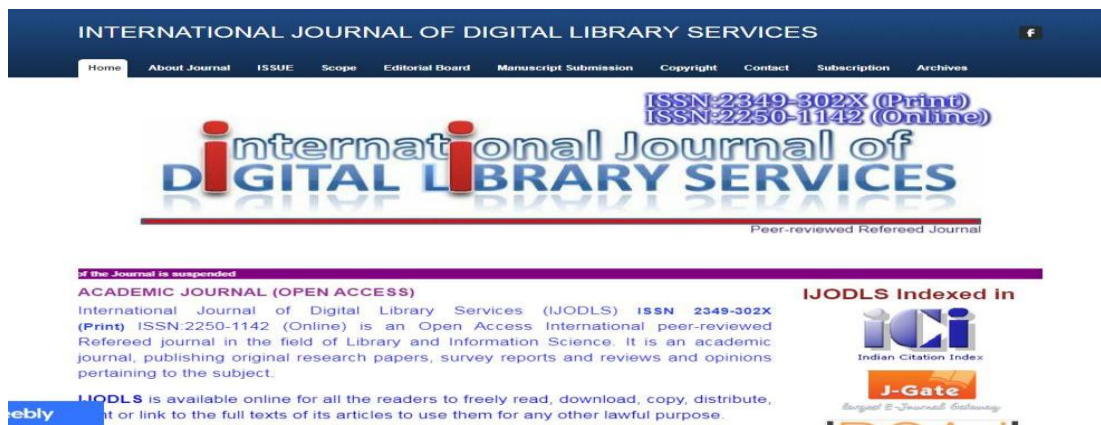
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**Figure-3.9.3: International Journal of Information Dissemination and Technology**

(Source: <https://www.ijidt.com>)

### 3.9.4 International Journal of Digital Library Services

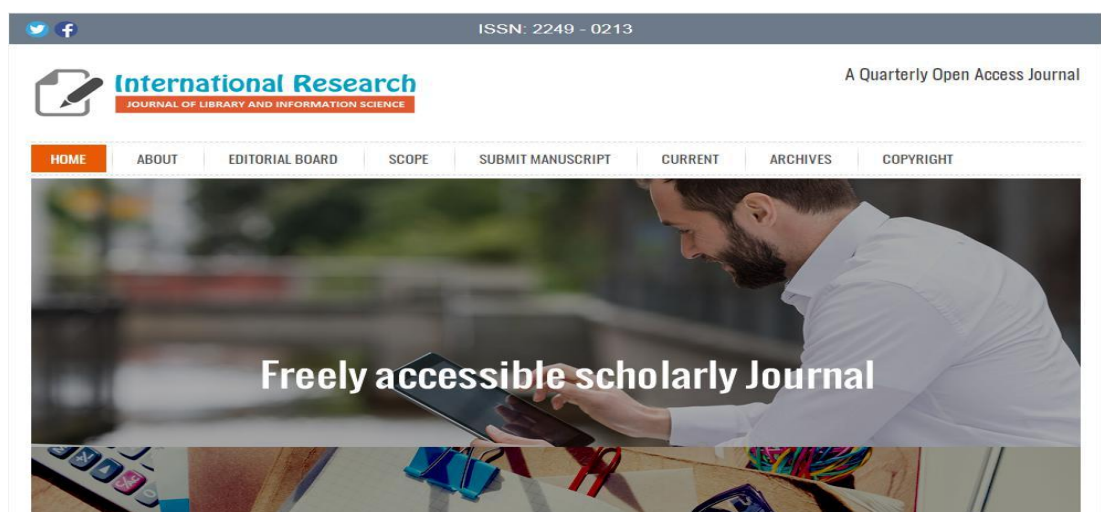
International Journal of Digital Library Services (IJODLS) is an academic journal that offers free access to research information to the global community without any cost, legal or technical obstacles. IJODLS aims to facilitate the distribution of research publications to the global community without constraint typically online. Therefore, all publications published under open access can be retrieved by anyone having an Internet connection. Abstracts and full texts (commonly in PDF format) of all publications published by the academic journal are freely accessible to everybody directly after publication. (Source: <http://www.ijodls.in/about-journal.html>. Accessed on October 8, 2020).



**Figure-3.9.4: International Journal of Digital Library Services**  
(Source: <http://www.ijodls.in>)

### 3.9.5 International Research: Journal of Library and Information Science

International Research: Journals of Library and Information Science (IRJLIS) is one of the peer reviewed online journal registered under the Directory of Open Access Journals (DOAJ) in the field of Library and Information science. It is easily available and can be freely accessible academic journal, devoted to issuing the knowledgeable fortitudes of academic groups in the field of Library and information science. It issues quarterly having inventive original research articles and review reports. (Source: <http://irjlis.com/> Accessed on 17 August 2020).



**Figure-3.9.5: International Research: Journal of Library and Information Science**  
(Source: <https://irjlis.com/>)



### **3.10 Conclusion**

The open access initiatives has given a platform to the researchers to get connected with information free of cost. Open access has open the different views to publish research outcomes and the development is not limited to one or two nations but has previously overwhelmed the entire world. It can't be deny that Open access has got a hopeful upcoming and researchers are working on it, developing awareness worldwide. India's task is to respond to the information movement and to increase the accessibility of Indian research publications. Open access drive has given a chance to the Indian journals to get connected to the mark spectators of the world's populations and now approximately not less than a hundred Indian journals offer free of cost accessibility to full-text articles.

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**CHAPTER 4**  
**SCIENTOMETRICS: AN OVERVIEW**

## 4.1 Introduction

This chapter will provide definitions and examples of the uses of basic Scientometric terms in the field of information science and provides a framework for connecting new findings to preceding findings in the relevant field. In the last few years, the field of Library and Information Science (LIS) has developed numerous quantitative approaches for the study. As LIS is an interdisciplinary field (Nisonger & Davis, 2005), academics from several disciplines have played a key role in the improvement of its methods.

This part gives definitions and instances of the uses of essential Scientometric terms in the zone of library and information science. Also, it gives a structure for relating discoveries to past discoveries to give writing audit of Scientometric concentrates in the relevant field. In the course of the last many years, the field of Library and Information Science (LIS) has created a few quantitative techniques for research. As LIS is a widely interdisciplinary field (Nisonger and Davis, 2005), scholastics from various disciplines (counting LIS) have assumed a significant part in the improvement of its techniques. Frequently researchers with an alternate foundation from LIS, like Tibor Braun (Chemistry) or Vasily Nalimov (Philosophy), have contributed important ideas.

The postfix 'metrics' is got either from the Latin or Greek word "metricus" or then again "metrikos" separately, each significance "measurement" (Sengupta, 1992). To date, a few distinctive metrics that manage the turn of events and utilization of measurement in the zone of Information Science have arisen, specifically: Bibliometrics, Scientometrics, Informetrics, Librametircs, webometrics. Notwithstanding, every one of these fields is firmly related, particularly Bibliometrics, Informetrics, and Scientometrics. A portion of bibliometrics works might be very effectively named informetric or scientometric studies and the other way around (Sengupta, 1992).

As per J.M. Tague-Sutcliffe (1992), "Scientometrics is the investigation of the quantitative attributes of science as an order. It is important for the social science of science and has been used in science policymaking. It incorporates quantitative investigations of logical exercises, distribution, thus covers bibliometrics somewhat."

India has an extensive practice of quantitative studies in library and information science. The number of studies in this field has been gradually increasing over the years as can be observed from bibliographies and reviews. In the national as well as in the international conferences also researchers are receiving good responses in their work.

According to B.M. Gupta (2014) - "India has a long custom of quantitative investigations in library and information science. The number of studies around there has been consistently becoming over a long time, as can be found in book indices and surveys. Be that as it may, at the public level, the field is accepting impressive consideration from the professionals since the 1970s, which has been reflected in the number of public gatherings coordinated in India and India's investment in global meetings, developing commitment of Indians in public and global journals and increment in the financing of undertakings to researchers from Indian logical divisions/research offices. Indians researchers have published more than 200 papers in the worldwide journal 'Scientometrics' since its establishment and have been partaking in expanding numbers in the half-yearly worldwide gatherings on Bibliometrics, Informetrics, and Scientometrics. Furthermore, more than 30 % of the articles distributed in expert library and information science diaries distributed from India and Ph.D. proposal submitted to the Departments of Library and Information Science of Indian colleges are given to quantitative investigations".



## **4.2 Definitions**

### ***4.2.1 Librametrics***

Librametrics, however the most little and most un-utilized of the measurement terms in library and information science (LIS). It originates from the term 'librametry' which was proposed by Ranganathan in 1948 at the Annual Aslib gathering as a conventional depiction for the utilization of numerical and factual strategies to library issues. Along these lines, it is characterized as the: Quantitative investigation of different aspects of library exercises and library records by use of numerical and factual math to look for an answer for library issues. (Sengupta, 1985). Ranganathan utilized factual techniques, for instance, to mastermind the request for books in the stack room, putting the most regularly requested books close to the passage, and the most un-mentioned farthest away. By this implies he guaranteed that the library staff would need to walk the most limited distance conceivable to recover the most mentioned books. He additionally utilized Librametric methods for different undertakings examining client solicitations, dissemination of books and periodicals; and even the actual arranging of libraries. Sadly the term Librametry has not been generally embraced, which in some cases prompts disarray among librarians and data scientists, who decipher Bibliometrics and its outcomes from alternate points of view. An issue likely most evident is in the matter of outdated nature, where librarians have difficulties concurring that any work may be obsolete.

The principal study, utilizing strategies related to Librametry, can be followed significantly further back than 1896, when Jewett (1848) introduced his report which followed references, in two areas (global law and science) to find out their accessibility from American libraries (Broadus, 1987). Utilizing quantitative investigation the author's aggregated top-notch science journals suggested for membership by college libraries.

### ***4.2.2 Bibliometrics***

The primary meaning of Bibliometrics was given by Pritchard in 1969. He proposed this term because the factual reference index, the term utilized around that time, had

some equivocalness as it could likewise be deciphered as book references on measurements.

The word “bibliometrics” is a mix of two words for example “Biblio” and “Metrics”. Biblio is gotten from Latin/Greek word “biblion” implies books, Metrics is gotten from Latin/Greek word “Metricus” or “Metrikos” which implies estimation.

The principal concentrate in Bibliometrics was by Hood and Wilson (2001) was a work of Campbell (1896). Notwithstanding, most reviews give Hulme (1923) and Cole and Eales (1917) as the soonest work in Bibliometrics, a reality that might be ascribed to them being recorded in Pritchard's underlying paper (Pritchard, 1969). Brookes (1990) unites the inceptions of Information Science and Documentation Science comparable to Bibliometrics and Hertzels (1987) gives a detailed review of the historical backdrop of Bibliometrics.

British Standard Institution (1976) depicted bibliometrics as the "use of numerical and measurable strategies in the investigation of documents and distribution designs."

Nicholas and Ritchie characterized "bibliometrics... give data about the construction of information and how it is conveyed." They further added that "bibliometrics contemplates fall for the most part into two general classes those portraying the attributes or highlights of a writing (spellbinding investigations) and those looking at the relationship framed between segments of a writing (social investigations)" (Kawatra, 2000).

Bibliometrics includes the investigations of the growth of publications for some subject, how much publications are contributed by different people, in collaboration or nations, how much exists in a different language, how the writing regarding some matter is dissipated, and how rapidly the writing regarding some matter become obsolete. One vital group of bibliometrics considers identified with what sources creator refer to. Reference is concerned with which creators are most referred to which journals are most referred to furthermore, what linkages exist through reference, and so on.

The three most usually utilized laws in bibliometrics are:

**Lotka's Law:** This law accentuates the productivity of creators in an order or other field.

The first of the three important laws to Scientometric study was introduced by Lotka, (1926). He was fascinated by the productivity of researchers and called his discovery the frequency scattering of scientific productivity. Despite the consideration Lotka's finding has acknowledged since then, it took fifteen years for the publication to get cited for the first time by Davis and another next eight years before it was considered Lotka's Law (Zipf, 1949). Lotka investigated the total contributions that have been contributed by various authors in two disciplines: Chemistry and Physics. In Chemistry, he examined 6,891 records in Chemical Abstracts, for the terms beginning with the letters A and B. He found that 58% of all contributors contributed just one contribution and that the frequency of authors with 2, 3, 4, contributions reduced exponentially. To understand if this was also the circumstance when the value of publications is taken into concern, he also observed at the frequency of periods contributors were recorded in Auerbach's eschichtstafeln der Physik, perceptive that only significant contributions to Physics listed there. Over again out of all 1,325 records for the entire alphabet 59% of the contributors were recorded just once, with the frequency of authors recorded more than once declining exponentially. Therefore, when the frequency of contributions for both Chemistry and Physics were drawn over the frequency of authors, the outcome was a Pareto-like distribution. This relationship can also be described as:

“... the number of authors who had published a specific number of papers was approximately equal to the inverse square of that number multiplied by the number of authors who had published one paper only”. (Wilson, 1999:165) So Lotka's Law is often known as the inverse square law. Lotka phrased the relationship himself as “the number [of authors] making  $n$  contributions is about  $1/n^2$  of those making one”, but was highlighting the fact that “this simple law” underestimates the number of “persons of very great productivity” (Lotka, 1926:323).

The importance of Lotka's finding was summed up by Bookstein as:

“The burden of publications is thus unevenly divided, with most scientists contributing rather infrequently, while a small number of scientists publish disproportionately frequently.” (Bookstein, 1979:153)

Price states that “the number of publications is not only affected by the productivity of one author, but also by the timespan that a person is actively publishing: authors differ not so much in their rate of publication of papers, but in the period they spend at the publication front” (Price, 1976:300).

**Bradford's Law:** This law accentuates the dissipating of literature in different periodicals. Bradford's (1934; 1937; 1953) name is linked with the scattering of relevant literature on a topic over periodicals. Consequently, it is now and then also denoted as the 'Bradford's law of scattering. He states that “one could assume:... that the bulk of the papers on a specific subject would be published in a few journals specially devoted to that subject, or to the major subject of which it forms a part, together with certain borderline journals and some more general periodicals”. (Bradford, 1934:176) Though, he presented that the statement was insignificant and does not redirect the real state. However numerous publications are significant for the literature of one topic, they only comprise a portion of the appropriate literature. A maximum of the literature connected with an arena is published in a growing number of journals, a portion of them published in journals with less than one relevant document per year. For this reason, Bradford was also challenging that topic-specific indexing of literature must be stopped in favor of source-related literature, as subject-specific indexing slips a huge number of relevant literature published in journals are not perused by the indexers. Concerning libraries he also determines that: “special libraries cannot gather together the complete literature of their subject, except by relinquishing altogether their specific character and becoming practically general libraries of science.” (Bradford, 1934:180)

Bradford presented this statement when positioning journals in reducing the order of productivity. In a graphical graph, the scatterings of articles over journals follow a Paretolike distribution. If the journal is then divided into zones with an equivalent number of articles, the frequency of journals in each zone grows exponentially. Bradford expressed this relation as “the number of periodicals in the nucleus and

succeeding zones will be as 1:  $n^1$ :  $n^2$  ...” (Bradford, 1934:178). This connection between the frequency of articles on a subject and the frequency of journals they were published in was again framed with additional mathematical explanations by Vickery (1948). An evaluation on articles of Bradford's Law was given by Lockett (1989) initiated the Groos droop, frequently referred to in explaining Bradford's Law to clarify the partial data for the less productive journals.

**Zipf's Law:** This law accentuation the recurrence of the word appropriation.

The law was postulated by Zipf (1935; 1949). Zipf investigated the number of dissimilar words that occur in a body of text and then classified them by their frequency of occurrences. One of his examples, the body of James Joyce's 'Ulysses', had 29,899 dissimilar words and a total of 260,430 words, which seems that on average every word occurred 8.7 times. But, the distribution of the dissimilar words in 'Ulysses' was by no means consistently blowout; it shadowed a much-tilted distribution with approximately one-third of the words occurring just once and ten of the words occurring more than 2,650 times each. Consequently, when the number of occurrences is drawn over the ranks of the word, the distribution has a Paretolike figure. Zipf expressed this connection as the rank times the frequency of occurrences being a constant:

“...we have found a clear cut correlation between the number of different words ... and the frequency of their usage, in the sense that they approximate the simple equation of an equilateral hyperbola:  $r * f = c$ ” (Zipf, 1949:24)

The technique used by Zipf of plotting the number above rank becomes recognized as the rank frequency distribution or the Zipflike plot and is currently extensively used in the external context of the practice of words in a body of text.

According to Egghe (1988) describes “Zipf's law an empirical law, a relation between the rank of a word and the frequency of its appearance in a long text. If 'r' is a rank of word and f is its

Frequency, then Zipf's law is stated as  $r*f = C$ ”

r = a rank of word

f = its frequency

C = is a constant.

### ***4.2.3 Scientometrics***

The focus of Scientometrics is the assessment of science and is subsequently concerned about the development, design, interrelationship, and profitability of logical controls (Hood and Wilson, 2001). Rather than Bibliometrics, the reason for scientometric investigation isn't restricted to composing correspondence as it were yet, can incorporate different sources too, for instance, the analysis of the subsidizing of establishments, the number of Ph.D. understudies, or different aspects.

The inceptions of the term Scientometrics reach back when two Russian researchers Namilov and Mulchenko coined the Russian expression 'naukometriya', which might be compared to the term Scientometrics. (Nalimov and Mulechenko, 1969) Namilov later turned into the first counseling editorial manager of Scientometrics (Hood and Wilson, 2001). Notwithstanding, Price (1963) might be seen as the first to investigate this territory, in expressing the point of his book as: " to deal statistically ... with general problems of the shape and size of science and the ground rules governing growth and behavior of science in the large" (Bensman, 2007).

The term had acquired wide acknowledgment by the establishment in 1978 of the journal Scientometrics by Tibor Braun in Hungary. As indicated by its caption, Scientometrics incorporates all quantitative parts of the study of science, correspondence in science, and science strategy (Wilson, 2001). Not long after its establishment, Nalimov turned into the (solitary) Consulting Editor. Some other early papers by Nalimov which assisted with supporting the incipient order of Scientometrics include: Nalimov (1970), Nalimov and Mulchenko (1969).

### ***4.2.4 Webometrics and Cybermetrics***

The term Webometrics was invented by Thomas Almind and Peter Ingwersen cited in Michael Thelwall (2009); though it took some years to develop the general term for the portrayal of the quantifiable study of the Web and its associated occurrences. In the initial years of Webometrics some further terms were utilized, amongst them Web Bibliometry, Internetometrics, Cybermetrics, or in computer science Web

metrics. Nowadays the term Webometrics is recognized. Though, the core journal in Webometrics still conveys the name Cybermetrics. The arena truly took off, though, with the introduction of the Web Impact Factor (WIF) metric to measure the impact of a website or extra zone of the web-based upon the number of hyperlinks directing to it.

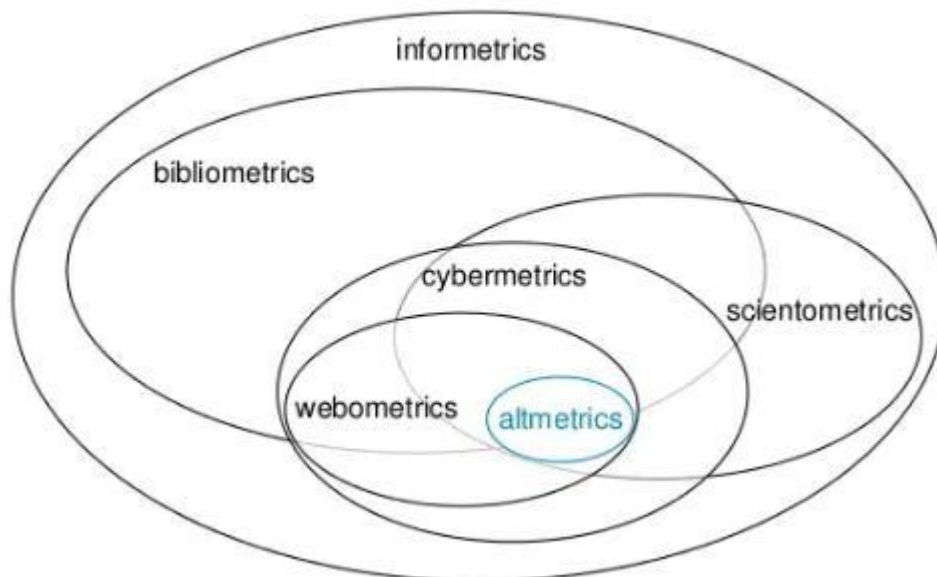
The term cybermetrics occurred consistently with the enhancement of webometrics. This term was used to depict mainly alike study as webometrics furthermore, was the name of an electronic journal published in 1997. The difference between the two terms was settled by authorizing cybermetrics to be more general—alluding to non-web Internet research, for example, email. (Bjorneborn and Ingwersen, 2004).

Long after its creation, webometrics was given its acknowledged definition as "the investigation of web-based particulars utilizing quantitative methods and depicted upon informetric techniques" (Bjorneborn and Ingwersen, 2004). The significance of this definition was its incorporation of informetric techniques as characterizing trademark, putting webometrics as a simple data science field.

Informetrics is a term applied inside data science to allude to quantitative research on estimating data. This incorporates reference analysis, for instance. The definition in this way avoids non-data science research in view of the web, for example, software engineering endeavors to gauge the size of the web (Lawrence and Giles, 1999) and factual physical science looks for numerical laws of connecting (Barabási and Albert, 1999), although in both these cases, similarities could be drawn with earlier informetric research. (Mike Thelwall. 2009)

#### ***4.2.5 Altmetrics***

Altmetrics is the way to measure the web-based content of how people are connected with intellectual work. It analyzed the qualitative data which are complementary to outmoded citation-based data. With the help of altmetrics, one can know a lot about how often a document and other research material are used all across the globe. "They aim to measure web-driven scholarly interaction, such as how often research is tweeted blogged, or bookmarked." Howard (2012).



**Figure-4.2: Relation among different metrics**

*(Source-Bjomebom & Ingwersen, 2004)*

### **4.3 Scientometric study – theoretical aspects**

In India, Scientometric approaches are using at consistent intervals for the Research to decide the distribution of funds to research organizations. The procedures used to quantities in Scientometric perspectives range from authorship productivity of specific authors, calculating impact factor, keyword analysis, connection in databases (Stern, 1977). The idea of this study is alike to citation analysis, where the common statement is that the number of times an article is mentioned is used to differentiate articles with a higher impact on the educational community than those that are infrequently cited ( Wilson, 1999a:126). Similarly, as Authorship pattern, Author productivity, in-depth investigation of an article on basis of keyword to recognize the complexity of the subject, country-wise scattering of articles, these are various significant aspects that can be used to differentiate journal of higher impact factors to scholars.



### 4.3.1 Aim of scientometrics

Scientometrics aims to deliver quantitative categorizations of scientific action. Because of the specific significance of publication in scientific societies, it overlays with bibliometrics, which is the quantitative study of media in any printed form. The 1970s saw the growth of scientometrics as an active activity. A reaction to the pressing demand for the ‘measuring of science’, particularly in Russia and the USA. Among the founding fathers of the discipline were de Garfield (1955) and Narin (1976) in the US, Nalimov & Mulczenko (1969) in Russia and Braun & Bujdosó (1975) in Hungary. Using bibliometric approaches to their field, scientometricians authorize that their specific area, standing at a joint of disciplines, advanced as a mixed field, both in subjects and practices.

### 4.3.2 Scope of scientometrics

The communication sciences and conventional philosophy of science, scientometrics centers on texts as experimental units of analysis. Fig. No.4.3.2 arranges the associations with further disciplinary perceptions in science research. Texts cannot be abridged to their authors—texts can be co-authored nor can theories be abridged to the documents in which they are distributed. Though, a measure in one aspect can be used as a substitution or indicator for the other given a research scheme. Loet Leydesdorff and Staša Milojević (2015)

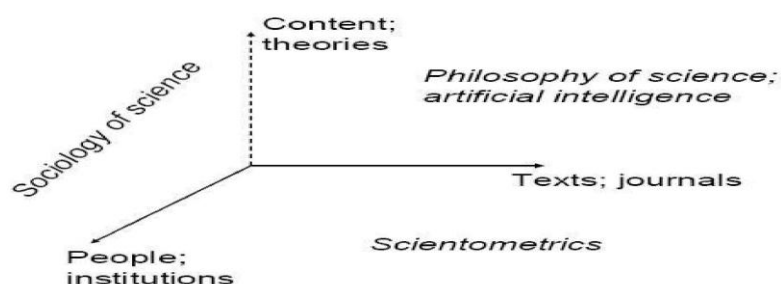


Figure 4.3.1 Three main dimensions in the dynamics of the sciences; adapted from Leydesdorff (1995).

(Source: *The International Encyclopedia of Social and Behavioral Sciences*)

The arena of scientometrics has also extended to diverse types of documents and other areas. For example, an alike procedure is employed in the technological area, but with different subtleties. Alike manuscripts, patent submissions contain understanding statements that refer to “prior art”. Though, the functions and therefore the institutional incentives are different: patents are intended to protect intellectual property, whereas the community sciences are also based on the standard of gift-giving.

#### ***4.3.3 Need and significance of scientometric studies***

Scientometrics includes quantifiable studies of scientific actions, comprising among other periodicals and so overlay bibliometrics to some point. Price (1963) précises the principle of scientometrics in the introduction to “Little science, big science” as follows, Science is a measurable element, and thus the manpower involved in science, the scientific works, ability, and expenditures afforded to science could be measured by appropriately selected statistical techniques. Scientometrics comprises all quantitative facets science of science, communication in science and science policy (Sarala, 2005).

#### ***4.3.4 Problems and limitations of scientometric methods***

Scientometrics is also like other practices is not restricted from criticism. Some of the key problems and boundaries of scientometrics are as below:

1. Scientometric research does not contain informal periodicals and communications; therefore the scientific progress cannot be anticipated appropriately.
2. The bibliographical references appended for citation analysis, are not constantly uniform. This causes difficulty while classification the authors based on the occurrence of their receiving citations. For example, the author, S.R. Ranganathan has been cited differently as Siyali Ramamrita Ranganathan, S. Ranganathan, and S.R. Ranganathan. This can cause

sprinkling of citations of the same person's-works. At the same time, it may be problematic to differentiate them.

3. In the case of collaborated authors, the cited publications seem only under the tag of the first author as recorded in each publication. There one needs to decide the names of distinct contributors who have collaborated the effort to acquire the authentic rank of the authors. This is a very problematic and dull process.
4. The citation index has also limitations, Self-citation is one more limitation of citation analysis research. Though the circumstances of self-citation of single-author contribution can be identified and removed, in collaborated works it is tough to figure out the self-citations of authors specifically for second authors or in other positions.
5. A major problem of citation analysis is "Hello citations" (Mahapatra, 1992), where author purposefully cite other author only as a favor. It is difficult to evaluate such citations during ranking the authors based on their citations.
6. Citation analysis in certain circumstances the citation itself is not appropriate to the perspective of the citing documents. Sometimes the citations are incomplete.
7. Many well-known scientists are not acknowledged for their effort, even though the work has been cited in many documents. The documents referring to the work do not give bibliographical facts of the source where the refereed documents seemed first. For example, the work of Einstein is no longer felt compulsory to acknowledge even though numerous studies are centered on Einstein's work. As a consequence of this, the citation count, which is accepted to find out the rank of authors, miscalculate the contributions of a lot of such well-known contributors in various arena.

Kademani et al. (2006) also enumerated few limitations of Scientometric studies:

- Scientometrics defines the text, not essentially meaning and context;
- Monographs are not covered properly;
- The citation indexes suggest discriminatory coverage of journals generally English;

- Only the first author of a publication is cited in the citation index;
- Homographs – more than one author recorded under the single name with variant initials diversified with full names;
- Transformed and transliterated names;
- Authors with document names (de, des, von, van, etc.);
- Maiden and marital name in case of the female author;
- Typographic human mistakes;
- Citations are occasionally prejudiced for other than academic reasons;
- Some publications may be ahead of their time, so not cited;
- Different references to the same element (year, volume, page, etc.)

Instead of the boundaries of scientometric study, it is perceived to be one of the finest methods in receiving information of scientific output of specific authors, scientists, institutions, and journals and to study the arrangement of the progress of literature and nature of research contribution, age of literature used, information needs of scientist, etc. (Mahapatra, 2000).

#### **4.4 Scientometric parameters**

##### ***4.4.1 Author Productivity***

Scientific publications signify present research trends and can be used to classify the focus of current, past, or future research (Garfield, 1970). Scientific efficiency is inclined by a huge number of aspects, comprising individual features such as age, gender, psychological characters, and educational background, as well as organizational features like funding, institutional context, and the association of the actual investigation (Babu and Singh, 1998). Over the previous few eras, science has progressively become performed by investigation groups rather than by individual researchers, adding significance to issues like the association between scientific efficiency and the size of the research crowd. Scientific teamwork would be expected to upsurge both the quality and the number of the scientific productivity (Wallmark,

1973), whereas some researchers have stated an optimistic correlation between group size and output (Wallmark, 1973). Stankiewicz (1979) suggested a team size of 3-5 researchers to be ideal but highlighted that the cohesiveness of the cluster as well as the knowledge of the group leader intensely determined whether the size of the productivity correlation was positive or negative. Janagap and Maclean (1993) developed bibliometric measures for assessing the excellence of research centres and scientific productivity by using author productivity data. In the works of bibliometrics, scientific efficiency is commonly measured in terms of published output, which may comprise of journal articles, reports, books and monographs, patents granted, etc. In elementary research, periodicals in the form of books and monographs, reports, and articles are used as an extent of output in productivity studies. Though, articles appearing in journals in most often chosen, since it is usually accepted that the journal articles are the major passage in recording scientific developments and forming scientific significance in most of the scientific fields. In applied research also patents, processes developed and processes applied can be deliberated as measures of the productivity of technology research of R & D institutions and industrial firms (Narin & Breitzman, 1994).

In the bibliometric literature, scientific productivity is frequently measured in terms of published output. One of the most important models for the scientist is to disseminate their research outcomes amongst their peers. This can be done by researchers in various ways, by distributing their research results through books, reports, working papers, preprints, articles in journals, etc. in simple research, the last selection is possibly the “best”, mainly if the journal agrees to take referred papers and his extensive global circulation and global reputation. We have used the research productivity of researchers as the only extent of their presentation in this study. This presentation measure in the actual condition is likely to take a distinct value. It is, so, rational to accept that a distinct probability scattering would, define the dissemination of scientific efficiency of researchers in research laboratories. In such circumstances, Lotka’s law and other statistical models are to be expected to be appropriate in the data on scientific efficiency of scientists (Gupta et al, 1999). A recognized output indicator is the number of papers contributed by researchers, organizations, or research teams. Scientometric and bibliometric methods have

developed tools to assess the productivity of investigation institutes, specific researchers, as well as to plot the progression of the research field.

In the current years, numerous formal systematic and analytical models developed for defining the occurrence of scientific efficiency. It is often measured in terms of published outcomes, possibly because of the data on the frequency of contribution by the authors. The frequency of publication, research contribution, reports, patents etc, of a specific researcher is considered as an extent of his or her scientific efficiency.

#### ***4.4.2 Authorship pattern***

In this period, individuals and researchers are revolving in the direction of information communication technology. Information communication technology (ICT) relates to the study. Researchers are more interested to work jointly with other researchers instead of single writing. Authorship patterns simply show the analysis of authors how they are connected with other authors. Whether they have published the document individually or jointly with others.

#### ***4.4.3 Collaboration pattern***

Collaboration pattern is one of the most significant requirements of present researches. The reason is that scientific arenas are overlying each other and many different technical studies need researchers with a diverse backgrounds to collaborate (Tianwei, et al, 2005). Collaboration is a powerful form of communication that permits effective communication and the distribution of proficiency and other means (Sagam et al. 2007). Collaboration is an important pointer of the environment of the scientific movement. In the evolution between 'little science' and 'big science' the nature of joint action has transformed to some amount from that between specific researchers to one refereed by the institution of countrywide and worldwide bodies. From the co-authorship statistics, it is conceivable to get data on worldwide collaboration, inter-state collaboration, inter-organizational collaboration, and singular collaboration. There were no researches done to analyze Indian research collaboration in the fields of science and technology for an extended period with bibliometric indicators (Anuradha, 2007; Maheswarappa & Mathias, 1987).

Chompalov (2002) deliberate the organization of scientific collaborations. They observed that the variability of structural arrangements of collaborative projects can be clustered into four types, extending from administrative to participating, using data cluster analysis. Excluding particle physics, which is devastatingly participating and non-bureaucratic, the involvement of the other three types is commonly cross-disciplinary.

Archibugi and Coco (2004) matched international partnerships for knowledge in business and academics between Europe and the USA. The main analysis discovered the relations between current scientific collaborations and the scientific and intelligence of the scientists as well as the effect of the features of the organization by which they are employed (Oliver, 2004). “Co-authorship networks and patterns of scientific collaboration were studied and structure of three networks of scientific collaborations” (Newman, 2004). Collaboration is expected in natural sciences and multidisciplinary parts to make substantial progress and breakthroughs (Macrina, 2000). Price (1965) examined the occurrence of collaboration in chemistry publications during 1910-1960, as replicated in the growth in the multi-authored publications in Chemical Abstracts Database. Gupta and Karisiddappa (2000) registered numerous studies accompanied in several disciplines which demonstrates a trend to multi-authorship publications. Collaboration patterns can be deliberate at nearly all levels; cooperation of specific scientists has, for illustration, been examined in the context of social stratification in science (Kretschmer, 1992). The published outcomes of intra-and extramural collaboration were compared at the organizational level, and the strongly escalating domestic and international collaboration has aided as a base of various bibliometric studies.

Bibliometric research has been carried out to examine the collaborative research trends in many disciplines such as geoscience information (Gupta, 1984, 1986). Indian earth science, applied science, Psychology (Karisiddappa et, al., 1990), and Zoological sciences, using the frequency of publication in all groups of authors. Zuckerman (1967) conducted a study of the collaborative inclinations of noble laureates in the United States and found a close correlation between the eminence of researchers and their scientific output. Kuch (1978) claimed that “the number of authors (of papers) is positively correlated with the number of significant words in

the title of the same paper”. The twentieth century was wonderful collaborative research among researchers working in clusters within and across the topographical boundaries of a country, which improved the capability of researchers to put in their intelligence cooperatively and make noteworthy progress in their domains of specialty.

#### ***4.4.4 Collaborative coefficient (CC)***

The collaborative Coefficient is one more indicator used to define the co-authorship appearances of the six countries in the arena of bioinformatics. It was first suggested by Ajiferruke et al. (1988) and used to evaluate the measure of collaboration in terms of co-efficient. The value of CC will be zero when single-authored papers dominant. This implication shows that the higher the value of CC, means the higher the probability of multi-authored papers. Gupta (1986) and Parvathamma (1990) calculated the values of collaboration co-efficient ‘g’ for different groups of authors using the CC formula.

#### ***4.4.5 Collaborative authorship***

Augmented collaboration shows rising fractional contributions to the publications by the authors. If this is not evaluated when associating authors we will get a false productivity growth. According to the Persson (2004) presents the percentage stake of author of author contributing 1, 2... papers a year for all field combined. “The “average productivity” has approximately improved by one half papers, from about 2.5 papers in 1980 to 3 papers in 2000. When we look at the distribution of papers over authors, we find that the mean productivity has increased, which is also reflected in the fact that the share of low-productivity authors has decreased, that of medium and high productivity has increased”. Author collaboration has been calculated in literature in the humanities, social sciences, and natural sciences but one subject that is slightly well-known about its author collaboration is African Trypanosomiasis. Price and beaver (1966) found that “the most productive fellow way by far the most collaborative in the literature of oxidative phosphorylation and terminal electron transport, they advocated that part of the social function of



collaboration is that it is a way of squeezing papers out of the rather population of people who have less than a complete paper in them". Goffman (1977) also connected authorship patterns to the Shannon entropy measure. Hirsch and Singleton (1965) revealed that "the amount of multiple authorship in a topic field is closely connected to the amount of financial help. Mullins (1968) explained the groups of collaborators sociologically as "solidarity groups" to highlight the role in the endorsing and devotion to that field. Pao (1982) has examined the association between collaboration and productivity in musicology and resolved that even though a lesser number of authors had co-authored, the substantial collaborators were also the most prolific in the area. Shaw (1979) detected that co-authorship creates a relation among authors which is an extent to which they connect directly and that the strength of this association between any two authors may be calculated by totaling the number of papers they contributed collaboratively. Weintraub (1980) discussed theoretical simplification that the researcher collaborates, while the humanist infrequently collaborates. Lawani (1980) recognized three factors that impact the association between collaboration and quality as individual's abilities of the members, size of the squad, and the cohesiveness of the group.

#### ***4.4.6 Degree of collaboration (DC)***

The degree of collaboration was defined as "the ratio of the number of collaborative research papers to the total number of research papers in the discipline during a certain period". Subramanyam (1983) introduced a method for calculating author collaboration and perceived that the degree of collaboration varies from one discipline to another. It is generally high in the strongly collaborative scientific and technical fields, but little in humanities in which the isolated scholar works without the trappings of "big science" still contributes much of the scholarly publications. Pao (1982) studied the degree of collaboration in the field of computational musicology and found that only 15% of the literature was co-authored in the field.

Advantages of collaborative research:

The importance of the collaborative study to authors and nations caused it's augmented than the numbers of publications. Apparently, the benefits of

collaboration comprising the productive discussion of ideas, the advanced quality of collaborative papers, getting high citations, are certain reasons for this fast growth. Administrative initiatives are endorsing international scientific agendas, delivering funds for travel, and exterior countries' assistance from the international collaboration are several other positive matters. Distribution of thoughts in a similar work area or over interconnected disciplines and prospect to practice modern technologies, instruments etc., accessibility of funds and sponsorship (Roy, 2004).

#### ***4.4.7 Publication density***

Publication density is defined as “the ratio of the total number of papers published to the total number of journals in which the papers were published and publication concentration as the ratio in the percentage of the journals containing half of the papers published to the total number of journals in which those papers were published during the period under study”. (Munnolli & Kalyane, 1995).

#### ***4.4.8 Productivity patterns***

The term productivity patterns reflect on author productivity, authorship pattern, channels of communication, impact factor of the author as well as journals, etc. Productivity patterns mean an excellent idea to produce (publish) research papers in the respective subject (Adhe, 2008).

#### ***4.4.9 Citation***

Citation is a reference to a distributed or undistributed source. More exactly, a citation is an abridged alphanumeric appearance (e.g. Adams84) inserted in the body of an academic work that signifies access in the bibliographic references segment of the work for the tenacity of acknowledging the significance of the works of others to the theme of conversation at the place where the citation seems. Usually, the grouping of both in the body citation and the bibliographic access creates what is commonly understood as a citation. A major reason for a citation is intelligent morality to feature prior work and ideas to the accurate sources and to permit the

reader to decide freely whether the referenced objects help the author's argument in the demanded way.

Importance of Citations:-

Citations play a significant character in research. "scientific paper or scientific research does not go alone, but it is embedded in the subject of literature, as a reference (citation) which is an acknowledgment for the use of information by another author who cites in his writing. A citation implies a relationship between a part of the whole of the cited document and a part of the whole of the citing document." Citation analysis is the part deals with the bibliometrics study of the relationship among cited and citing documents and those studies are important to figure out the scholarly growth in any subject domain.

#### ***4.4.10 Citation analysis***

Citation analysis is the study of the frequency, patterns, and graphs of citations in a document. It practices the directed graph of citations associates from one document to another, to disclose characteristics of the documents. The main objective of the citation analysis is to figure out the most significant document in the collection. When one author cites another author, a connection is established. "Citation analysis uses citations in academic works to create links. Many dissimilar links can be established, such as links between authors, between scholarly works, between journals, between fields, or even between countries. Citations both from and to a certain document may be studied. One very common use of citation analysis is to determine the impact of a single author on a given field by counting the number of times the author has been cited by others. One possible drawback of this approach is that authors may be citing the single author in a negative context". (Osareh 1996).

#### ***4.4.11 Co-citation analysis***

Co-citation analysis is a process used to create a subject resemblance between two papers. If papers A and B are both cited by paper C, they can be understood to be connected to one another, however, they may not directly cite each other. If papers A

and B are both cited by numerous other documents, they have a strong connection. The more documents they are cited by, the closer their connection is.

#### ***4.4.12 Bibliographic coupling***

Bibliographic coupling is beneficial to show the overlay of references in research productivities by presenting the strengths of output depends on the frequency of citation two outputs might have in conjoint (Van Eck & Waltman, 2014). The usage of the bibliographic coupling is significant to find the connection between two or more substances that both cite the same article. Though the co-citation link displays the link between two substances that are cited by the same document, They used the manuscript as the unit of analysis, restricted the citation threshold to three, and 365 articles met this condition. The color specified productivities published within a particular period in the network, but the productivities indicate a lack of co-citation, excluding those in the center that comprised 46 authors when the cluster was increased out.

#### ***4.4.13 Year-wise productivity***

When chronological distribution a specific period span is taking into concern and things are organized according to days, months, years, decades, centuries, and so on. At that particular period, how books and periodicals or articles are distributed, was analyzed by Senapati (2003).

#### ***4.4.14 G-Index***

The g-index is an index for measuring the scientific output of researchers depend on their publication record. It was suggested in 2006 by Egghe. The index is determined by the distribution of citations got by a specific researcher's publications. A substitute definition is "Given a set of articles ranked in decreasing order of the number of citations that they received, the g-index is the (unique) largest number such that the top g articles received on average at least g citations". Tol (2008) anticipated a balanced simplification. He also suggested a sequential g-index. "Given

a set of researchers ranked in decreasing order of their g-index, the g<sub>1</sub>-index is the (unique) largest number such that the top g<sub>1</sub> researchers have on average at least a g-index of g<sub>1</sub>".

#### ***4.4.15 H-Index***

The h-index is an index that counts both the authentic scientific output and the seeming scientific impact of a researcher. The index is centred on the set of the scientist's maximum cited publications and the frequency of citations that they have to get in other person's periodicals. The index can also be useful to the productivity and impact of a cluster of scientists, such as a department or college, or nation. The index was recommended by Hirsch (2005), a physicist at UCSD, as an instrument for shaping theoretical physicists' comparative worth and is occasionally called the Hirsch index or Hirsch number. He advocated that "for physicists, a value for h of about 10-12 might be a useful guideline for tenure decisions at major research universities. A value of about 18 could mean a full professorship, 15–20 could mean a fellowship in the American Physical Society, and 45 or higher could mean membership in the United States National Academy of Sciences" (Peterson, 2005). The index is based on the scattering of citations got by a researcher's publications. Hirsch (2005) A scientist define h index as "if h of their N<sub>p</sub> papers have at least h citations each, and the other (N<sub>p</sub> - h) papers have at most h citations each. In other words, a scholar with an index of h has published h papers each of which has been cited by others at least h times". So, the h-index reveals both the frequency of publications and the frequency of citations per publication. The h-index aids as a substitute to old-style journal impact factor metrics in the assessment of the impact of the work of a specific investigator. Because only the highly cited publications subsidize to the h-index, its purpose is a comparatively simpler method. He has revealed that h index has high analytical value for a scientist whether he has won honors like National Academy membership or the Nobel Prize.

#### ***4.4.16 i10-Index***

The i10-index is the metric introduced by Google Scholar in 2011. It is a simple and direct indexing method that calculates the number of publications with at least 10 citations. This metric was only proved by google scholar. (Google Scholar Blog, 2011).

#### ***4.4.17 i20-Index***

Noruzi and Alireza (2016), in an editorial issue, states that “i20-index, is obtained by tallying a journal’s total number of published papers with at least 20 citations.

#### ***4.4.18 M-Index***

**M-index** is another form of the h-index that shows the h-index per year since first publication. The h-index inclines with career length, and the m-index can be used in conditions where this is failing, such as comparing researchers in the same field but with very different career spans. The m-index characteristically assumes continuous research activity since the first publication.

### **4.5 Conclusion**

The chapter discussed the different metrics such as bibliometrics, scientometrics, webometrics, cyber metrics. All those metrics are very close to each other and they deal according to their subject domain. Different studies were taken place by different authors as an individual or in collaboration. The researchers used different parameters to conduct their studies, in the same way, the parameters used in this study were also discussed elaborately. Scientometrics or any metric study tries to find out the productivity, importance of the contribution and helps the contributor to make visibility worldwide.

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## **CHAPTER-5**

### **DATA ANALYSIS AND INTERPRETATION**

## **5.1 Introduction**

The analysis and interpretation of data comprise of critical investigation of the data with an intention in mind for understanding the pattern of connection among the variables. Data analysis and findings are an essential core part of the research. In this study, the researcher gathered the relevant bibliographic data of the two selected source journals namely "Annals of library and information studies" and "College and research libraries" during 2011-2020. The data analysis section is divided into two parts. In the first part the data analysis of "Annals of library and information studies" was carried out and in the second part data analysis of "College and research libraries" was carried out and plotted the inferences.

## **5.2 Part A: Analysis of Journal - Annals of library and Information Studies (ALIS)**

From the available resources, it was found that 312 documents were published in the NISCAIR Annals of Library and Information Studies from the year 2011 to 2020. For each article, names of authors, number of authorship, number of references, author's institutional affiliation and country, type of article, pages of the article, etc. were noted down. All the necessary information was compiled, recorded, tabulated, and analyzed for making observations as indicated in the objectives of the study. A database that was created using Microsoft Excel was used to generate data such as frequency distribution, range, mean and ranked list of references, authorship, institutional affiliation, subject distribution, pages as well as types of articles, the form of cited documents included in the articles. For visualization and plotting of chart VOS viewer and bibliometrix Biblioshiny software were used.

### ***5.2.1 Year-wise distribution of publications***

Table-5.2.1 and Figure-5.2.1 show the year-wise distribution of the publications in the Annals of Library and Information Studies (ALIS) journal from 2011 to 2020. It was observed that there are a total of 312 articles published in 10 volumes during the

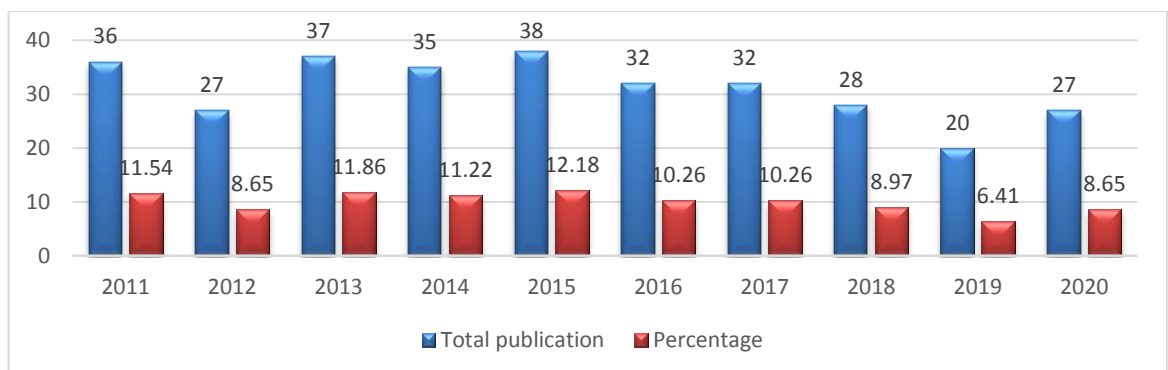


study period out of which the highest 38 (12.18%) articles were published in the year 2015 followed by the year 2013 having 37 (11.86%) publications, in the year 2011 total publications count 36 (11.54%), in the year 2014 total count 35 (11.22%), in the years 2016 and 2017 they have published equally count 32 (10.26%), in the year 2018 publication count 28 (8.97%), in the year 2012 and 2010 again they have published equally count 27 (8.65) and the year 2019 the publication was lowest having count 20 (6.41%). Based on the analysis it was found that the average publication per year is 31.2 (10%) out of a total of 312 publications.

**Table-5.2.1: Year-wise distribution of publications**

Year	Vol.no.	No. of Issues	Issue No. 1	Issue No. 2	Issue No. 3	Issue No. 4	Total publication	Percentage
2011	58	4	10	10	9	7	36	11.54
2012	59	4	6	6	8	7	27	8.65
2013	60	4	9	9	9	10	37	11.86
2014	61	4	9	8	11	7	35	11.22
2015	62	4	6	7	9	16	38	12.18
2016	63	4	10	8	8	6	32	10.26
2017	64	4	10	6	6	10	32	10.26
2018	65	4	8	7	7	6	28	8.97
2019	66	4	6	4	5	5	20	6.41
2020	67	4	7	6	5	9	27	8.65
	Total		81	71	77	83	312	100.00

(Source: Data extracted from Scopus)



**Figure-5.2.1: Year-wise distribution of publications**

### 5.2.2 Annual growth of publications

Annual growth of publication states the increase of the number of publications of the present year concerning the previous year. It may be positive or negative based on

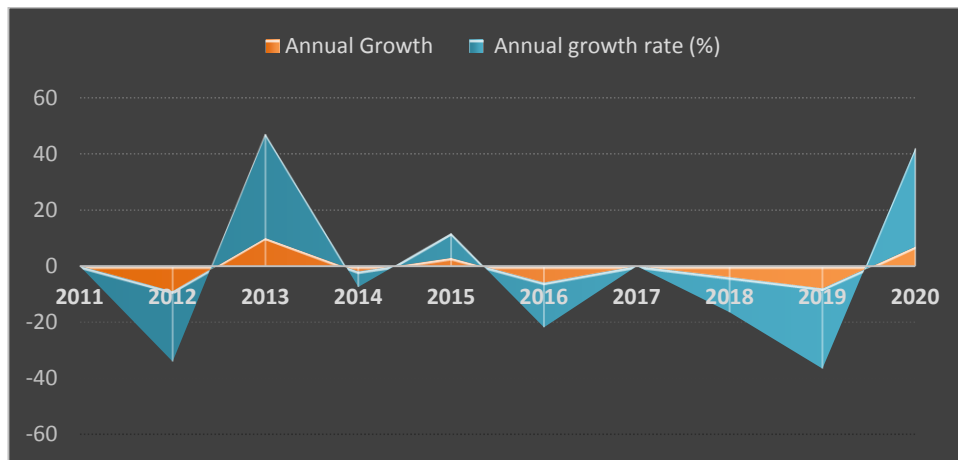
the literature published in a particular year. It is calculated to understand the trend of research on a particular topic in a particular year.

Table 5.2.2 and Figure 5.2.2 depict the annual growth of the publications. It was observed that the highest growth of publications was in the year 2013 having 10 (37.04%) publications more than the previous year 2012. The starting year was taken 2011, so the growth of publication was not considered based on the previous year. In the year 2012, the growth was declined by 9 (-25%) publications. In the year 2014, the growth was declined by 2 (-5.41%), in the year 2015, 3 more publications added compared to the previous year and it increased by 3(8.57%) publications. In the year 2016, growth was decreased by 6 (-15.79%), and the same number of publications published in the year 2017 so, there is no change found in growth. Again the year 2018 and 2019 were declining by 4 (-12.50%) and 8 (-28.57%) respectively. The year 2019 shows the highest declination having 8 (-28.57%) publications compared to previous years' publications. And the year 2020 shows an inclination in growth by publishing 7(35%) more publications as compared to the previous year 2019.

**Table- 5.2.2: Annual growth rate of publications**

<b>Year</b>	<b>Total No. of papers</b>	<b>Annual Growth</b>	<b>Annual growth rate (%)</b>
2011	36	-	
2012	27	-9	-25.00
2013	37	10	37.04
2014	35	-2	-5.41
2015	38	3	8.57
2016	32	-6	-15.79
2017	32	0	0.00
2018	28	-4	-12.50
2019	20	-8	-28.57
2020	27	7	35.00
	312		

(Source: Calculation based on Scopus data)



**Figure- 5.2.2: Annual growth rate of publications**

### ***5.2.3 Relative growth rate of publications***

The growth of Publication was analyzed by Relative Growth Rate (RGR) and Doubling Time (DT). RGR is a Measure to study the increase in the number of articles over time (Mahapatra 1985) and DT is directly related to RGR. It is the years that requested for articles to become double of the existing literature.

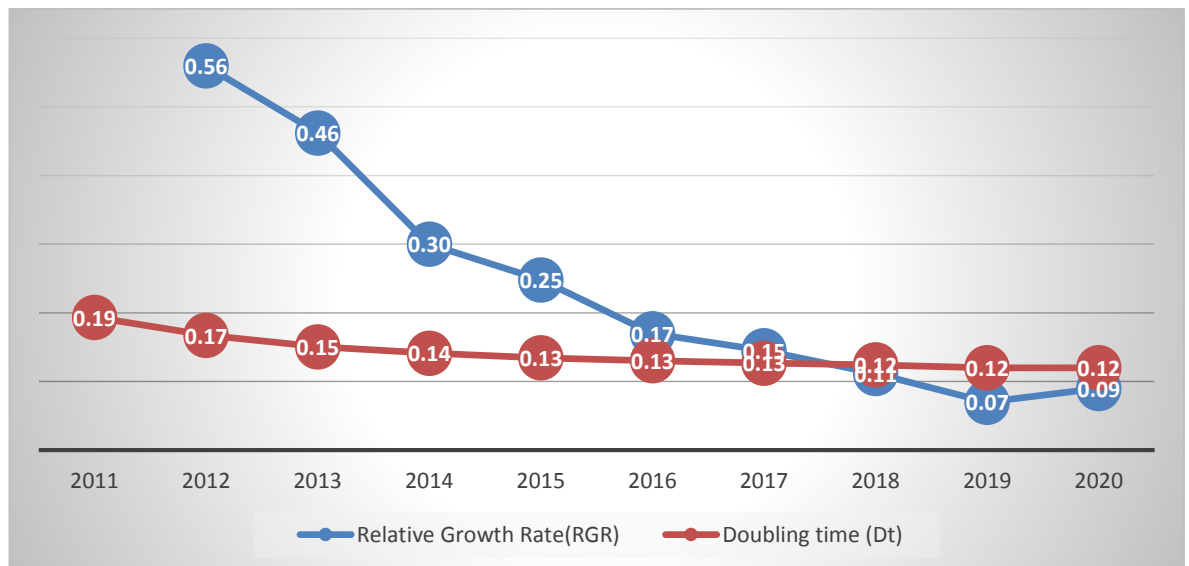
Table 5.2.3 and Figure 5.2.3 show the relative growth rate and doubling time of the publications. It was perceived that the highest relative growth rate was observed in the year 2012 having RGR 0.56, followed by the year 2013 having RGR 0.46, in the year 2014 having RGR 0.30, in the year 2015 having RGR 0.25, in the year 2016 having RGR 0.17, in the year 2017 having RGR 0.15, in the year 2018 having RGR 0.11, in the year 2019 having RGR 0.07 which is the lowest RGR compared to other RGR and in the year 2020, RGR is 0.09. It was found that the relative growth rate was gradually decreasing from the early period to the later period of the study. The Mean RGR for the first block of 5 years was 0.43 and the 2<sup>nd</sup> 5-year block was 0.12. After the analysis of relative growth rate, doubling time was also calculated where it was observed that the highest doubling time was in the year 2011 having Dt 0.19, followed by the year 2012 having Dt 0.17, in the year 2013 having Dt 0.15, in the year 2014 having Dt 0.14. In the years 2015, 2016, and 2017 the doubling time was the same having Dt 0.13. And the lowest doubling time was observed in the years 2018, 2019, and 2020 having dt 0.12. The mean doubling time for the first block was

observed as 0.16 and for the last block of 5 years, it was 0.12. Which shows a negative trend in doubling the time of the publications.

**Table-5.2.3: Relative growth rate of publications**

Year	Total No. of papers	Cumulative no. of articles	W1	W2	Relative Growth Rate(RGR)	Mean RGR	Doubling time (Dt)	Mean Dt
2011	36	36		3.58		0.43		0.16
2012	27	63	3.58	4.14	0.56		0.17	
2013	37	100	4.14	4.61	0.46		0.15	
2014	35	135	4.61	4.91	0.30		0.14	
2015	38	173	4.91	5.15	0.25		0.13	
2016	32	205	5.15	5.32	0.17	0.12	0.13	0.12
2017	32	237	5.32	5.47	0.15		0.13	
2018	28	265	5.47	5.58	0.11		0.12	
2019	20	285	5.58	5.65	0.07		0.12	
2020	27	312	5.65	5.74	0.09		0.12	

(Source: Calculation based on Scopus data)



**Figure-5.2.3: Relative growth rate of publications**

### 5.2.4 Time series analysis of publications

Time series analysis is the art of estimating future publications by anticipating what authors are likely to do under a given set of conditions. Time series analysis is depicted in Table 5.2.4 and Figure 5.2.4. In this study, time series analysis is done for the next 5 and 10 years of growth of literature of source journals. It was observed that based on the present scenario the estimated publication in the year 2025 is 20.27 and in the year 2030 is 14.52. It shows a negative trend towards the growth of the literature.

**Table-5.2.4: Time series analysis of publications**

Year	Total No. of publications (Y)	X	X <sup>2</sup>	XY
2011	36	-4.5	20.25	-162
2012	27	-3.5	12.25	-94.5
2013	37	-2.5	6.25	-92.5
2014	35	-1.5	2.25	-52.5
2015	38	-0.5	0.25	-19
2016	32	0.5	0.25	16
2017	32	1.5	2.25	48
2018	28	2.5	6.25	70
2019	20	3.5	12.25	70
2020	27	4.5	20.25	121.5
	$\Sigma Y = 312$		$\Sigma X^2 = 82.5$	$\Sigma XY = -95$

(Source: Calculation based on Scopus data)

Straight line equation  $Y=a+bX$

$$a = \frac{\Sigma Y}{N} = \frac{312}{10} = 31.2$$

$$b = \frac{\Sigma XY}{\Sigma X^2} = \frac{-95}{82.5} = -1.15$$

Estimated literature in 2025 is when  $X = 9.5$

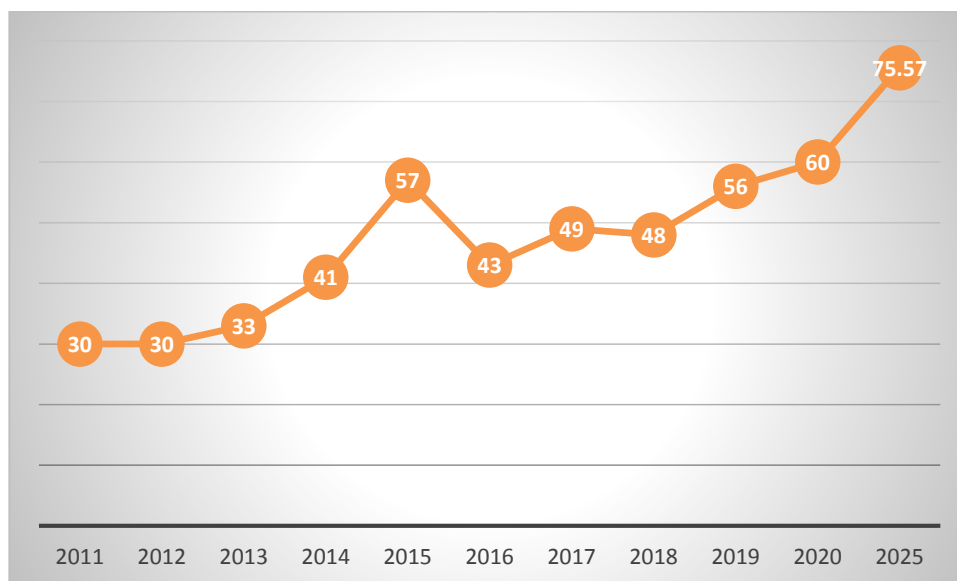
$$= 31.2 + (-1.15) * 9.5$$

$$= 20.27$$

Estimated literature in 2030 is when  $X = 14.5$

$$= 31.2 + (-1.15) * 14.5$$

$$= 14.52$$



**Figure-5.2.4: Time series analysis of publications**

### *5.2.5 Year-wise authorship pattern of contributions*

Table 5.2.5 shows the year-wise authorship pattern of contributions. It was observed that in the year 2011, out of 36 publications single and double authored publications were 14 each, 3 authors' publications were 7, and only 1 publication of 6 authors. In the year 2012, there was a total of 27 publications where single-authored publications were 11, double authored publications were 10, 3 authors publications were 6. In the year 2013, the total publications were 37, where single-authored publications were 12, double authored publications were 18, triple authored publications were 5 and five & six authored publications were 1 each. In the year 2014, the total publications were 35, where single-authored publications were 12, double authored publications were 18, triple authored publications were 3, and four authored publications were 2. In the year 2015, the total publications were 38, where single-authored publications were 18, double authored publications were 14, triple authored publications were 4 and four authored and five authored publications were 1 each. In the year 2016, the total publications were 32, where single-authored publications were 8, double authored publications were 18, triple authored publications were 3, four authored publications were 2 and five authored publications were only 1. In the year 2017, the

total publications were 32, where single-authored publications were 9, double authored publications were 17 and triple authored publications were 6. In the year 2018, the total publications were 28, where single-authored publications were 8, double authored publications were 16, triple authored and four authored publications were 2 each. In the year 2019, the total publications were 20, where single-authored publications were 5, double authored publications were 6, triple authored publications were 4 and four authored publications were 5 and in the year 2013, the total publications were 27, where single-authored publications were 7, double authored publications were 12, triple authored publications were 3, four authored publications were 4 and five authored publication was 1. In the year 2015 highest single-authored publications were observed and in the years 2013, 2014, and 2016 highest double-authored publications were observed.

**Table- 5.2.5: Year-wise authorship pattern of contributions**

Year	No. of Authors						Total
	1	2	3	4	5	6	
2011	14	14	7	0	0	1	36
2012	11	10	6	0	0	0	27
2013	12	18	5	0	1	1	37
2014	12	18	3	2	0	0	35
2015	18	14	4	1	1	0	38
2016	8	18	3	2	1	0	32
2017	9	17	6	0	0	0	32
2018	8	16	2	2	0	0	28
2019	5	6	4	5	0	0	20
2020	7	12	3	4	1	0	27
Total	104	143	43	16	4	2	312

(Source: Data extracted from Scopus )

### 5.2.6 Growth of single and multiple authorship publications

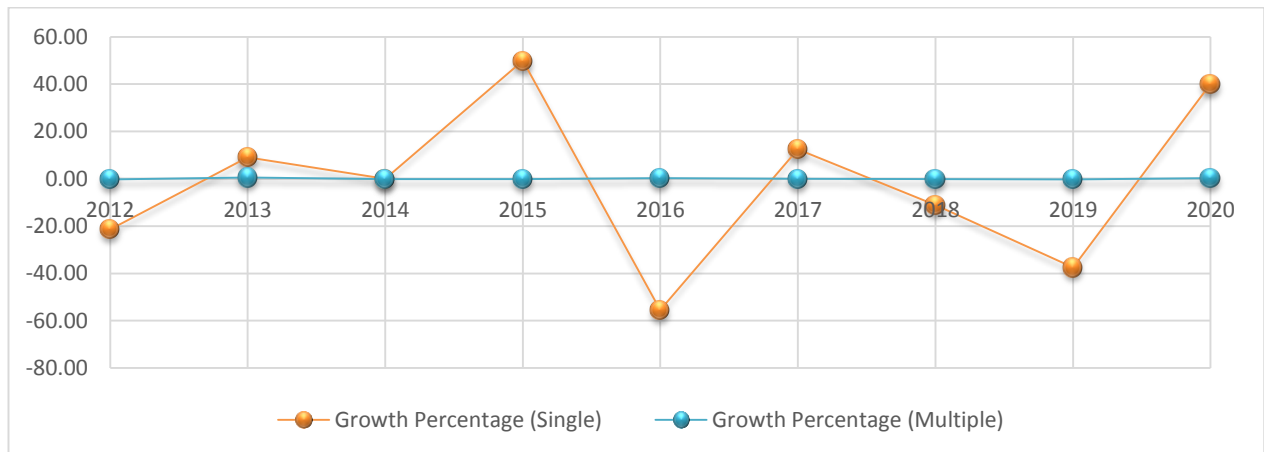
Table 5.2.6 and Figure 5.2.5 show the growth of single and multiple authorship patterns. It was analysed that in the year 2012, single-author publications were decreased by 3 (-21.43%) whereas multiple-authored publications were also decreased by 6 (-0.27%) publications. In the year 2013, in the single authorship pattern, 1 (9.09%) publications increased from the previous year whereas in the multiple authorship pattern 9 (0.56) publications increased from the previous year. In 2014, no growth was observed in the single authorship pattern as there was no change in the growth of publications but in multiple authorship, pattern growth declined by 2 (-0.08%). In the year 2015, the highest number 6 (50%) growth was observed and in multiple authorship patterns, it was declining by 3 (-0.13%). In 2016, the lowest growth was observed in the single authorship pattern having a decline of 10 (-55.56%) publications whereas in the multiple authorship pattern it was increased by 4 (0.20) publications. In 2017, only 1 (12.50%) publication increased in single authorship pattern and 1(-0.04) publication decreased in multiple authorship pattern. In 2018, 1(-11.11%) publication decreased in single authorship pattern and 3(-0.13) publications decreased in multiple authorship pattern. In 2019, 3 (-37.5%) publications decreased in single authorship and 5 (-0.25) publications decreased in multiple authorship patterns. In 2020, Single authorship has increased by 2 (40%) publications and 5 (0.33%) increased by multiple authorship patterns.

**Table- 5.2.6: Growth of single and multiple authorship publications**

Year	Single Author publications	Growth	Growth Percentage	Multiple Authors publications	Growth	Growth Percentage
2011	14			22		
2012	11	-3	-21.43	16	-6	-0.27
2013	12	1	9.09	25	9	0.56
2014	12	0	0.00	23	-2	-0.08
2015	18	6	50.00	20	-3	-0.13
2016	8	-10	-55.56	24	4	0.20
2017	9	1	12.50	23	-1	-0.04
2018	8	-1	-11.11	20	-3	-0.13
2019	5	-3	-37.50	15	-5	-0.25
2020	7	2	40.00	20	5	0.33
Total	104			208		

(Source: Calculation based on Scopus data)





**Figure-5.2.5: Growth of single and multiple authorship**

### 5.2.7 Time series analysis of single-author publication

Time series analysis of single-author publication is shown in Table 5.2.7. In this study, time series analysis is done for the next 5 and 10 years of single-author publication of source journal. It was observed that based on the present scenario the estimated publication in the year 2025 is 2.13 and in the year 2030 is -2.21. It shows a negative trend towards the single author publication in the future.

**Table- 5.2.7: Time series analysis of single-author publication**

Year	Single author publication (Y)	X	X <sup>2</sup>	XY
2011	14	-4.5	20.25	-63
2012	11	-3.5	12.25	-38.5
2013	12	-2.5	6.25	-30
2014	12	-1.5	2.25	-18
2015	18	-0.5	0.25	-9
2016	8	0.5	0.25	4
2017	9	1.5	2.25	13.5
2018	8	2.5	6.25	20
2019	5	3.5	12.25	17.5
2020	7	4.5	20.25	31.5
	<b>ΣY =104</b>		<b>ΣX<sup>2</sup>= 82.5</b>	<b>ΣXY= -72</b>

(Source: Calculation based on Scopus data)

Straight line equation  $Y=a+bX$

$$a = \frac{\sum Y}{N} = \frac{104}{10} = 10.4$$

$$b = \frac{\sum XY}{\sum X^2} = \frac{-72}{82.5} = -0.87$$

Estimated single authors publication in 2025 is when  $X = 9.5$

$$= 10.4 + (-0.87) * 9.5$$

$$= 2.13$$

Estimated single authors publication in 2030 is when  $X = 14.5$

$$= 10.4 + (-0.87) * 14.5$$

$$= -2.21$$

### 5.2.8 Time series analysis of multi-authored publication

Time series analysis of Multi-authored publications is shown in Table 5.2.8. In this study, time series analysis is done for the multi-author publication in the years 2025 and 2030. It was observed that based on the present scenario the estimated multi-authored publication in the year 2025 is 18.23 and in the year 2030 is 16.88. It shows a slight negative trend towards the multi-authored publication in the future but based on publication it may also increase.

**Table- 5.2.8: Time series analysis of multi-author publications**

Year	Multi authored Publications (Y)	X	X <sup>2</sup>	XY
2011	22	-4.5	20.25	-99
2012	16	-3.5	12.25	-56
2013	25	-2.5	6.25	-62.5
2014	23	-1.5	2.25	-34.5
2015	20	-0.5	0.25	-10
2016	24	0.5	0.25	12
2017	23	1.5	2.25	34.5
2018	20	2.5	6.25	50
2019	15	3.5	12.25	52.5
2020	20	4.5	20.25	90
	$\sum Y = 208$		$\sum X^2 = 82.5$	$\sum XY = -23$

(Source: Calculation based on Scopus data)

Straight line equation  $Y=a+bX$

$$a = \frac{\sum Y}{N} = \frac{208}{10} = 20.8$$

$$b = \frac{\sum XY}{\sum X^2} = \frac{-23}{82.5} = -0.27$$

Estimated multi authors publication in 2025 is when  $X = 9.5$

$$= 20.8 + (-0.27) * 9.5$$

$$= 18.23$$

Estimated multi authors publication in 2030 is when  $X = 14.5$

$$= 20.8 + (-0.27) * 14.5$$

$$= 16.88$$

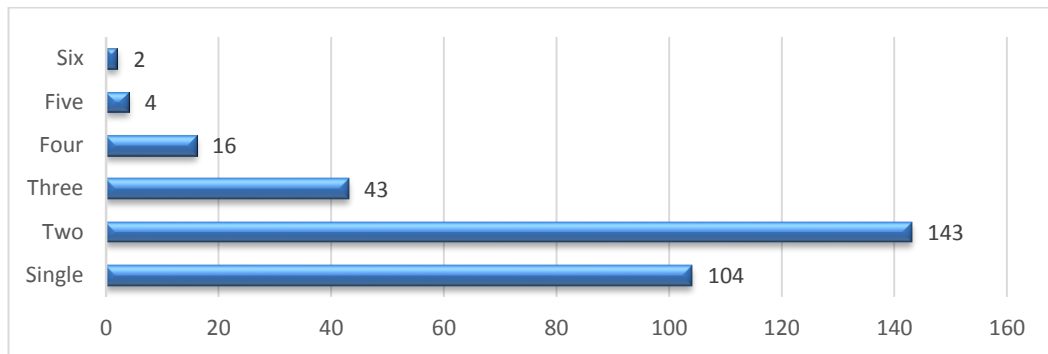
### 5.2.9 Authorship pattern trend-wise distribution

The authorship pattern shows the number of publications published by authors as a single author or multiple authors. Table 5.2.9 and Figure 5.2.6 revealed the authorship pattern trend where it was found that out of a total of 312 publications two authored publications were dominating over others. There were 143 (45.83%) publications were contributed by two authored patterns, followed by single-authored publications having 104 (33.33) publications, three authored publications were 43 (13.78%), four authored publications were 16 (5.13%) and the lowest number of publications contributed by six authored pattern having 2 (0.64%) publications.

**Table-5.2.9: Authorship pattern trend-wise distribution**

Sl. No	Authors	No. of publications	Cumulative Publication	Percentage	Cumulative percentage
1	Single	104	104	33.33	33.33
2	Two	143	247	45.83	79.16
3	Three	43	290	13.78	92.95
4	Four	16	306	5.13	98.07
5	Five	4	310	1.28	99.36
6	Six	2	312	0.64	100.00
	Total	312			

(Source: Calculation based on Scopus data)



**Figure-5.2.6: Authorship pattern trend-wise distribution**

### ***5.2.10 Frequency distribution of the number of papers published***

Table 5.2.10 portrays the frequency distributions of the number of the paper published. It was observed that there was a total of 414 authors who contributed to the ALIS journal from 2011 to 2020. Total of 321 (77.54%) authors written 1 paper each, 56 (13.53%) authors written 2 papers each, 16 (3.86%) authors written 3 papers each, 8 (1.93%) authors written 4 papers each, 4 (0.97%) authors written 5 papers each, 6,7,8 papers written by 2 (0.48%) authors individually, and 39 more papers written by 1 (0.24%) author individually.

**Table-5.2.10: Frequency distribution of the number of papers published**

<b>Paper published</b>	<b>No. of Authors</b>	<b>Percentage of Authors</b>
1	321	77.54
2	56	13.53
3	16	3.86
4	8	1.93
5	4	0.97
6	2	0.48
7	2	0.48
8	2	0.48
9	1	0.24
11	1	0.24
19	1	0.24
Total - 414		

(Source: Data extracted from Scopus )

### 5.2.11 Lotka's law of scientific productivity

Lotka's formula for scientific productivity of authors is as follows:

$$Y=C/X^n$$

Where,

X = Number of Publications

Y = Relative Frequency of Authors with X publications

C = Constants depending on the specified field

Calculations of n:

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

Where N is the number of data pairs considered;

X is the logarithm of x (x=number of articles); and

Y is the logarithm of y (y=number of authors)

The constant C is calculated using the formula:

$$C = \frac{1}{\sum 1/x^n}$$

Table- 5.2.11 depicts the productivity of the researchers in Annals of library and information studies journal and it is tested to find whether it will follow Lotka's law. To verify whether the author's productivity frequency sustains Lotka's law, the Chi-square test is applied to the data set when

$$C = 321$$

$$n = 2.17$$

The Chi-square test for observed and hypothetical authors are calculated.

To get the Chi-Square value, calculating the sum of all the difference between the square of observed and expected frequency (fo-fe)<sup>2</sup> and dividing it by the expected frequency i.e. (fo-fe)<sup>2</sup>/fe. The Chi-square test was calculated at a degree of freedom 10, and a level of significance of 5%. The critical value at the 5% significance level is 18.30 and The Chi-Square value obtained is 24.05, which is highly significant and

greater than the critical value. Hence it found that the law is not in conformity with the present data set.

Hence the Lotka's law does not follow the present author productivity distribution of Annals of library and information studies journal. Hence the Lotka's law in its generalized form does not fit in the contribution frequency of authors' productivity.

**Table-5.2.11: Appropriateness of Lotka's law**

No. of papers (x)	No. of Observed authors(fo)	X	Y	XY	X <sup>2</sup>	No. of expected authors (fe)	fo-fe	(fo-fe) <sup>2</sup>	(fo-fe) <sup>2</sup> /fe
1.00	321.00	0.00	5.77	0.00	0.00	321.00	0.00	0.00	0.00
2.00	56.00	0.69	4.03	2.79	0.48	71.33	-15.33	235.00	3.29
3.00	16.00	1.10	2.77	3.05	1.21	29.59	-13.59	184.70	6.24
4.00	8.00	1.39	2.08	2.88	1.92	15.85	-7.85	61.63	3.89
5.00	4.00	1.61	1.39	2.23	2.59	9.77	-5.77	33.25	3.40
6.00	2.00	1.79	0.69	1.24	3.21	6.58	-4.58	20.93	3.18
7.00	2.00	1.95	0.69	1.35	3.79	4.71	-2.71	7.32	1.56
8.00	2.00	2.08	0.69	1.44	4.32	3.52	-1.52	2.32	0.66
9.00	1.00	2.20	0.00	0.00	4.83	2.73	-1.73	2.98	1.09
11.00	1.00	2.40	0.00	0.00	5.75	1.76	-0.76	0.58	0.33
19.00	1.00	2.94	0.00	0.00	8.67	0.54	0.46	0.21	0.39
Total	414.00	18.14	18.11	14.98	36.77				
								Chi <sup>2</sup>	24.05

(Source: Calculation based on Scopus data)

### 5.2.12 Most prolific authors

Table 5.2.12 shows the most prolific authors of the source journal ALIS during the period of study. Based on the data retrieved from the Scopus database on 4<sup>th</sup> March 2021 a total of 414 authors contributed to the journal out of this only those authors were considered who have 5 or more than 5 contributions. It was observed that Sen B.K has contributed the highest number of contributions having 19 documents with 38 citations and CPP 2. For the remaining authors, the first number indicates document, the second number indicates citations and the third number indicates citation per paper. The authors are Garg K.C (11;57;5.18), Dutta B (9;11;1.22), Gupta B.M (8;49;6.13), Pujar S.M (7; 64; 9.14), Kumar S (7;26;3.71), Tripathi H.K

(6; 35; 5.83), Ray P.P (6;8;1.33), Dutt B (5;31;6.2), Ram S (5; 31; 6.2), Pal J.K (5; 20; 4) and Kumar V (5;7;1.4).

**Table-5.2.12: Most prolific authors**

Rank	Author	Documents	Citations (Scopus)	Citation per paper(CPP) (Scopus)
1	Sen B.K.	19	38	2
2	Garg K.C.	11	57	5.18
3	Dutta B.	9	11	1.22
4	Gupta B.M.	8	49	6.13
5	Pujar S.M.	7	64	9.14
5	Kumar S.	7	26	3.71
6	Tripathi H.K.	6	35	5.83
6	Ray P.P.	6	8	1.33
7	Dutt B.	5	31	6.2
7	Ram S.	5	31	6.2
7	Pal J.K.	5	20	4
7	Kumar V.	5	7	1.4

(Source: Calculation based on Scopus data)

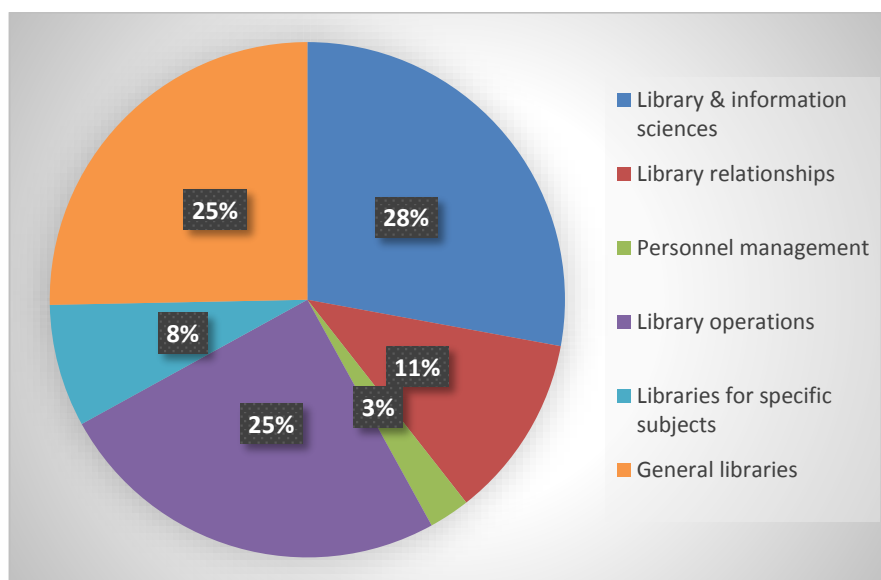
### ***5.2.13 Topic-wise distribution of publications***

The publications of the source journals are scattered in various topics of library and information science. Table 5.2.13 and Figure 5.2.7 demonstrates the topic-wise distribution of publications, where it was observed that the topic “Library & Information Sciences” has the highest number of publications having 87 (27.88%) publications, followed by "General Libraries” having 79 (25.32%) publications, “Library Operations” having 78 (25%) publications, “Library Relationships” having 36 (11.54%) publications, “Libraries for specific subjects” having 24 (7.69%) publications and least publication was from the topic “Personnel Management” having 8 (2.56%) publications out total 312 publications published during the period of study.

**Table-5.2.13: Topic-wise distribution of publications**

Topic	No. of Publications	Percentage	Cumulative percentage
Library & information sciences	87	27.88	27.88
Library relationships	36	11.54	39.42
Personnel management	8	2.56	41.98
Library operations	78	25.00	66.98
Libraries for specific subjects	24	7.69	74.67
General libraries	79	25.32	100.00
	312		

(Source: Data extracted from Scopus )



**Figure-5.2.7: Topic-wise distribution of articles**

#### ***5.2.14 Country wise distributions of articles***

In the journal of Annals of library and information studies, a total of 21 countries contributed 312 publications from 2011 to 2020. Table 5.2.14 shows the country-wise distribution of the articles. It was observed that India has contributed the highest number of publications 234 (75%) and received the highest citations having 845, followed by Nigeria having 24 (7.69%) contributions and 67 citations. Sri Lanka has contributed 14 (4.49%) publications having citations 41. Bangladesh has contributed 9 (2.88%) publications having citations 39. Iran has contributed 6 (1.92%) having 23



citations. The United States of America has contributed 3 (0.96%) publications having 2 citations. Belgium, Kazakhstan, Uganda, Hungary, South Africa, Canada Netherland has contributed 2(0.64%) publications each, and some other countries the United Arab Emirates, Sudan, Tanzania, Brazil, Fiji, Russia, California, and China has contributed only 1 (0.32%) publications each. Compared to other less contributed countries, Uganda and Russia have got a good number of citations having 16 and 15 respectively.

**Table-5.2.14: Country-wise distributions of articles**

<b>Country</b>	<b>No. of publications</b>	<b>Percentage</b>	<b>Cumulative Percentage</b>	<b>Citations</b>
India	234	75.00	75	845
Nigeria	24	7.69	82.69	67
Sri Lanka	14	4.49	87.18	41
Bangladesh	9	2.88	90.06	39
Iran	6	1.92	91.99	23
United States of America	3	0.96	92.95	2
Belgium	2	0.64	93.59	8
Kazakhstan	2	0.64	94.23	5
Uganda	2	0.64	94.87	16
Hungary	2	0.64	95.51	0
South Africa	2	0.64	96.15	4
Canada	2	0.64	96.79	5
Netherlands	2	0.64	97.44	0
United Arab Emirates	1	0.32	97.76	1
Sudan	1	0.32	98.08	2
Tanzania	1	0.32	98.40	3
Brazil	1	0.32	98.72	0
Fiji	1	0.32	99.04	1
Russia	1	0.32	99.36	15
California	1	0.32	99.68	0
China	1	0.32	100.00	8
<b>Total</b>	<b>312</b>			

(Source: Data extracted from Scopus )

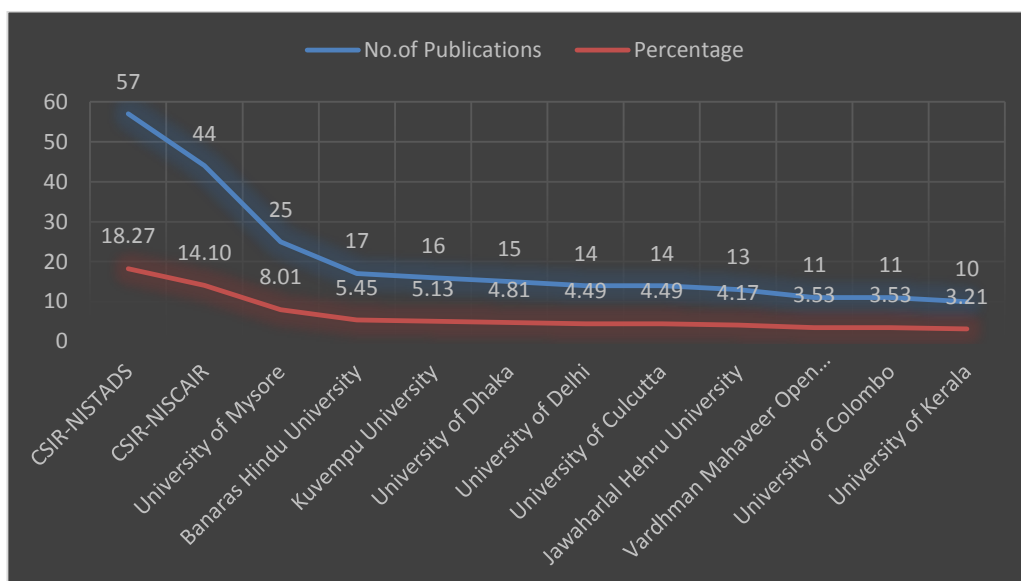
### 5.2.15 Most publishing institutions

Table 5.2.15 and Figure 5.2.8 discuss the most publishing institutions. The top 10 institutions were ranked based on their contribution to source journal ALIS during 2011-2020. Out of a total of 312 publications, CSIR-NISTADS have contributed the highest 57 (18.27%) publications followed by CSIR-NISCAIR having contributed 44 (14.1%) publications. The University of Mysore has contributed 25 (8.01%) publications and occupied 3<sup>rd</sup> rank, Banaras Hindu University has contributed 17 (5.45%) publications is in 4<sup>th</sup> rank, Kuvempu University has contributed 16 (5.13%) publications is in 5<sup>th</sup> rank, the University of Dhaka has contributed 15 (4.81%) publications is in 6<sup>th</sup> rank, the University of Delhi and University of Calcutta both individually contributed 14 (4.49%) papers and in 7<sup>th</sup> rank, Jawaharlal Nehru University (JNU) has contributed 13 (4.17%) publications is in 8<sup>th</sup> rank, Vardhman Mahaveer Open University and University of Colombo have contributed individually 11(3.53%) publications are in 9<sup>th</sup> rank and the University of Kerala has contributed 10 (3.21%) publications is in 10<sup>th</sup> rank.

**Table-5.2.15: Most publishing institutions**

Sl.No	Institutions	No.of Publications	Percentage	Rank
1	CSIR-NISTADS	57	18.27	1
2	CSIR-NISCAIR	44	14.10	2
3	University of Mysore	25	8.01	3
4	Banaras Hindu University	17	5.45	4
5	Kuvempu University	16	5.13	5
6	University of Dhaka	15	4.81	6
7	University of Delhi	14	4.49	7
8	University of Calcutta	14	4.49	7
9	Jawaharlal Nehru University	13	4.17	8
10	Vardhman Mahaveer Open University	11	3.53	9
11	University of Colombo	11	3.53	9
12	University of Kerala	10	3.21	10

(Source: Data extracted from Scopus )



**Figure-5.2.8: Most publishing institutions**

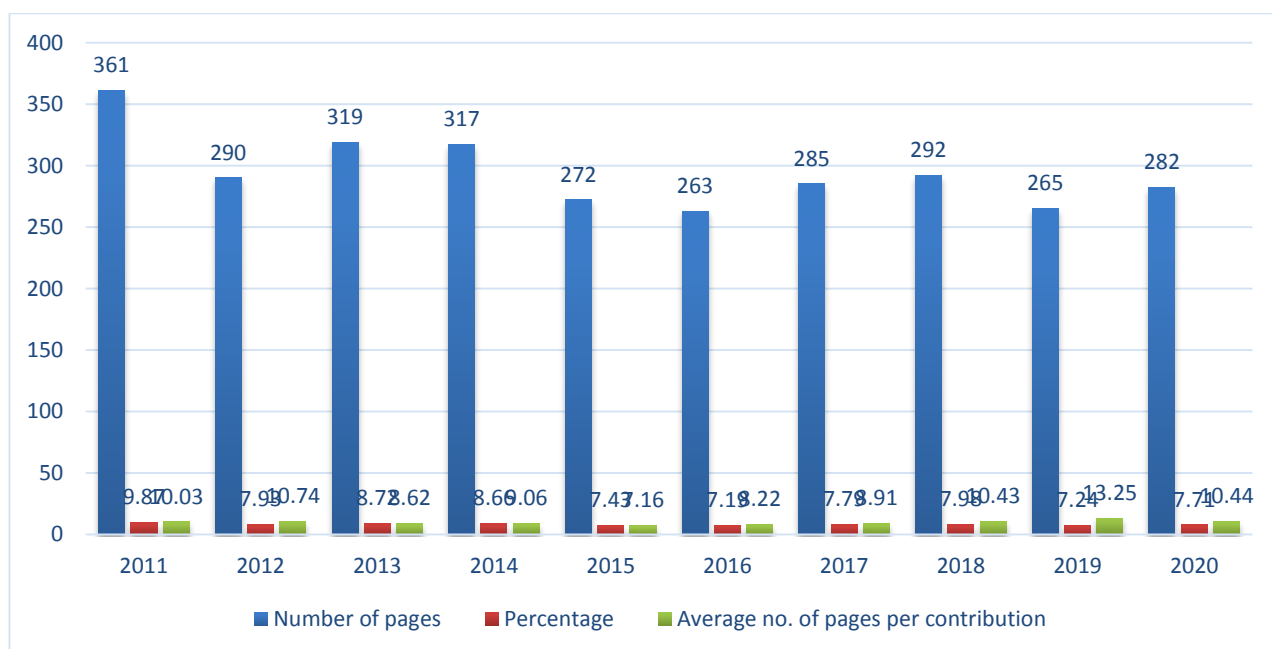
### 5.2.16 Year-wise distribution of pages

Table 5.2.16 and Figure 5.2.9 depict the year-wise distribution of pages of publications. Total numbers of pages were counted 3659 from 10 volumes of a total of 312 publications during 2011-2020. It was observed that the highest 361 (9.87%) pages were there in the year 2011 in total 36 publications and an average number of pages per contribution is 10.03. For remaining years, year 2012 (27; 290; 7.93; 10.74), for the year 2013 (37; 319; 8.72; 8.62), for the year 2014 (35; 317; 8.66; 9.06), for the year 2015 (38; 272; 7.43; 7.16) and for the year 2020 (27; 282; 7.71; 10.44) (**Note- first number indicates number of publications, second number indicates total number of pages, third number indicates percentage and fourth number indicates average number of pages per contribution**). The least number of pages were found in the year 2020. In the average number of pages per contribution, the highest was in the year 2019, and the least was in 2015. Considering the total number of pages and total publications of the study period, the average number of pages per contribution is 11.72 which is a very decent number of pages for any publication.

**Table-5.2.16: Year-wise distribution of pages**

Year	Number of publications	Number of pages	Percentage	Average no. of pages per contribution
2011	36	361	9.87	10.03
2012	27	290	7.93	10.74
2013	37	319	8.72	8.62
2014	35	317	8.66	9.06
2015	38	272	7.43	7.16
2016	32	263	7.19	8.22
2017	32	285	7.79	8.91
2018	28	292	7.98	10.43
2019	20	265	7.24	13.25
2020	27	282	7.71	10.44
Total	312	3659		Average: 11.72

(Source: Data extracted from Scopus)



**Figure-5.2.9: Year-wise distribution of pages**

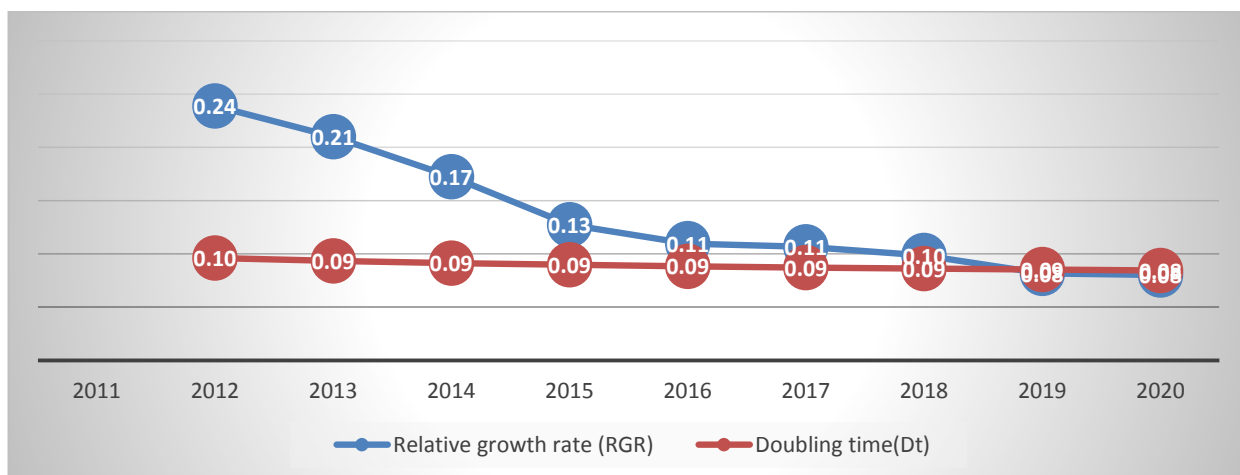
### 5.2.17 Relative growth rate and double-time of pages

Table 5.2.17 and Figure 5.2.10 show the relative growth rate and doubling time of the pages of publications. It was perceived that the highest relative growth rate was observed in the year 2012 having RGR 0.24, followed by the year 2013 having RGR 0.21, in the year 2014 having RGR 0.17, in the year 2015 having RGR 0.13, in the year 2016 and 2017 the RGR was same having 0.11, in the year 2018 having RGR 0.10, again in the year 2019 and 2020 the RGR was found to be same having 0.08. It was observed that the relative growth rate of pages was gradually decreasing from the early period to the later period of the study. The Mean RGR for the first block of 5 years was 0.19 and the last block was 0.10. After the analysis of relative growth rate, the doubling time was also calculated where it was observed that the highest doubling time was in the year 2012 and 2013 having Dt 0.10, followed by all the remaining years having the same Dt of 0.09. The mean doubling time for the first block and the second block was the same having Dt 0.09. It shows that the doubling time (Dt) of pages are consistent, there is no growth and decline of the number of pages over both five years blocks as per as Dt is a concern.

**Table-5.2.17: Relative growth rate and double-time of pages**

Year	Publications	pages	Cumulative no. of pages	W1	W2	RGR	Mean RGR	Dt	Mean Dt
2011	36	361	1074		6.98		0.19		0.09
2012	27	290	1364	6.98	7.22	0.24		0.10	
2013	37	319	1683	7.22	7.43	0.21		0.10	
2014	35	317	2000	7.43	7.60	0.17		0.09	
2015	38	272	2272	7.60	7.73	0.13		0.09	
2016	32	263	2535	7.73	7.84	0.11	0.10	0.09	0.09
2017	32	285	2820	7.84	7.94	0.11		0.09	
2018	28	292	3112	7.94	8.04	0.10		0.09	
2019	20	265	3377	8.04	8.12	0.08		0.09	
2020	27	282	3659	8.12	8.20	0.08		0.09	

(Source: calculation based on Scopus data)



**Figure-5.2.10: Relative growth rate and double-time of pages**

### 5.2.18 Degree of collaboration

Table 5.2.18 shows the degree of collaboration of publications published during 2011- 2020 in the journal Annals of library and information studies. Out of the total of 312 publications, a total of 104 publications are singled authored and 208 publications are multiple-authored. In the years 2016 and 2019, the degree of collaboration is found to be highest (0.75) in each year, followed by in the year 2020 having the degree of collaboration is 0.74, in the year 2017 degree of collaboration was observed 0.72, similarly in the year 2018 it was 0.71, in the year 2013 it was 0.68, in the year 2014 it was 0.66 and in the year 2011, it was 0.61. The degree of collaboration was found to be the lowest (0.59) in the year 2012. From the study, it was found that the average degree of collaboration is 0.67, which means multiple authors are dominating over the single author publications during the period of study. The value of the degree of collaboration increases means the domination of joint author papers increases.

**Table-5.2.18: Degree of collaboration**

Year	Single authored publications ( $N_s$ )	Multiple authored publications ( $N_m$ )	( $N_s+N_m$ )	Degree of collaboration (DC)
2011	14	22	36	0.61
2012	11	16	27	0.59

2013	12	25	37	0.68
2014	12	23	35	0.66
2015	18	20	38	0.53
2016	8	24	32	0.75
2017	9	23	32	0.72
2018	8	20	28	0.71
2019	5	15	20	0.75
2020	7	20	27	0.74
Total	104	208	312	Average:0.67

(Source: calculation based on Scopus data)

### 5.2.19 Collaboration index

Collaboration Index has been calculated by using the formula given by Lawani in 1980. The Collaboration index (CI) is the simplest index presently used to explore the literature, which is to be interpreted as the mean number of authors per paper.

Table 5.2.19 portrays the collaboration index of the publications which are published in the ALIS journal during the study period. It was observed that the highest (2.45) CI was in the year 2019, followed by in the year 2020 having CI 2.45, in the year 2016, the CI was 2.06, in the year 2013 CI was 2.00, in the year 2018 CI was 1.93, in the year 2011 CI was 1.92, in the year 2017 CI was 1.91, in the year 2014 CI was 1.86, in the year 2012 CI was 1.81 and lowest CI 1.76 was in the year 2015. The collaboration Index depends upon the frequency of publication collaborated by the authors. The average collaboration index of 2.00 has been recorded during the study period 2011-2020. From the table, the study tells that the average Collaboration index is 2, which means the average collaborative author per paper is 2.

**Table-5.2.19: Collaboration index**

Year	No. of Authors							Collaboration Index(CI)
	1	2	3	4	5	6	Total	
2011	14	14	7	0	0	1	36	1.92
2012	11	10	6	0	0	0	27	1.81
2013	12	18	5	0	1	1	37	2.00
2014	12	18	3	2	0	0	35	1.86
2015	18	14	4	1	1	0	38	1.76
2016	8	18	3	2	1	0	32	2.06

2017	9	17	6	0	0	0	32	1.91
2018	8	16	2	2	0	0	28	1.93
2019	5	6	4	5	0	0	20	2.45
2020	7	12	3	4	1	0	27	2.26
Total	104	143	43	16	4	2	312	Average:2.00

(Source: calculation based on Scopus data)

### 5.2.20 Collaborative coefficient

The collaborative coefficient was detected by Ajiferuke, that the value of CC will be zero when single-authored papers are dominant. This implication shows that the higher the value of CC means the higher the probability of multi-authored papers.

Table 5.2.20 shows a better understanding of the collaborative coefficient during the period of study. The highest collaborative coefficient of 0.47 was counted in the year 2019, followed by the year 2020, 2016 with 0.44 and 0.42 respectively, In the years 2017, 2018 the CC was the same with 0.39 each the lowest collaborative coefficient was found in the year 2015 with 0.30. The average CC was observed as 0.38. As the result shows that the value of the collaborative coefficient lies between 0 and 1, and it is tending towards the 1, which clearly shows that multi-author papers are more dominating over the single-author paper.

**Table-5.2.20: Collaborative coefficient**

Year	Number of Authors							Collaborative Coefficient(CC)
	1	2	3	4	5	6	Total	
2011	14	14	7	0	0	1	36	0.35
2012	11	10	6	0	0	0	27	0.33
2013	12	18	5	0	1	1	37	0.38
2014	12	18	3	2	0	0	35	0.36
2015	18	14	4	1	1	0	38	0.30
2016	8	18	3	2	1	0	32	0.42
2017	9	17	6	0	0	0	32	0.39
2018	8	16	2	2	0	0	28	0.39
2019	5	6	4	5	0	0	20	0.47
2020	7	12	3	4	1	0	27	0.44
Total	104	143	43	16	4	2	312	Average: 0.38

(Source: calculation based on Scopus data)



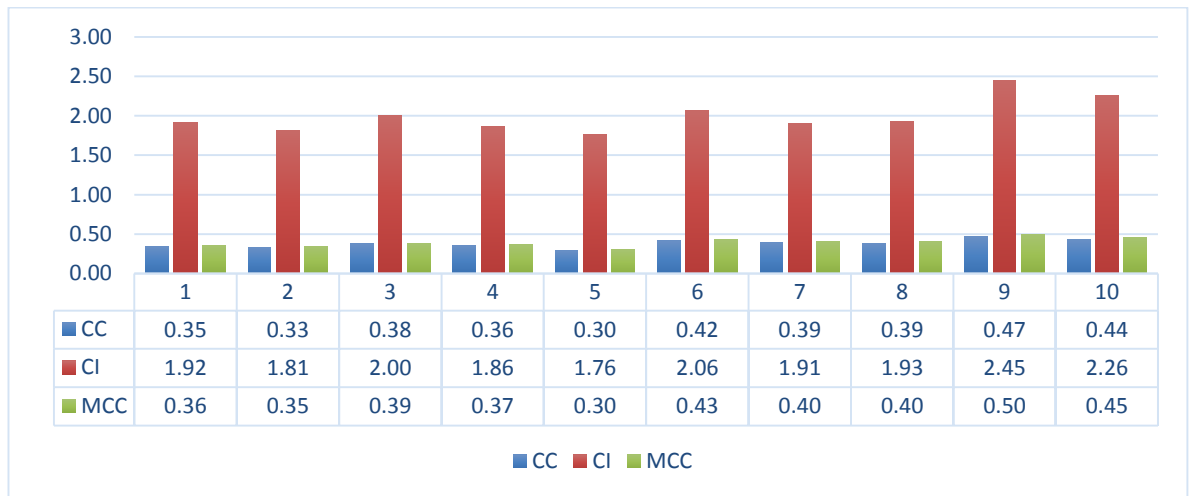
### 5.2.21 Modified collaborative coefficient

Table 5.2.21 shows a better understanding of the modified collaborative coefficient during the period of study. It was observed that the highest MCC was in the year 2019, followed by the year 2020 having MCC 0.45, in the year 2016 having MCC 0.43, in the year 2017, and in 2018 having MCC 0.40 in each year. The lowest MCC was observed in the year 2015 having MCC 0.30. The average modified collaborative coefficient of 0.39 was counted during the period of study 2011-2020. Figure 5.2.11 shows the graphical representation of the Collaborative coefficient, modified collaborative coefficient, and collaboration index.

**Table-5.2.21: Modified collaborative coefficient**

Year	1	2	3	4	5	6	Total	Modified Collaborative Coefficient (MCC)
2011	14	14	7	0	0	1	36	0.36
2012	11	10	6	0	0	0	27	0.35
2013	12	18	5	0	1	1	37	0.39
2014	12	18	3	2	0	0	35	0.37
2015	18	14	4	1	1	0	38	0.30
2016	8	18	3	2	1	0	32	0.43
2017	9	17	6	0	0	0	32	0.40
2018	8	16	2	2	0	0	28	0.40
2019	5	6	4	5	0	0	20	0.50
2020	7	12	3	4	1	0	27	0.45
Total	104	143	43	16	4	2	312	Average: 0.39

(Source: calculation based on Scopus data)



**Figure-5.2.11: Collaboration pattern**

### 5.2.22 Co-authorship index (CAI)

Table 5.2.22 specifies the calculated values of the Co-authorship Index (CAI) for publication having a single author, two authors, three authors, four authors, five authors, and six authors. From the table, we can see that the value of CAI for single authors was increasing in the years 2012, 2014, 2015, 2017, 2018, and 2020. The highest CAI 1832.79 was observed in the year 2015 and the lowest CAI 967.31 was observed in the year 2019. This means there is a decrease in the single authorship concerning the overall output. In the case of double authorship, the highest (346.30) CAI was found in the year 2018 and the lowest (181.81) was in the year 2019, it was gradually going down except in some of the years. In the case of three authorships, the highest (134.67) CAI was found in the year 2012 and the lowest (43.29) was in the year 2018. In the case of four authorships, the highest (120.20) CAI was found in the year 2019, and in many other years, there was no contribution by 4 authors. In the case of five authorship, the highest (26.24) CAI was found in the year 2020. In the case of six authorships, only 2011 and 2013 there was only 1 publication individually in each year. The highest (1832.79) CAI among all was found in the year 2015 concerning authors' contribution. From the overall analysis, it can be seen that CAI for single authorship gradually decreases from later to early period except in some of the years of study which shows a negative trend in single authorship pattern, in 2 authors, CAI gradually increases except some of the years which show a positive

trend in two authors' publications. In 3 authors publication, CAI gradually decreases, which mean that 3 authors contribution are also decreasing from later to the early period. In the 4 authors' publications, the CAI value was fluctuating and there is no accurate trend observed, In 5 authors publications, there were very fewer publications and CAI was also fluctuating. In six authors' publications, only 2 publications were having 1 paper in each different year, so CAI was slightly increased due to the number of publications increased.

**Table-5.2.22: Co-authorship index (CAI)**

Years	1 Authored Paper	CAI for 1 Author	2 Authored Paper	CAI for 2 Author	3 Authored Paper	CAI for 3 Author	4 Authored Paper	CAI for 4 Author	5 Authored Paper	CAI for Five Author	6 Authored Paper	CAI for Six Author	Total Papers
2011	14	1504.70	14	235.68	7	117.84	0	0.00	0	0.00	1	9.38	36
2012	11	1576.35	10	224.45	6	134.67	0	0.00	0	0.00	0	0.00	27
2013	12	1254.89	18	294.82	5	81.90	0	0.00	1	19.15	1	9.12	37
2014	12	1326.59	18	311.67	3	51.94	2	27.64	0	0.00	0	0.00	35
2015	18	1832.79	14	223.27	4	63.79	1	12.73	1	18.64	0	0.00	38
2016	8	967.31	18	340.89	3	56.81	2	30.23	1	22.14	0	0.00	32
2017	9	1088.22	17	321.95	6	113.63	0	0.00	0	0.00	0	0.00	32
2018	8	1105.49	16	346.30	2	43.29	2	34.55	0	0.00	0	0.00	28
2019	5	967.31	6	181.81	4	121.20	5	120.91	0	0.00	0	0.00	20
2020	7	1003.13	12	269.34	3	67.34	4	71.65	1	26.24	0	0.00	27

(Source: calculation based on Scopus data)

### 5.2.23 Most cited publications

Citation is the most important aspect to measure the quality of productivity. Most cited publications are presented in Table 5.2.23 and Figure 5.2.12 with visualization. The visualization is done through the VOS viewer software. A publications' minimum number of citations was considered 15 in this analysis. Of the 312 documents, 9 publications met this threshold. For all the publications, the number of citations, authors, and year of publications was extracted from the Scopus database on 4<sup>th</sup> March 2021. In the visualization figure, different colors indicate the different clusters. The documents are categorized into 9 different clusters under association normalization methods. In visualization, weight is given to the citation and font used

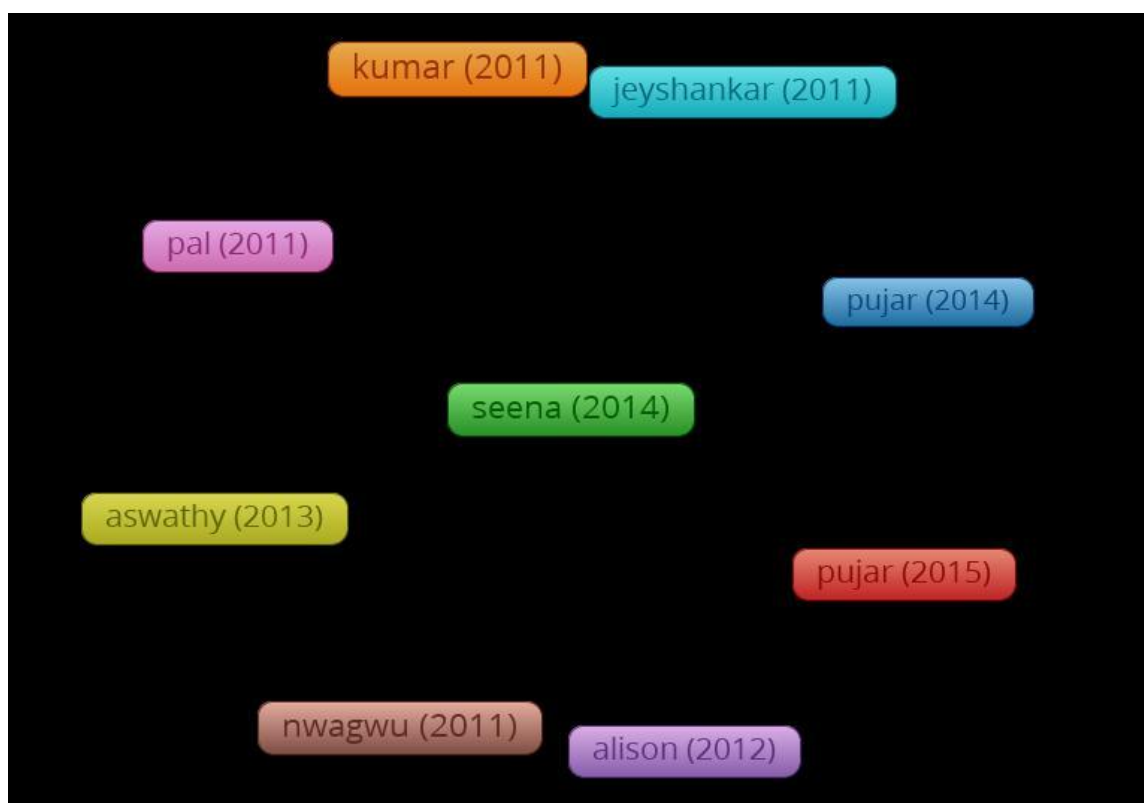
open Sans. The publication “Comparative analysis of scientific output of BRIC countries” by (Kumar, 2011) in cluster 1 got the highest 21 citations. Followed by the publication “A study of ICT skills among library professionals in Kerala university library system” by (Seena & Sudhier, 2014) in cluster 2 had 19 citations, the publication “Women’s health information and information sources: A study of a rural oil palm business community in south-western Nigeria” by (Nwagwu & Ajama, 2011) in cluster 3 got 18 citations placed in 3rd rank. 5 publications individually by (Pujar & Satyanarayan, 2015) in cluster 4, (Awasthy & Gopikuttan, 2013) in cluster 5, (Alison & Kiyingi, 2012) in cluster 6, (Jeyshankar & Ramesh, 2011) in cluster 7 and (Pal, 2011) in cluster 8 got an equal number of citations (16) and were place in 4<sup>th</sup> rank. The publication “MOOCs and LIS education: A massive opportunity or challenge” by (Pujar & Bansode, 2014) in cluster 9 got 15 citations and placed in 5<sup>th</sup> rank. Collectively most of the top-cited papers were published in the year 2011.

**Table-5.2.23: Most cited publications**

Sl. No	Rank	Total Citations	Title	Author
1	1	21	Comparative analysis of scientific output of BRIC countries	(Kumar, 2011)
2	2	19	A study of ICT skills among library professionals in Kerala university library system	(Seena & Sudhier, 2014)
3	3	18	Women’s health information and information sources: A study of a rural oil palm business community in south-western Nigeria	(Nwagwu & Ajama, 2011)
4	4	16	Internet of things and libraries	(Pujar & Satyanarayan, 2015)
5	4	16	Productivity pattern of universities in Kerala: A scientometric analysis	(Awasthy & Gopikuttan, 2013)
6	4	16	Factors affecting utilization of electronic health information resources in universities in Uganda	(Alison & Kiyingi, 2012)
7	4	16	The research output of CSIR-	(Jeyshankar &

			central electrochemical research institute: A study	Ramesh, 2011)
8	4	16	Usefulness and application of data mining in extracting information from different perspectives	(Pal, 2011)
9	5	15	MOOCs and LIS education: A massive opportunity or challenge	(Pujar & Bansode, 2014)

(Source: Data extracted from Scopus)



**Figure-5.2.12: Most cited publications (Visualization)**

#### **5.2.24 Most cited authors of ALIS**

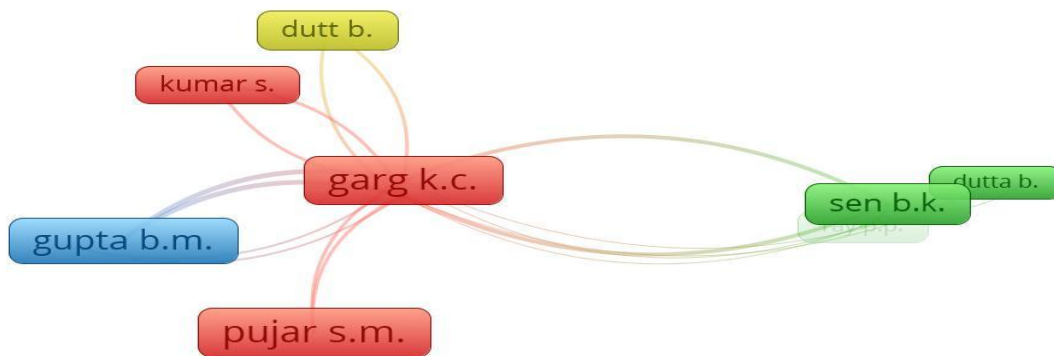
Citation is the most significant aspect to measure the quality of the productivity of an author. Table 5.2.24 and Figure 5.2.13 show the Citation impact of the authors based on the data retrieved from the Scopus database on 4<sup>th</sup> March 2021 contributed in the source journal Annals of library and information studies and with the help of visualization software VOS viewer network visualization map plotted. An author's

minimum number of documents was considered 5 in this analysis. Of the 414 authors, 12 met the threshold. It was observed that author Pujar S.M has the highest number of citations having 64 in 7 documents having CPP 9.14 and total link strength of 6. Although Sen B.K has the highest number of publications but his citation is 38, CPP is 2.00 and Total link strength of 12 got the 4<sup>th</sup> position. Remaining other authors are, Garg K.C (57;11;5.18;33), followed by Gupta B.M (49; 8; 6.13; 11), Tripathi H.K (35;6; 5.83; 33), Dutt B. (31; 5; 6.20; 6), Ram S. (31; 5; 6.20; 5), Kumar S. (26; 7; 3.71; 6), Pal J.K (20; 5; 4.0;0), Dutta B (11; 9; 1.22; 3), Ray P.P (8;6;1.33; 5) and Kumar V (7;5;1.4;2). 12 authors are distributed in 4 different clusters under association normalization methods. In visualization, weight is given to the citation of the authors, and font used open Sans. The authors in the same cluster are highly connected based on their topic of research. In cluster 1 illustrated by red color, there are 4 authors are Garg K.C., Kumar S., Pujar S.M., and Tripathi H.K. In cluster 2 illustrated by green color, the authors are Dutta B., Kumar V., Ray P.P., and Sen B.K. In cluster 3 illustrated by blue color, authors are Gupta B.M and Ram S. In cluster 4 illustrated by yellow, there is only 1 author Dutt B. The Colour differences in Figure 5.2.13 show the clusters of those authors according to their citation strength.

**Table-5.2.24: Most cited authors**

<b>Rank</b>	<b>Author</b>	<b>Citations</b>	<b>Documents</b>	<b>Citation per paper(CPP)</b>	<b>Total link strength</b>
1	Pujar S.M.	64	7	9.14	6
2	Garg K.C.	57	11	5.18	33
3	Gupta B.M.	49	8	6.13	11
4	Sen B.K.	38	19	2.00	12
5	Tripathi H.K.	35	6	5.83	33
6	Dutt B.	31	5	6.20	6
6	Ram S.	31	5	6.20	5
7	Kumar S.	26	7	3.71	6
8	Pal J.K.	20	5	4.00	0
9	Dutta B.	11	9	1.22	3
10	Ray P.P.	8	6	1.33	5
11	Kumar V.	7	5	1.40	2

(Source: Data extracted from Scopus)



**Figure-5.2.13: Most cited authors of ALIS (Network visualization)**

### 5.2.25 Co-authorship analysis of authors

Co-authorship analysis of the authors is presented in Table 5.2.25 and Figure 5.2.14 with network visualization. An author's minimum number of documents was considered 4 in this analysis. Out of a total of 414 authors, 16 met the threshold level. For all the authors, the number of documents, the number of citations, and their total link strengths were evaluated. The authors with the highest total link strengths were selected. The strongest author was Garg K.C. with 11 documents, 57 citations, and 1318 total link strength. Although Sen B.K. has the highest number of publications with 19 documents, he was the third strongest author in this Co-authorship analysis due to a reduced number of citations (38) and total link strength (386). The remaining of the authors are presented in order; Tripathi H.K. (6; 35; 1235), Dutt B. (5; 31; 323), Nikam K. (4; 28; 282), Dutta B. (9; 11; 132), Ray P.P. (6; 8; 132), Pujar S.M. (7; 64; 87) is most cited author in this journal with 64 citations though, he is at the 8<sup>th</sup> order in this list due to his smaller number of total link strength. Kumar S. (7; 26; 86), Gupta B.M. (8, 49, 49), Gupta R. (4, 12, 25), Ram S. (5; 31; 24). Kumar V. (5; 7; 12), Das A.K. (4; 7; 1), Pal J.K. (5; 20; 0), Wijetunge P. (4; 2; 0). (Note: the first number stands for the number of documents, the second one is the number of citations, and the third one is the total link strengths.) Out of 16 authors 2 authors have not any citation so, 14 authors are distributed in 3 different clusters under association normalization methods. In visualization, weight is given to the documents published by the authors, and font style is used 'open Sans'. The authors

in the same cluster are highly connected based on their related topics of research. In cluster 1 represented by red color, there are 6 authors the authors are Das B.K., Dutta B., Kumar V., Pujar S.M., Ray P.P., and Sen B.K. In cluster 2 represented by green color, authors are Dutt B., Kumar S., and Nikam K. In cluster 3 represented by blue color, there are 3 authors are Gupta B.M. and Gupta R. The Colour differences in Figure 5.2.14 show the clusters of those authors according to their citation strength.

**Table-5.2.25: Co-authorship analysis of authors**

Author	No. of Documents	Citations	Total link strength
Sen B.K.	19	38	6
Garg K.C.	11	57	8
Dutta B.	9	11	3
Gupta B.M.	8	49	3
Kumar S.	7	26	2
Pujar S.M.	7	64	0
Ray P.P.	6	8	2
Tripathi H.K.	6	35	6
Dutt B.	5	31	5
Kumar V.	5	7	0
Pal J.K.	5	20	0
Ram S.	5	31	0
Das A.K.	4	7	0
Gupta R.	4	12	3
Nikam K.	4	28	4
Wijetunge P.	4	2	0

(Source: Data extracted from Scopus)



**Figure-5.2.14: Co-authorship analysis (Network visualization)**



### 5.2.26 Co-citation analysis of cited authors

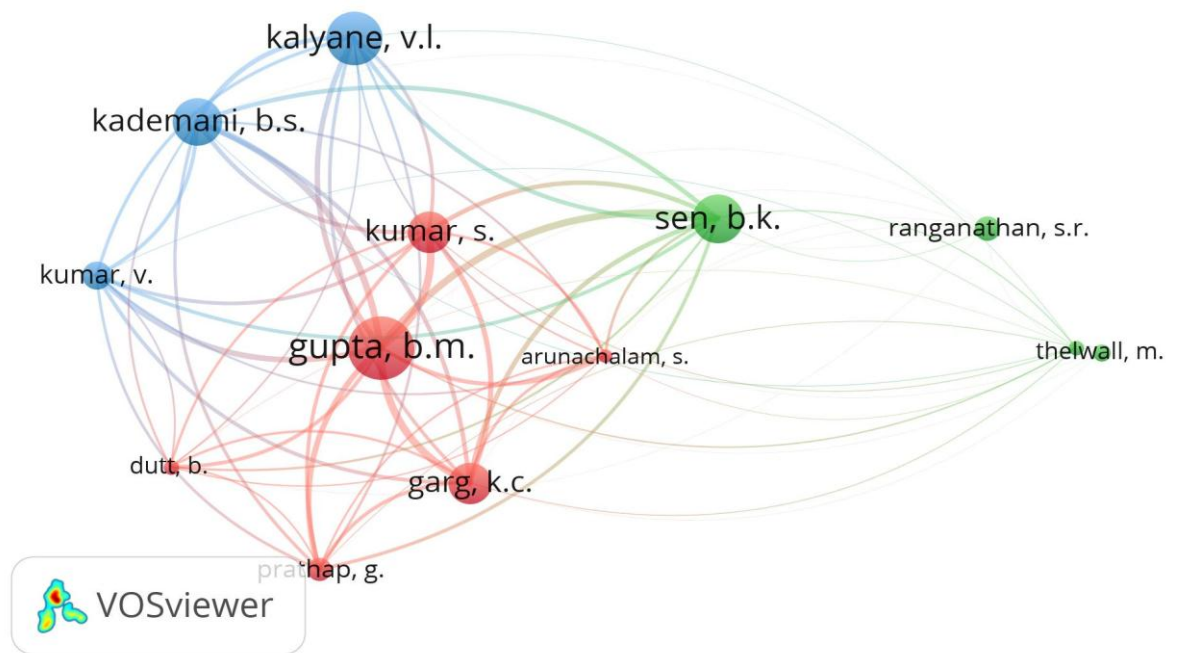
Co-citation analysis of the cited authors is presented in Table 5.2.26 and Figure 5.2.15 with network visualization. A cited author's minimum number of citations was considered 30 in this analysis. Among the 6907 cited authors, 14 authors met the threshold level. For all the authors, the number of citations and their total link strengths was evaluated. The authors with the highest total link strengths were selected. The strongest author was Gupta B.M. with 173 citations and 38632 total link strength. The remaining of the authors are presented in order; Garg, K.C. (107;21132), Kumar, S.(107; 20744), Sen B.K.(129; 20579), Kademani, B.S.(124; 19136), Kalyane V.L.(143; 14198), Kumar V.(68; 13976), Prathap G.(56; 12344), Arunachalam S.(30; 7428), Dutt B.(35; 6061), Rousseau, R.(35; 1115), Ranganathan S.R.(59; 78), Thelwall M.( 39; 25) and Rao C.(42; 0). (Note: the first number stands for the number of citations and the second one is the total link strengths.) Out of 14 authors, 1 author has not any citation so, 13 authors are distributed in 3 different clusters illustrated with different colors. In cluster 1 the authors are Gupta B.M, Kumar.S, Garg, K.C Pratap G, Dutt, B., and Arunachalam, S is highly connected illustrated by red color. In cluster 2, the authors are Kumar V, Kademani B.S, and Kalyane V.L which is illustrated by blue color and in the cluster 3, the authors are Sen B.K, Ranganathan S.R, and Thelwal M which is illustrated by green color. The cluster formed is under association normalization methods, weight is given to the number of citations they have got and font used open Sans.

**Table-5.2.26: Co-citation analysis of cited authors**

<b>Author</b>	<b>Citations</b>	<b>Total link strength</b>
Gupta, B.M.	173	38632
Kalyane, V.L.	143	14198
Kademani, B.S.	124	19136
Garg, K.C.	107	21132
Kumar, S.	107	20744
Kumar, V.	68	13976
Ranganathan, S.R.	59	78
Prathap, G.	56	12344
Rao, C.	42	0
Dutt, B.	35	6061
Rousseau, R.	35	1115

Arunachalam, S.	30	7428
Sen, B.K.	129	20579
Thelwall, M.	39	25

(Source: Data extracted from Scopus)



**Figure-5.2.15: Co-citation analysis of cited authors (Network visualization)**

### 5.2.27 Co-citation analysis of cited sources

Co-citation of the cited sources presented in Table 5.2.27 with network visualization in Figure 5.2.16. A cited journal's minimum number of citations was considered up to 40 only. Among the 3046 journals, only 15 journals met the threshold level. For those 15 journals, the number of citations, and their total strength of the bibliographic coupling links with other journals were calculated. The top journal is *Annals of library and information studies* with 450 citations and 114646 total link strength. For all the sources, the first number stands for the number of citations and the second one is the total link strength. The other journals are; *Annals of library science and documentation* (100; 6491), *Collnet journal of scientometrics and information*

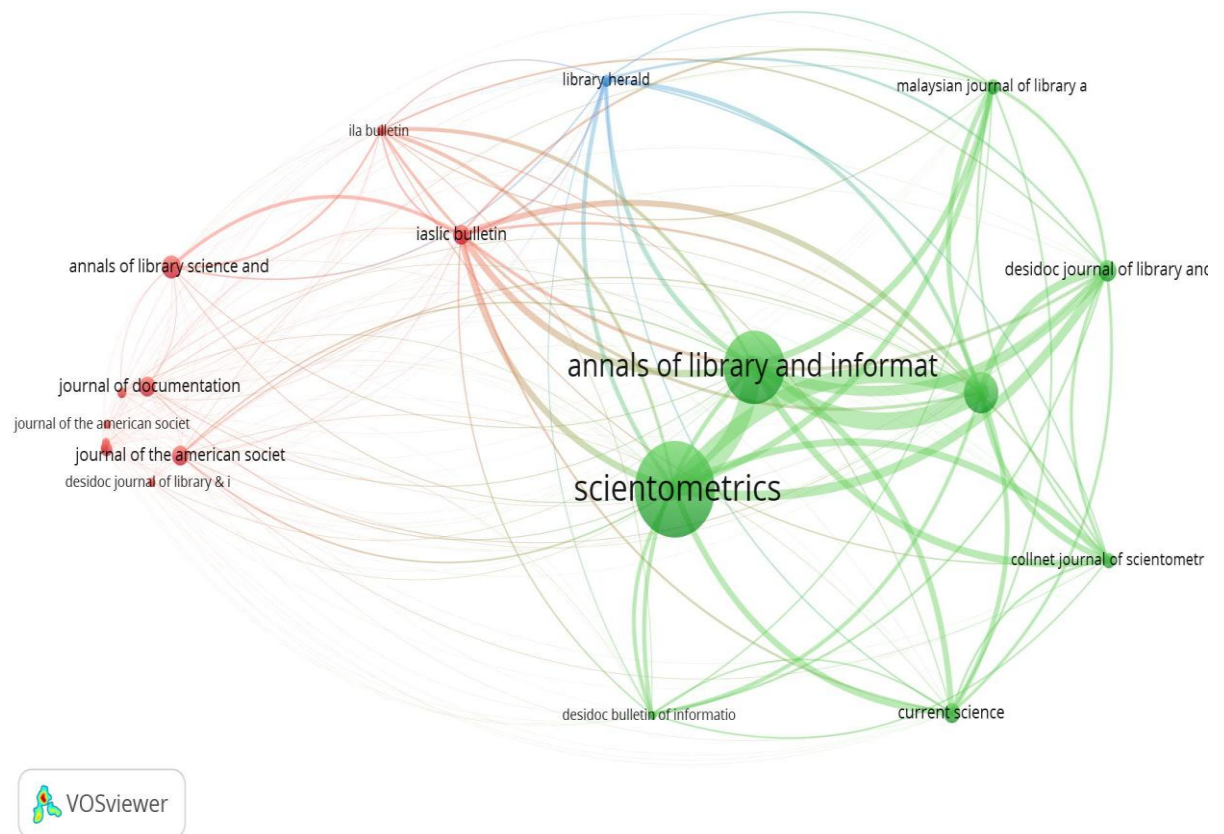
management (62; 29762 ), Current Science ( 85; 26650), Desidoc journal of library & information technology (131; 60155), IASLIC bulletin ( 85; 31777), ILA bulletin ( 46; 15041), Journal of documentation ( 86; 2558), Journal of the American Society for information science ( 47; 1552), Library herald( 50; 20617), Library Review (36; 166), Malaysian journal of library and information science (67; 27225), Scientometrics (465; 94298), SRELS journal of information management(183; 80652), The electronic library (60; 184). In the Figure, each circle stands for a journal, which was distributed in 3 clusters. The cluster formed is under association normalization methods, weight is given to the number of citations they have got and font used open Sans. In cluster 1 the journals are Scientometrics, Annals of library and information science, Iaslic bulletin, Desidoc journal of library and information technology, Malaysian journal of library and information science, and Collnet journal of scientometrics and information management which are illustrated by green color. In cluster 2, the journals are ILA Bulletin, Journal of the American Society for information science and technology, Journal of documentation, Journal of information science, Journal of the American Society for information science, The electronic library which is illustrated by red colors. And in cluster 3 illustrated by blue color, only one journal is there Library herald. This network visualization was showing the close connections between the different journals cited together where journal Annals of library and information studies and Scientometric journal highly co-cited with different other journals.

**Table- 5.2.27: Co-citation analysis of cited sources**

Source	Citations	Total link strength
Annals of library and information studies	450	114646
Scientometrics	465	94068
Srels journal of information management	183	80502
Desidoc journal of library and information technology	131	60155
Iaslic bulletin	85	31731
Collnet journal of scientometrics and information management	62	29713
Malaysian Journal of library and information science	67	27178
Current science	85	26601

Library herald	50	20589
Ila bulletin	46	15021
Journal of the American Society for information science and technology	86	4201
Journal of documentation	86	2525
Journal of information science	47	1529
Journal of the American Society for information science	40	347
The electronic library	60	120

(Source: Data extracted from Scopus)



**Figure-5.2.16: Co-citation analysis of sources (Network visualization)**

### **5.2.28 Bibliographic coupling of the countries**

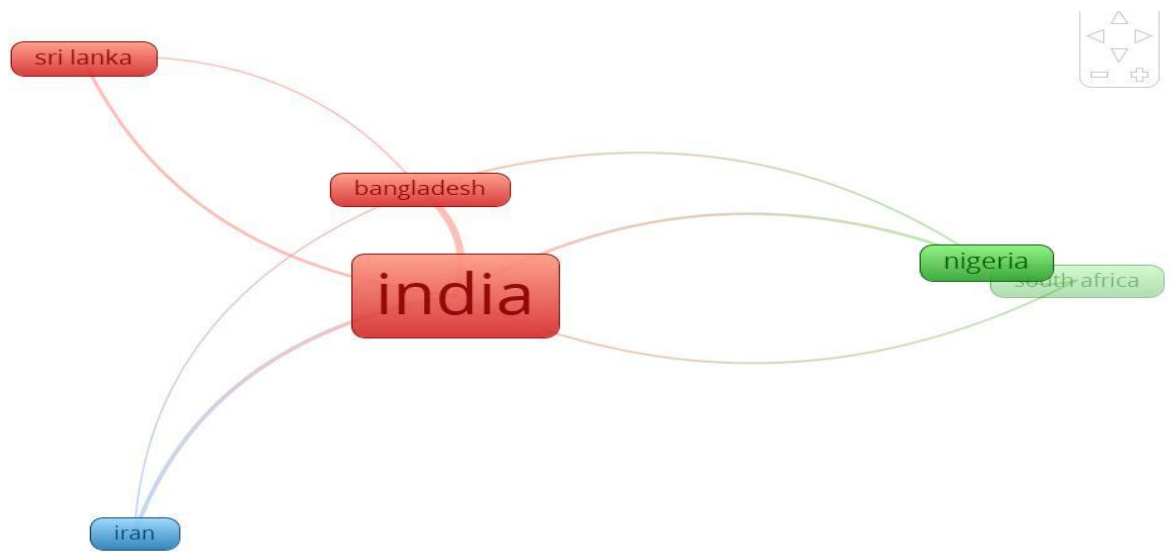
The usage of the bibliographic coupling is significant to find the connection between two or more substances that both cite the same article. Here bibliographic coupling of the countries means that the publications of both the countries cite the same article

for their publications. Bibliographic coupling of the countries is presented in Table 5.2.28 Figure 5.2.17 with network visualization. A country's minimum number of publications was 3. Among the 21 countries, 7 countries met the minimum threshold level. For each of the 7 countries, the total link strength with other countries was calculated. For all of the countries, the number of documents, the number of citations, and total link strength were calculated and presented in mentioned table and figure. The countries with highly bibliographically coupled were listed. The top one was India with 234 documents, 845 citations, and 85 total link strength. For the other countries, the first numbers stand for the number of publications, the second one is the number of citations and the third one is the total link strengths. The other countries were; Nigeria (24; 67; 18), Sri Lanka (14; 41; 13), Bangladesh (9; 39; 55), Iran (6; 23; 20), South Africa (4; 4; 9) and United States of America (3; 2; 0). In the Figure, the countries are divided into three clusters according to their citations and total link strength. Different colors show different clusters that were more commonly connected. It means that the studies initiated from the countries in the same cluster cite each other more regularly. The cluster formed by software VOSviewer is under association normalization methods, weight is given to the number of citations they have got and font used open Sans. In cluster 1 illustrated by red color are India, Bangladesh, and Sri Lanka. In cluster 2 illustrated by green color, the countries are Nigeria and South Africa. And in cluster 3 illustrated by blue color, there is only 1 country Iran.

**Table-5.2.28: Bibliographic coupling of the countries**

<b>Country</b>	<b>Documents</b>	<b>Citations</b>	<b>Total link strength</b>
India	234	845	85
Nigeria	24	67	18
Sri Lanka	14	41	13
Bangladesh	9	39	55
Iran	6	23	20
South Africa	4	4	9
United States of America	3	2	0

(Source: Data extracted from Scopus)



**Figure-5.2.17: Bibliographic coupling of the countries (Network visualization)**

### ***5.2.29 Bibliographic coupling of the publications***

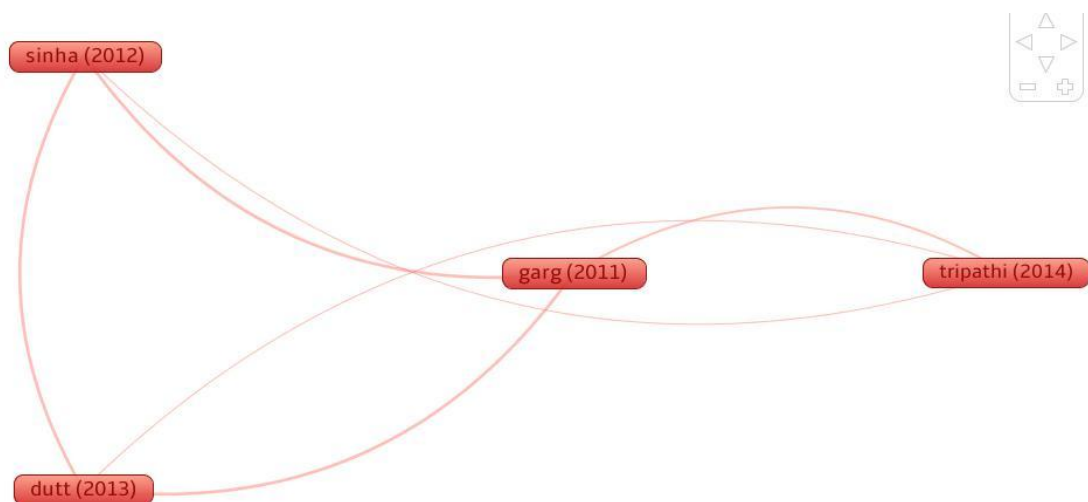
The usage of the bibliographic coupling is significant to find the connection between two or more substances that both cite the same article. Here bibliographic coupling of the publications means that the two publications cite the same article. Bibliographic coupling of the publications is presented in Table 5.2.29 and Figure 5.2.18 with density visualization. Only the publications that have a minimum number of 10 citations were included in this analysis. Out of 312 documents, 28 met the threshold level. But those publications which have total link strength above 1 were tabulated. For all the publications, the number of citations and their total link strengths was calculated. The documents with the greatest total link strength were selected. The strongest one was Garg (2011) with 14 citations and 15 total link strengths. Although Aswathy (2013) and Jeysankar (2011) have the highest citations but their link strength is 4 and 2 respectively which is very less. The network visualization shown in the Figure demonstrates the connectivity of the publications in the cluster. The largest set of connectivity formed only 1 cluster which is illustrated by red color. The network of highly bibliographically coupled publications was considered by the software. The cluster formed by software

VOSviewer is under association normalization methods, weight is given to the number of citations they have got and font used open Sans.

**Table-5.2.29: Bibliographic coupling of the publications**

<b>Publications</b>	<b>Citations</b>	<b>Total link strength</b>
Garg (2011)	14	15
Dutt (2013)	14	13
Sinha (2012)	13	13
Tripathi (2014)	12	5
Aswathy (2013)	16	4
Pillai Sudhir (2013)	11	4
Jeyshankar (2011)	16	2

(Source: Data extracted from Scopus)



**Figure-5.2.18: Bibliographic coupling of the publications (Network visualization)**

### 5.2.30 Bibliographic coupling of the authors

Bibliographic coupling of the authors is presented in Table 5.2 30 and Figure 5.2.19 with network visualization. An author's minimum number of publications was 4 to be included in this analysis. Out of a total of 414 authors, 16 met the threshold level. For all the authors, the number of documents, the number of citations, and their total link strengths were evaluated. The authors with the greatest total link strengths were

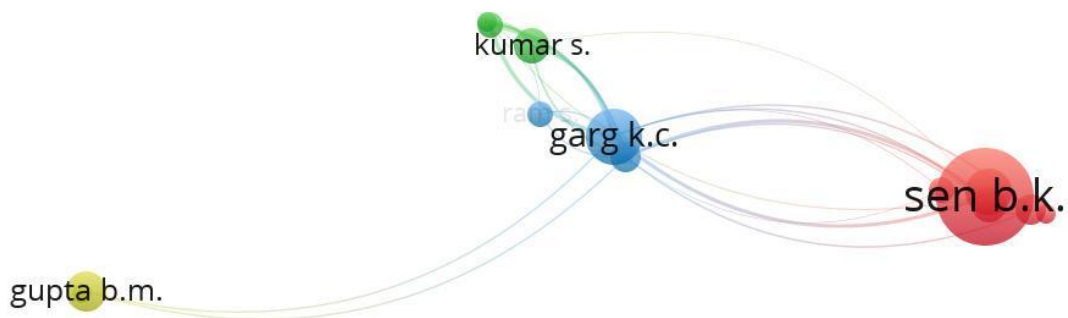
considered. The highest total link strength was observed in the author Garg K.C. (11; 57; 1318), the author Pujar S.M (7; 64; 87) has the highest citation but total link strength is less so, it is in 8<sup>th</sup> position. The other authors were, Tripathi (6; 35; 1235), Sen (19; 38; 386), Dutt (5; 31; 323), Nikam (4; 28; 282), Dutta (9; 11; 132), Ray (6; 8; 132), Kumar (7; 26; 86), Gupta (8; 49; 49), Gupta (4;12;25), Ram (5;31;24), Kumar (5; 7; 12), Das (4; 7; 1), Pal (5;20;0) and Wijetunge (4;2;0). (Note: the first numbers stand for the number of publications, the second one is the number of citations and the third one is the total link strengths). The authors are divided into 4 clusters according to their link strength. In cluster 1 illustrated by red color, there are 6 authors, the authors are Das A.K, Dutta B, Kumar V, Pujar S.M, Ray P.P, and Sen B.K. In cluster 2 illustrated by green color, there are 3 authors, the authors are Dutt B, Kumar S and Nikam K. In cluster 3 illustrated by blue color there are 3 authors, the authors are Garg K.C, Tripathi H.K, and Ram S. And in the cluster 4 illustrated by yellow color, there are 2 authors Gupta B.M and Gupta R.

**Table-5.2.30: Bibliographic coupling of the authors**

<b>Author</b>	<b>Documents</b>	<b>Citations</b>	<b>Total link strength</b>
Garg K.C.	11	57	1318
Tripathi H.K.	6	35	1235
Sen B.K.	19	38	386
Dutt B.	5	31	323
Nikam K.	4	28	282
Dutta B.	9	11	132
Ray P.P.	6	8	132
Pujar S.M.	7	64	87
Kumar S.	7	26	86
Gupta B.M.	8	49	49
Gupta R.	4	12	25
Ram S.	5	31	24
Kumar V.	5	7	12
Das A.K.	4	7	1
Pal J.K.	5	20	0
Wijetunge P.	4	2	0

(Source: Data extracted from Scopus)





**Figure-5.2.19: Bibliographic coupling of the authors (Network visualization)**

### ***5.2.31 Year-wise citation appended***

Table 5.2.31 shows the year-wise citation appended in the documents of the journal. It was found that the highest (817) citations appended in the year 2013 having citation per paper (CPP) 22.69. Followed by the year 2014 with 804 citations appended having CPP 29.78, the year 2011 with 669 citations appended having CPP 19.68, the year 2015 with 654 citations appended having CPP 17.68, the year 2017 with 603 citations appended having CPP 15.87, in the year 2018 with 564 citations appended having CPP 17.63, the year 2016 with 555 citations appended having CPP 15.86. The lowest citation was observed in the year 2019 with 387 citations having a CPP of 12.09. From the table, it can be observed that the highest number of the paper published in the year 2017 and lowest was in 2014 but the highest number of citation appended in the year 2013 and lowest was in 2019. If we consider Citation per paper then the highest was observed in the year 2014 and the lowest was in 2012. Overall we can say that out of 10 years, in five years CPP was above the average CPP, and in the other 5 years, CPP was below average CPP.

**Table 5.2.31: Year-wise citation appended**

<b>Year</b>	<b>TP</b>	<b>TC</b>	<b>Citation per paper (CPP)</b>
2011	34	669	19.68
2012	43	466	10.84

2013	36	817	22.69
2014	27	804	29.78
2015	37	654	17.68
2016	35	555	15.86
2017	38	603	15.87
2018	32	564	17.63
2019	32	387	12.09
2020	28	450	16.07
Total	342	5969	Average: 17.45

(Source: Data extracted from Scopus)

### ***5.2.32 Form of cited documents***

Form of the cited document means the different types of sources cited in any particular publication by an author, it may be the book, web link, journal articles, conference proceedings, etc. Table 5.2.32 shows the year-wise distribution of different cited documents. In the ALIS journal during the period of study, a total of 5969 cited documents were recognized. In 2011 total cited documents were 669, out of which the highest (416) documents were cited as journals followed by books having 91 cited documents. In 2012 total cited documents were 446, out of which the highest (242) documents were cited as journals followed by web resources having 89 cited documents. In 2013 total cited documents were 817, out of which the highest (535) documents were cited as journals followed by books having 133 cited documents. In the year 2014 total cited documents were 804, out of which the highest (556) documents were cited as journals followed by web resources having 81 cited documents. In the year 2015 total cited documents were 654, out of which the highest (368) documents were cited as journals followed by books having 141 cited documents. In the year 2016 total cited documents were 555, out of which the highest (340) documents were cited as journals followed by web resources having 82 cited documents. In the year 2017 total cited documents were 603, out of which the highest (370) documents were cited as journals followed by web resources having 97 cited documents. In the year 2018 total cited documents were 564, out of which the highest (361) documents were cited as journals followed by web resources having 99 cited documents. In the year 2019 total cited documents were 387, out of which the highest (250) documents were cited as journals followed by web resources having 76

cited documents, and in the year 2020 total cited documents were 450, out of which highest (315) documents were cited as journals followed by web resources having 83 cited documents. The most cited document was journals having 3753 (62.87%), followed by web resources having 839 (14.06%) documents, and followed by books having 664 (11.12%) documents. The less cited document was reference books having 39 (0.65%). Overall it was found that the highest number of citations was appended in the year 2013, followed by the year 2014, and the lowest number of citations appended in the year 2019. In the case of the form of cited documents journals were the most cited documents, followed by the web resources which shows that researchers are much more interested to cite journal articles and web resources in this digital era as compared to other sources. The less cited documents were reference books and workshops as these types of documents are not sufficient to provide fresh ideas for any further research.

**Table-5.2.32: Form of cited documents**

Documents	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Percentage
Books	91	57	133	73	141	52	60	24	15	18	664	11.12
Journals	416	242	535	556	368	340	370	361	250	315	3753	62.87
Web resources	78	89	60	81	94	82	97	99	76	83	839	14.06
Conference	33	27	33	55	21	34	31	21	14	12	281	4.71
Workshop	4	9	2	5	1	8	9	1	1	3	43	0.72
Thesis/Dissertation	12	18	14	12	3	5	8	12	8	10	102	1.71
Reference books	2	2	2	4	1	3	12	4	4	5	39	0.65
Reports	22	9	13	5	7	17	6	16	7	4	106	1.78
Others	11	13	25	13	18	14	10	26	12	16	142	2.38
Total	669	466	817	804	654	555	603	564	387	450	5969	

(Source: Data extracted from Scopus)

### 5.2.33 Top cited journals

Table 5.2.33 shows the top-cited journals, out of all the journal participated in citation only 26 journals were found the whose the minimum number of citation was 23 and were considered for the study. It was observed that journal "SCIENTOMETRICS" has got the highest number of citations having 463 citations,

followed by "ANNALS OF LIBRARY AND INFORMATION STUDIES" having 452 citations, journal "SRELS JOURNAL OF INFORMATION MANAGEMENT" having 183 citations, journal "DESIDOC JOURNAL OF LIBRARY AND INFORMATION TECHNOLOGY" having 167 citations, journal "JOURNAL OF DOCUMENTATION" having 86 citations, journal "JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY" having 85 citations, journal "CURRENT SCIENCE" having 83 citations. There are more than 19 journals that have less than 80 citations and more than 22 citations. Based on top-cited journals it can be observed that the source journal highly published the research of bibliometric and scientometric. And besides this, the researchers highly cite the source journals documents after the scientometric journal. Other journals are also get cited but scientometric journals and ALIS journals are highly cited as compared to other cited journals.

**Table-5.2.33: Top cited journals**

<b>Sources</b>	<b>No. of citations</b>
SCIENTOMETRICS	463
ANNALS OF LIBRARY AND INFORMATION STUDIES	452
SRELS JOURNAL OF INFORMATION MANAGEMENT	183
DESIDOC JOURNAL OF LIBRARY AND INFORMATION TECHNOLOGY	167
JOURNAL OF DOCUMENTATION	86
JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY	85
CURRENT SCIENCE	83
IASLIC BULLETIN	76
MALAYSIAN JOURNAL OF LIBRARY AND INFORMATION SCIENCE	65
COLLNET JOURNAL OF SCIENTOMETRICS AND INFORMATION MANAGEMENT	62
THE ELECTRONIC LIBRARY	59
LIBRARY HERALD	50
JOURNAL OF INFORMATION SCIENCE	47
ILA BULLETIN	44
JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE	39
LIBRARY REVIEW	34
LIBRARY TRENDS	34

ASLIB PROCEEDINGS	33
ONLINE INFORMATION REVIEW	30
LIBRARY MANAGEMENT	29
COLLEGE & RESEARCH LIBRARIES	28
INFORMATION STUDIES	27
LIBRARY HI-TECH	25
LIBRARY SCIENCE WITH A SLANT TO DOCUMENTATION AND INFORMATION STUDIES	25
LIBRARY PHILOSOPHY AND PRACTICE	24
INFORMATION PROCESSING & MANAGEMENT	23

(Source: Data extracted from Scopus)

### ***5.2.34 Co-occurrences of the author keywords***

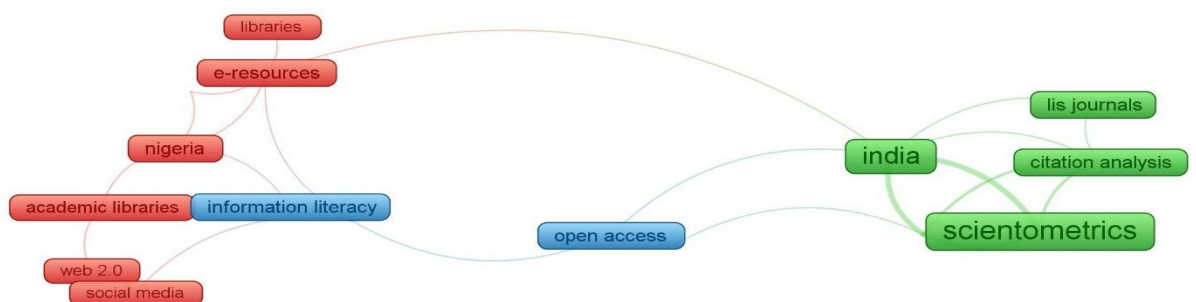
Co-occurrences of the author keywords are presented in Table 5.2.34 and Figure 5.2.20 with network visualization. As insertion criteria, the minimum number of occurrences of a keyword was 6. Out of the total 893 keywords, minimum of 16 times used keywords met the threshold level for analysis. For all the keywords, the number of occurrences and their total link strength with other keywords were calculated. The keywords with the greatest total link strength were considered based on the prefixed threshold. India has the highest total link strength of 19 with 23 occurrences. Scientometrics is the most frequent keyword with 26 occurrences and 18 total link strength but it got the 3<sup>rd</sup> rank in the list according to total link strength. For the others, the first number stands for their occurrences and the second one is their total link strength. Bibliometrics (24; 18), Citation analysis (10; 8), Sri Lanka (8; 6), E-resources (10; 5), Information literacy (10; 4), Nigeria(11; 4), Social media (6; 4), web 2.0 ( 6; 4), Open access (9; 3), Academic libraries (8; 2), Impact factor (6; 2), LIS journal (9; 2), University libraries(6; 2) and Libraries (6;1). In Figure, different colors show 3 different clusters in which the terms are more often connected. Cluster 1 illustrated by red color included of 7 keywords is Academic libraries, e-resources, libraries, Nigeria, social media, university libraries, and web 2.0. Cluster 2 illustrated by green color included 5 keywords are bibliometrics, citation analysis, India, LIS journals, and scientometrics. Cluster 3 illustrated by blue color included 4 keywords are impact factor, information literacy, open access, and Sri Lanka. The keyword occurrence of the same cluster is highly interconnected with

each other. From the analysis, it can reveal that the word scientometric has been highly used by the authors in the publication followed by the words bibliometrics, India, Nigeria.

**Table-5.2.34: Co-occurrences of the author keywords**

Keyword	Occurrences	Total link strength
Scientometrics	26	18
Bibliometrics	24	18
India	23	19
Nigeria	11	4
Citation analysis	10	8
E-resources	10	5
Information literacy	10	4
LIS journals	9	2
Open access	9	3
Academic Libraries	8	2
Sri Lanka	8	6
Impact factor	6	2
Libraries	6	1
Social media	6	4
University libraries	6	2
Web 2.0	6	4

(Source: Data extracted from Scopus)



**Figure-5.2.20: Co-occurrences of the author keywords (Network visualization)**

### 5.2.35 Co-word network analysis of the title of the documents

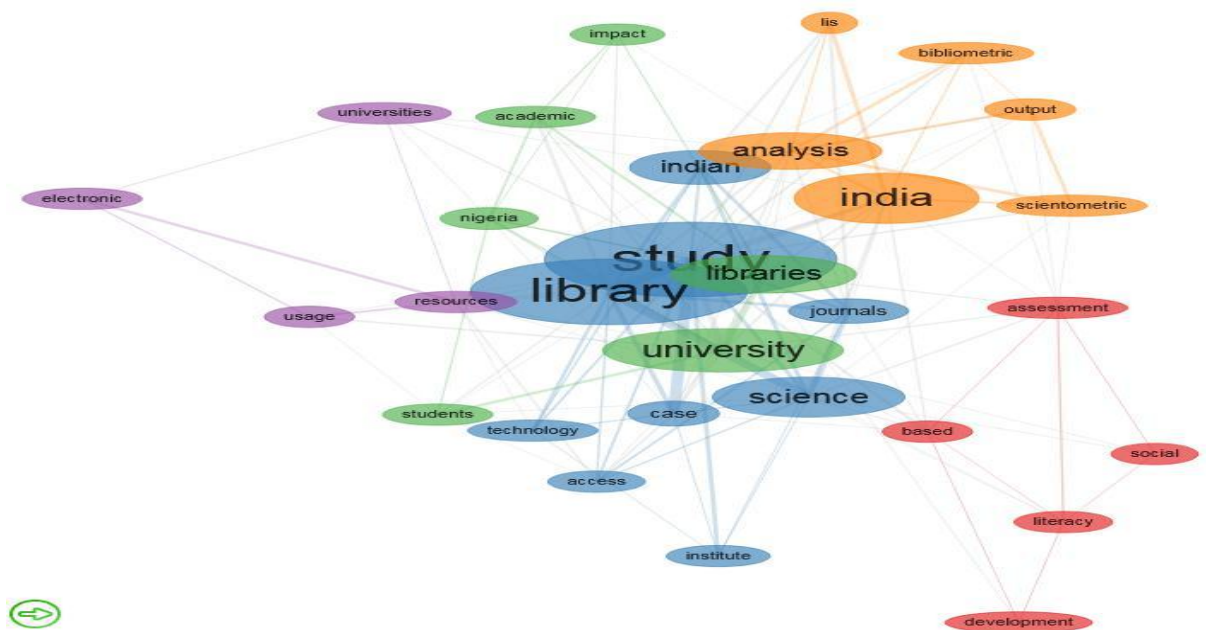
Co-word network analysis is a content analysis method that practices patterns of co-occurrence of substances. Table 5.2.35 and Figure 5.2.21 describes the Co-word network analysis of the title of the documents. Biblioshiny software was used to calculate the betweenness and closeness among the words. Between-ness means, how many times they occurred in the title and closeness means how they are connected with other words. In the software network layout kept as "Automatic network", normalization as "association" and clustering algorithm used Louvain. The number of nodes used was 50, but out of them 28 keywords were considered based on their between-ness. Based on between-ness and closeness strength, the total 28 title keywords were again divided into 5 clusters according to their between-ness strength. The word "Study" is used highly in the title of the documents having between-ness 96.13 and closeness 0.03. Followed by the word "Library" having between-ness is 38.89 and closeness are 0.03. The analysis shows the connectivity among the different words used by the authors in the title of the documents. The different 5 clusters are shown in different colors in the figure. In the figure, it can be seen that the highest font size of the word is highly connected with other words. More the between-ness more association of the word with other words. Accordingly, the word 'study' is highly connected with other words, followed by the word 'library', 'university', 'science', and so on.

**Table-5.2.35: Co-word network analysis of the title of the documents**

<b>words</b>	<b>Cluster</b>	<b>Between-ness</b>	<b>Closeness</b>
Study	2	96.13	0.03
Library	2	38.89	0.03
University	3	33.48	0.02
Science	2	31.60	0.02
Libraries	3	27.73	0.02
Resources	4	20.56	0.02
India	5	17.08	0.02
Indian	2	10.43	0.02
Analysis	5	10.36	0.02
Assessment	1	8.52	0.02

Based	1	8.25	0.02
Universities	4	4.83	0.02
Usage	4	4.71	0.02
Nigeria	3	4.54	0.02
Journals	2	4.30	0.02
Literacy	1	2.85	0.02
Case	2	2.09	0.02
Access	2	0.82	0.02
Output	5	0.77	0.02
Scientometric	5	0.63	0.02
Students	3	0.54	0.02
Technology	2	0.46	0.02
Bibliometric	5	0.45	0.02
Electronic	4	0.30	0.01
Academic	3	0.25	0.02
Development	1	0.21	0.02
Institute	2	0.12	0.02
Impact	3	0.11	0.02

(Source: Data extracted from Scopus)



**Figure-5.2.21: Co-word network analysis of the title of the documents (Network visualization)**



### 5.2.36 Word cloud of author keyword

Word cloud is a pictorial representation of word occurrence in a data set. The bigger the font size of the word denotes the more occurrence of the words. It gives an insight into the most occurred words. Word cloud formed by a cloud of most occurred word based on authors keyword. Table 5.2.36 and Figure 5.2.22 describes the word cloud of author keywords, where the author's keywords were considered for the study. The different words are shown in different colors in the figure. In the figure, it can be seen that the highest font size of the word has more occurrence in the author keyword of the document. It was observed that the keyword "Scientometric" highly occurred having a frequency of 27, followed by "Bibliometrics" occurred 24 times. The keyword "India" occurred 23 times and so on. From this analysis it can recognize that maximum publications are from scientometrics, bibliometrics and India is the leading country to publish the paper in ALIS journal.

**Table-5.2.36: Word cloud of author keyword**

<b>Words</b>	<b>Occurrences</b>
Scientometrics	27
Bibliometrics	24
India	23
Information literacy	11
Nigeria	11
Citation analysis	10
e-resources	10
lis journals	9
open access	9
academic libraries	8
Sri Lanka	8
s r Ranganathan	7
impact factor	6
libraries	6
social media	6
university libraries	6
web 2 0	6
Bangladesh	5
citations	5
collection development	5

colon classification	5
consortia	5
electronic resources	5
internet	5
library and information science	5
scholarly communication	5
Scopus	5

(Source: Data extracted from Scopus)

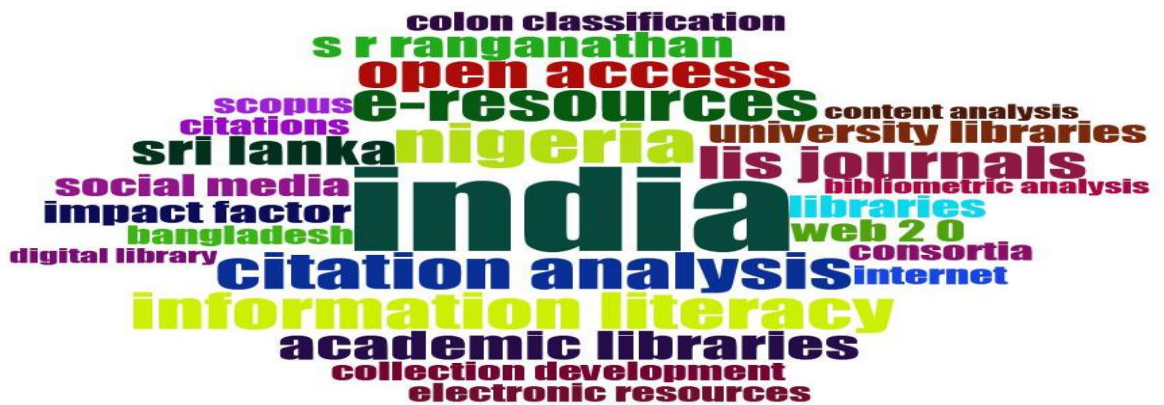


Figure-5.2.22: Word cloud of author keyword

### 5.2.37 Word cloud of title keyword

Word cloud formed by a cloud of most occurred words occurred in the title of the document. Table 5.2.37 and Figure 5.2.23 describes the word cloud of title keywords, where title keywords were considered for the study. The different words are shown in different colors in the figure. In the figure, it can be seen that the highest font size of the word has more occurrence in the title of the document. It was observed that the keyword “study” highly occurred having a frequency of 65, followed by “library” occurred 60 times. The keyword “India” occurred 41 times and so on. From this analysis, it can recognize that maximum publications have the word "study" "library" and "India" in the title of the document.

Table-5.2.37: Word cloud of title keyword

Words	Occurrences
study	65
library	60
India	41
analysis	33
university	33
libraries	32
science	32
Indian	30
journals	21
scientometric	19
case	18
bibliometric	17
assessment	16
lis	15
output	15
resources	15
Nigeria	14
access	13
impact	13
academic	12
based	12
development	12
literacy	12
universities	12

(Source: Data extracted from Scopus)



Figure-5.2.23: Word cloud of title keyword

### 5.2.38 Word cloud of abstract keyword

Word cloud formed by a cloud of most occurred words in abstract of the document. Table 5.2.38 and Figure 5.2.24 describes the word cloud of abstract keywords, where abstract keywords were considered for the study. The different words are shown in different colors in the figure. In the figure, it can be seen that the highest font size of the word has more occurrence in the abstract of the document. It was observed that the keyword “science” highly occurred having a frequency of 317, followed by “study” occurred 305 times. The keyword “library” occurred 284 times and so on. From this analysis, it can recognize that maximum publications are having the words science, study, library, resources, etc. in the abstract of the document.

**Table-5.2.38: Word cloud of abstract keyword**

<b>Words</b>	<b>Occurrences</b>
science	317
study	305
library	284
resources	257
national	225
communication	219
institute	211
journals	193
paper	183
NASCAR	159
libraries	152
data	146
university	134
number	130
papers	121
india	119
indian	119
published	115

(Source: Data extracted from Scopus)



Figure-5.2.24: Word cloud of abstract keyword

### 5.2.39 Word dynamics analysis of authors' keyword

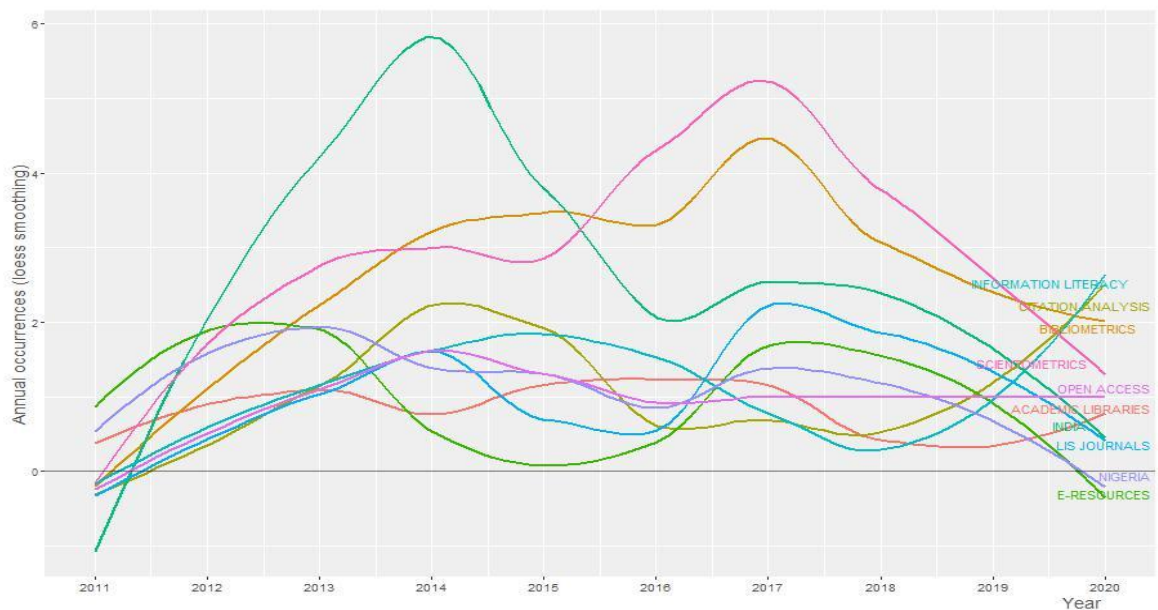
Word dynamics analysis states the activeness of the words how frequently it is occurring in a year. Table 5.2.39 and Figure 5.2.25 show the word dynamics analysis of the author keywords. It means the analysis will identify the year-wise most occurred author keywords among all the top keywords of the ALIS journal during the period of study. It was found that in the year 2011, there were no top keywords among highly occurred keywords while in the year 2012 the keyword “E-resources” highly occurred with a count of 4. In 2013 and 2018, the word "scientometrics" highly occurred with a count of 4. In the years 2014 and 2019, the word “India” occurred highest 9 times in each year. In the year 2015, the keywords "scientometrics", "bibliometrics", "information literacy", "citation analysis" occurred twice individually. In the years 2016 and 2017, the keyword "scientometric" occurred highest 5 times in each year. In the year 2020, the words "bibliometrics", "information literacy" and "citation analysis" occurred thrice individually that year. In the figure, it can be easily seen that different colors show the year-wise variations of its occurrence. By the overall analysis, it was cleared that word India shown in

green line occurred highest in the year 2014, followed by the word scientometrics in pink line in 2017 and bibliometrics in brown line 2017 are the leading keywords used in the research published in Annals of library and Information studies during the study period.

**Table-5.2.39: Word dynamics analysis of authors' keyword**

Word	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Scientometrics	0	1	4	3	2	5	5	4	1	2
Bibliometrics	0	1	1	5	2	4	4	4	0	3
India	0	0	3	9	1	3	3	1	3	0
Information Literacy	0	0	2	1	2	2	0	1	0	3
Nigeria	0	3	1	2	1	1	1	2	0	0
Citation Analysis	0	0	0	3	2	0	1	1	0	3
E-resources	0	4	1	1	0	0	2	2	0	0
LIS journals	0	0	0	3	0	0	3	2	0	1
Open access	0	0	1	2	1	1	1	1	1	1
Academic libraries	0	2	0	2	0	2	1	0	0	1

(Source: Data extracted from Scopus)



**Figure-5.2.25: Word dynamics analysis of authors' keyword**

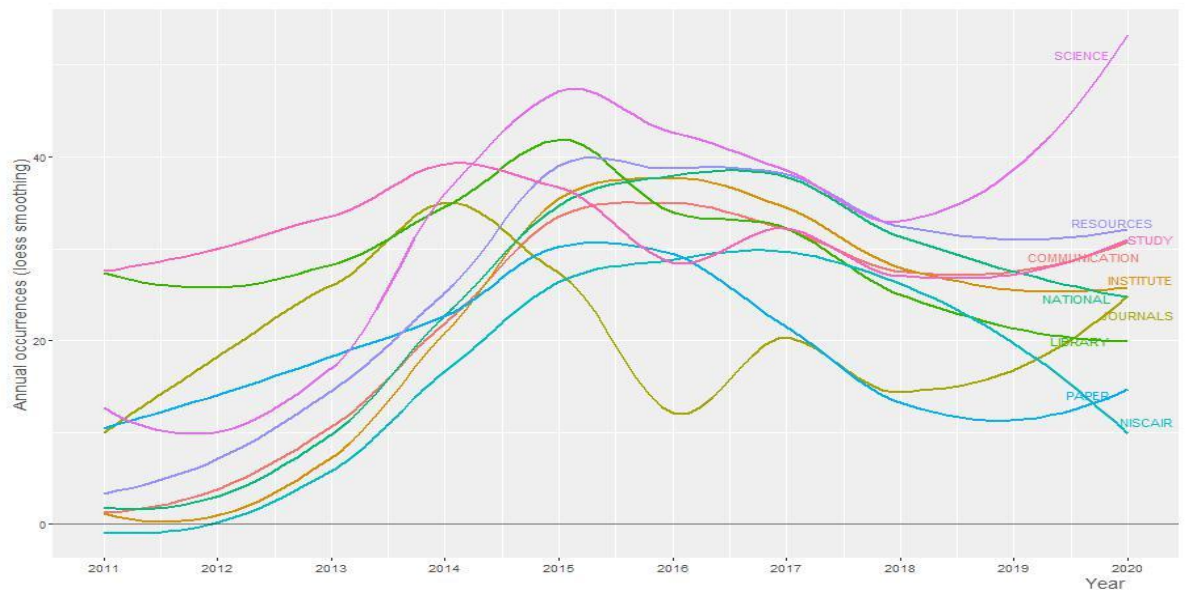
#### 5.2.40 Word dynamics analysis of abstract keyword

Table 5.2.40 and Figure 5.2.26 show the word dynamics analysis of abstract keywords. It means the analysis will identify the year-wise most occurred abstract keywords among all the words of the abstract published by the ALIS journal during the period of study. It was found that in the years 2011 and 2013, the word “study” highly occurred with a count of 30, 21 respectively. In the year 2012 the word “Library” highly occurred with a count of 34. In the year 2014, the word “Journals” occurred highest 60 times. In the year 2015, the keywords “science” occurred highest 53 times. In the years 2016 and 2018 the keyword “Resources” occurred highest 38 individually in each year. In the year 2017, the word "National" occurred highest with a count of 44. In the years 2019 and 2020, the word “Science” occurred highest with a count of 25 and 59 respectively in each year. In the figure, it can be easily seen that different colors show the year-wise variations of its occurrence. By the overall analysis, it was cleared that word 'science' shown in the violet line occurred highest in the year 2020, followed by the word 'study' in pink line in 2014, and the word 'National' in brown line 2017 is the leading keywords used in the research published in Annals of library and Information studies during the study period. If we see the overall trend then it can be said that the word “Science” occurred highly followed by the word ‘study’, ‘library’ ‘National’ and so on in the abstract section of the article of ALIS journal during the period of study.

**Table-5.2.40: Word dynamics analysis of abstract keyword**

Word	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Science	17	3	9	37	53	36	41	37	25	59
Study	30	28	21	54	27	31	32	29	18	35
Library	26	34	9	47	38	33	33	27	14	23
Resources	2	13	4	29	40	38	36	38	21	36
National	2	5	2	22	42	29	44	32	18	29
Communication	1	6	5	20	40	29	35	29	20	34
Institute	2	1	1	21	39	35	35	30	18	29
Journals	15	12	8	60	9	19	17	20	2	31
Paper	10	16	15	26	26	35	18	12	9	16
NISCAIR	0	0	0	18	29	25	32	27	17	11

(Source: Data extracted from Scopus)



**Figure-5.2.26: Word dynamics analysis of abstract keyword**

#### **5.2.41 Word dynamics analysis of title keyword**

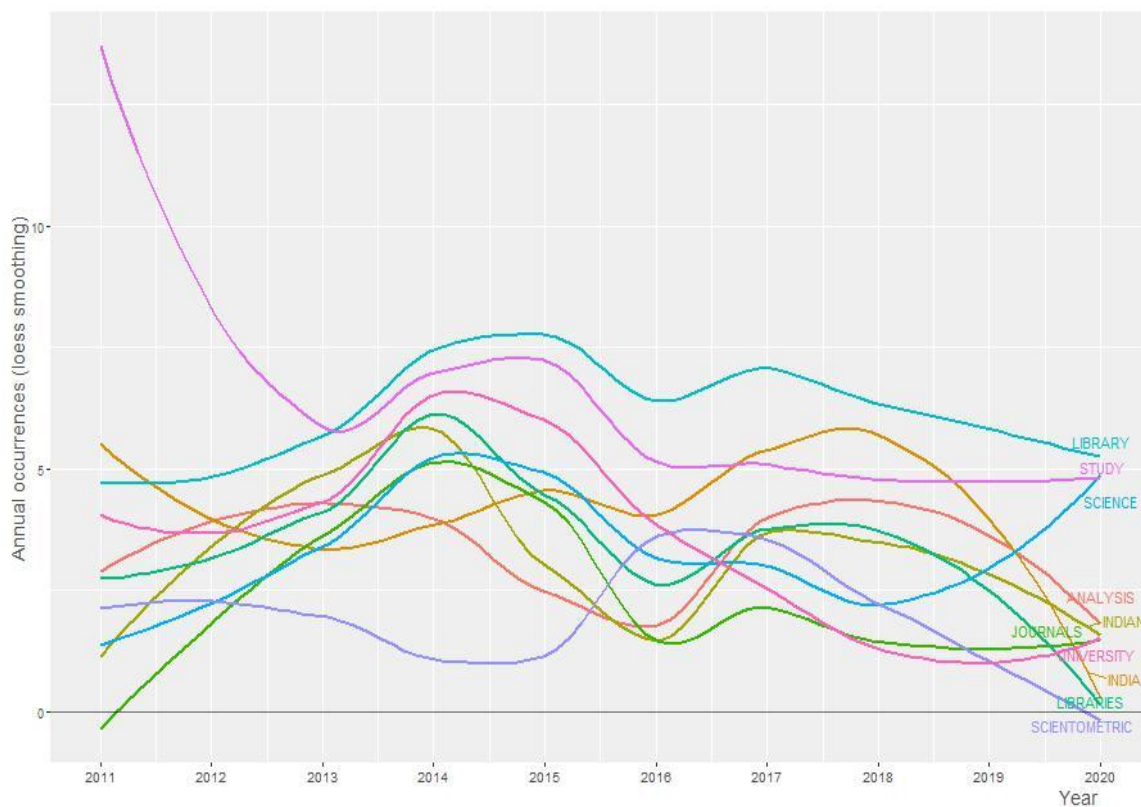
Table 5.2.41 and Figure 5.2.27 show the word dynamics analysis of title keywords. It means the analysis will identify the year-wise most occurred title keywords among all the words of the titles of the documents published by the ALIS journal during the period of study. It was found that in the years 2011, 2012, 2013, 2014, 2016, 2019 the word “study” highly occurred with a count of 15, 6, 4, 6, and 4 respectively in each year. In the years 2015 and 2020 the keyword “Library” occurred highest 8 and 6 times respectively. In the year 2018, the word "India” occurred highest with a count of 7. In the figure, it is clear that the word 'study' shown in the violet line occurred highest in the year 2011, followed by the word 'library' in the deep blue line in 2014 and the word 'University' in pink line 2014 is the leading keywords used in the research published during the study period. If we see the overall trend then it can be said that the word “Study” occurred highly followed by the word 'library', 'University' and so on in the title section of the article of ALIS journal during the period of study.



**Table-5.2.41: Word dynamics analysis of title keyword**

Word	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Study	15	6	4	9	6	6	4	6	4	5
Library	5	5	3	9	8	5	8	7	4	6
India	6	3	3	5	3	6	3	8	4	0
Analysis	3	4	3	6	1	2	4	5	3	2
University	5	2	3	7	7	2	4	1	0	2
Libraries	4	1	2	9	3	2	5	3	3	0
Science	2	1	3	5	6	2	3	4	0	6
Indian	2	2	3	9	1	1	5	3	2	2
Journals	0	2	0	9	2	2	2	2	0	2
Scientometric	2	2	4	0	1	4	4	1	1	0

(Source: Data extracted from Scopus)



**Figure-5.2.27: Word dynamics analysis of title keyword**

#### **5.2.42 Trend topics based on abstract keywords**

Trend topics show the most growing topics, but here the discussion is based on the keywords. For the study purpose, the top 30 keywords are considered based on their occurrence in the abstract of the different documents. Table 5.2.42 depicts the trend topics based on abstract keywords. It was observed that the keyword "science" occurred highest 317 times in the year 2017 among all the abstract keywords, followed by "study" occurred 305 times and "library" occurred 284 times in the year 2015, keyword "Resources" occurred 257 times in the year 2017. Instead of this in the table, more than 26 keywords are having more than 20 occurrences. Based on abstract keywords, overall we can say that the most trending researches are from the library science field published by different national institutes from India. Internet and web-based researches are also growing from later to early periods of study. The word "Doctoral" was highly used in the year 2018, which means that the research on the doctoral thesis is also trending in the source journal in the latest period of the study.

**Table-5.2.42: Trend topics based on abstract keywords**

<b>Keywords</b>	<b>Occurrence</b>	<b>Year</b>
SCIENCE	317	2017
STUDY	305	2015
LIBRARY	284	2015
RESOURCES	257	2017
NATIONAL	225	2017
COMMUNICATION	219	2017
INSTITUTE	211	2017
JOURNALS	193	2015
PAPER	183	2015
LIBRARIES	152	2015
PAPERS	121	2016
INDIAN	119	2014
INDIA	119	2016
JOURNAL	90	2014
BASED	84	2016
WEB	82	2014
ACCESS	79	2016
AUTHORS	76	2016
LIS	73	2014

PUBLICATIONS	73	2014
INTERNET	47	2013
LIBRARIANS	46	2013
MAJOR	40	2013
ELECTRONIC	30	2012
CONCLUDES	26	2012
SCIENTISTS	25	2013
WEBSITES	24	2011
JOB	23	2013
WILL	22	2012
DOCTORAL	21	2018

(Source: Data extracted from Scopus)

#### **5.2.43 Trend topics based on title keywords**

Trend topics show the most growing topics, but here the discussion is based on the keywords. For the study purpose, the top 30 keywords are considered based on their occurrence in the title of the different documents. Table 5.2.43 depicts the trend topics based on title keywords. It was observed that the keyword "Study" occurred highest 65 times in the year 2014 among all the title keywords, followed by "Library" occurred 60 times and "India" occurred 41 times in the year 2016, keyword "University" occurred 33 times in the year 2014. Instead of this in the table, more than 26 keywords are having more than 6 occurrences. Overall trend based on title keywords can be said that the study on library from Indian University has highly opted research topic, the study on bibliometrics and scientometrics of journals are the most trending topics of research as they highly occurred in authors keyword.

**Table-5.2.43: Trend topics based on title keywords**

<b>Keywords</b>	<b>Occurrence</b>	<b>Year</b>
STUDY	65	2014
LIBRARY	60	2016
INDIA	41	2016
UNIVERSITY	33	2014
ANALYSIS	33	2015
SCIENCE	32	2015
LIBRARIES	32	2014
INDIAN	30	2014

JOURNALS	21	2014
SCIENTOMETRIC	19	2016
CASE	18	2016
BIBLIOMETRIC	17	2015
ASSESSMENT	16	2016
RESOURCES	15	2015
OUTPUT	15	2013
ACCESS	13	2015
IMPACT	13	2015
LITERACY	12	2017
BASED	12	2018
DEVELOPMENT	12	2018
UNIVERSITIES	12	2013
TECHNOLOGY	11	2013
PUBLICATIONS	10	2017
ELECTRONIC	10	2012
LITERATURE	8	2018
STUDIES	8	2018
SERVICES	8	2017
SRI	7	2017
PROFESSIONALS	7	2018
E-RESOURCES	7	2013

(Source: Data extracted from Scopus)

#### ***5.2.44 Trend topics based on author keywords***

Trend topics show the most growing topics, but here the discussion is based on the keywords. For the study purpose, the top 20 keywords are considered based on their occurrence in the author keyword of the different documents. Table 5.2.44 depicts the trend topics based on author keywords. It was observed that keywords "Scientometrics" and "Bibliometrics" occurred highest 27 and 24 times respectively in the year 2016, followed by "India" occurred 23 times in the year 2014, keyword "Information Literacy" and "Nigeria" occurred 11times individually in the years 2016 and 2014 respectively. Instead of this in the table, more than 15 keywords are having more than 4 occurrences. Overall trend based on authors' keyword can be said that scientometrics and bibliometrics are highly opted research topic especially contributed by Indian and Nigeria. Other than this, Information literacy, citation analysis, E-resources, open access, academic libraries researches are conducted

widely. Besides India and Nigeria, Bangladesh has also contributed research papers in this journal.

**Table-5.2.44: Trend topics based on author keywords**

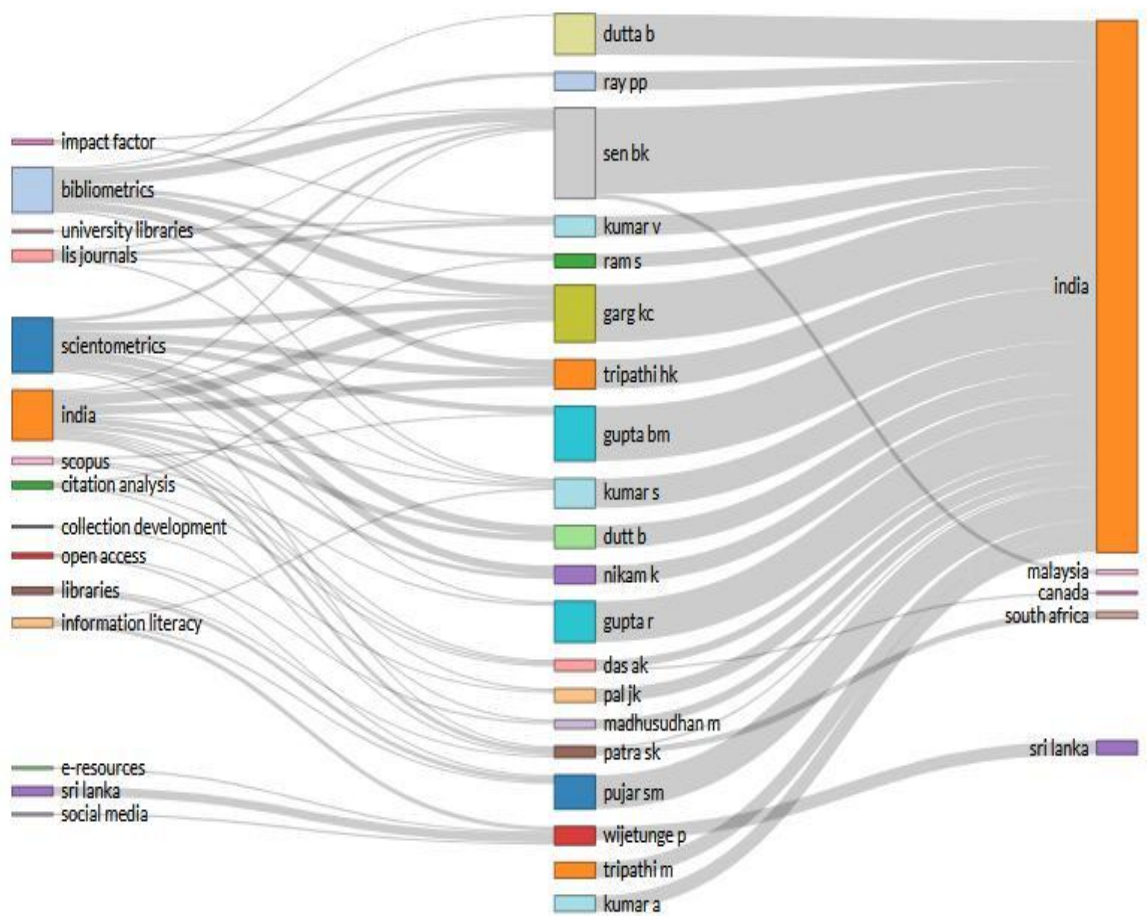
<b>Keywords</b>	<b>Occurrence</b>	<b>Year</b>
SCIENTOMETRICS	27	2016
BIBLIOMETRICS	24	2016
INDIA	23	2014
INFORMATION LITERACY	11	2016
NIGERIA	11	2014
CITATION ANALYSIS	10	2016
E-RESOURCES	10	2014
OPEN ACCESS	9	2016
LIS JOURNALS	9	2017
ACADEMIC LIBRARIES	8	2015
SOCIAL MEDIA	6	2015
UNIVERSITY LIBRARIES	6	2014
WEB 2.0	6	2015
IMPACT FACTOR	6	2014
BANGLADESH	5	2015
CITATIONS	5	2015
INTERNET	5	2015
CONSORTIA	5	2012
ELECTRONIC RESOURCES	5	2012
COLON CLASSIFICATION	5	2015

(Source: Data extracted from Scopus)

#### ***5.2.45 Three field plot analysis***

Three field plot analysis in the Figure 5.2.28 shows the visual representation of connections of different 3 fields of bibliometric data. It is analyzed by biblioshiny software. For the study, the different three fields were considered namely author keywords on the left, authors' names in the middle, and country on the right. It was observed that the word in left field scientometrics in blue color, bibliometrics in sky blue color, and India in orange color are highly connected with the authors in the

middle field. The highly connected authors in the middle field author Sen B.K in grey color, Garg K.C in yellow color, and Gupta B.M in light blue color are highly connected with the other two fields. In the third field, the country India in orange color is the leading country to contribute the highest number of publications thus highly connected with other two fields in the plot.



**Figure-5.2.28: Three-fields plot analysis**

### 5.3 Part B: Analysis of Journal – College and Research Libraries (C & RL)

From the available resources, it was found that 447 documents were published in the College and research libraries journal from the year 2011 to 2020. For each article, names of authors, number of authorship, number of references, author's institutional affiliation and country, type of article, pages of the article, were noted down. All the necessary information was compiled, recorded, tabulated, and analyzed for making observations as indicated in the objectives of the study. A database that was created using Microsoft Excel was used to generate data such as frequency distribution, range, mean and ranked list of references, authorship, institutional affiliation, subject distribution, pages as well as types of articles and form of cited documents included in the articles. For visualization and plotting of chart VOS viewer and bibliometrix Biblioshiny software were used.

#### 5.3.1 Year-wise distribution of publications

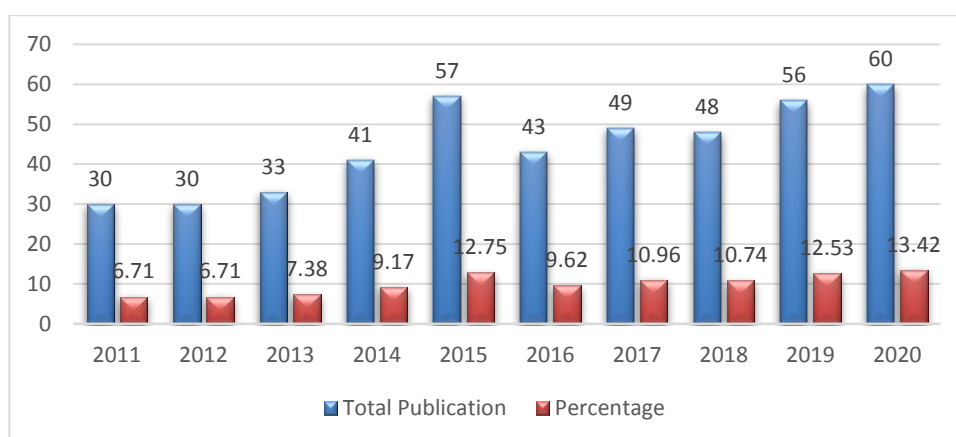
Table-5.3.1 and Figure-5.3.1 show the year-wise distribution of the publications in College and research libraries journal from 2011 to 2020. It was observed that there are a total of 447 articles published in 10 volumes during the study period out of which the highest 60 (13.42%) articles were published in the year 2020 followed by the year 2015 having 57 (12.75%) publications, in the year 2019 having 56 (12.53%) publications, in the year 2017 total publications count 49 (10.96%), in the year 2018 total count 48 (10.74%), in the year 2016 total count 43 (9.62%), in the year 2014 total count 41 (9.17%), in the year 2013 total count 33 (7.38%) and the years 2011 and 2012 they have published equally count 30 (6.71%) each. Based on the analysis it was found that the average publication per year is 44.7 (10%) out of a total of 447 publications.

**Table-5.3.1: Year-wise distribution of publications**

<b>Year</b>	<b>Vol. No.</b>	<b>Issues</b>	<b>Total Publication</b>	<b>Percentage</b>
2011	72	6	30	6.71
2012	73	6	30	6.71
2013	74	6	33	7.38

2014	75	6	41	9.17
2015	76	7	57	12.75
2016	77	6	43	9.62
2017	78	7	49	10.96
2018	79	7	48	10.74
2019	80	6	56	12.53
2020	81	6	60	13.42
	Total		447	

(Source: Data extracted from Scopus)



**Figure-5.3.1: Year-wise distribution of publications**

### **5.3.2 Annual growth of publications**

Annual growth of publication states the increase of the number of publications of the present year concerning the previous year. It may be positive or negative based on the literature published in a particular year. It is calculated to understand the trend of research on a particular topic in a particular year.

Table 5.3.2 and Figure 5.3.2 depict the annual growth of the publications. It was observed that the highest growth of publications was in the year 2015 having 16 (39.02%) publications more than the previous year 2014. The starting year was taken 2011, so the growth of publication was not considered based on the previous year. In the year 2012, the growth was 0 because there was the same number of publications as the previous year. In the year 2013, the growth was increased by 3 (10%), in the year 2014, 8 more publications were added compared to the previous year and it increased by 8 (24.24%) publications. In the year 2016, growth was decreased by 14

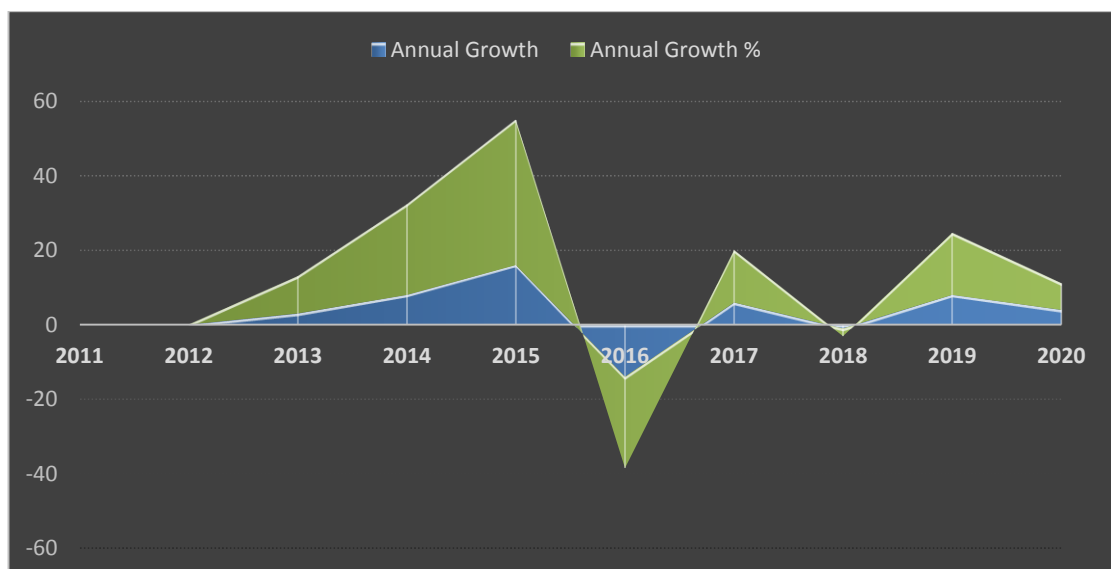


(-24.56%), in the year 2017 it was increased by 6 (13.95%) publications, in the year 2018 it was decreased by 1 (-2.04%) publications, in the year 2019 it was increased by 8 (16.67%) and in the year 2020, it was increased by 4 (7.14%) publications. The growth shows that there is an upward inclination in the productivity except in some of the years.

**Table-5.3.2: Annual growth of publications**

Year	Total Publication	Annual Growth	Annual Growth %
2011	30		
2012	30	0	0.00
2013	33	3	10.00
2014	41	8	24.24
2015	57	16	39.02
2016	43	-14	-24.56
2017	49	6	13.95
2018	48	-1	-2.04
2019	56	8	16.67
2020	60	4	7.14

(Source: calculation based on Scopus data)



**Figure-5.3.2: Annual growth of publications**

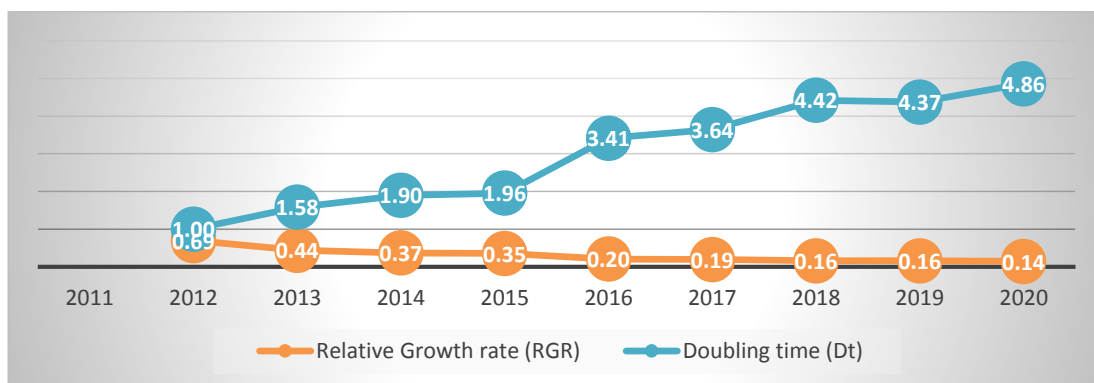
### 5.3.3 Relative growth rate of publications

Table 5.3.3 and Figure 5.3.3 show the relative growth rate and doubling time of the publications. It was perceived that the highest relative growth rate was observed in the year 2012 having RGR 0.69, followed by the year 2013 having RGR 0.44, in the year 2014 having RGR 0.37, in the year 2015 having RGR 0.35, in the year 2016 having RGR 0.20, in the year 2017 having RGR 0.19, in the year 2018 and 2019 having RGR 0.16 in each year and the lowest RGR compared to other RGR in the year 2020, RGR is 0.14. It was found that the relative growth rate was gradually decreasing from the early period to the later period of the study. The mean RGR for the first block of 5 years was 0.46 and the last block was 0.17. After the analysis of relative growth rate, doubling time was also calculated where it was observed that the highest doubling time was in the year 2020 having Dt 4.86, followed by the year 2018 having Dt 4.42, in the year 2019 having Dt 4.37, in the year 2017 having Dt 3.64. The lowest doubling time was observed in the years 2011 having dt 1. The mean doubling time for the first block was observed as 1.61 and for the last block of 5 years, it was 4.14.

**Table-5.3.3: Relative growth rate of publications**

Year	Total No. of papers	Cumulative no. of articles	W1	W2	Relative Growth Rate(RGR)	Mean RGR	Doubling time (Dt)	Mean Dt
2011	30	30		3.40		0.46		1.61
2012	30	60	3.40	4.09	0.69		1.00	
2013	33	93	4.09	4.53	0.44		1.58	
2014	41	134	4.53	4.90	0.37		1.90	
2015	57	191	4.90	5.25	0.35		1.96	
2016	43	234	5.25	5.46	0.20	0.17	3.41	4.14
2017	49	283	5.46	5.65	0.19		3.64	
2018	48	331	5.65	5.80	0.16		4.42	
2019	56	387	5.8	5.96	0.16		4.37	
2020	60	447	5.96	6.10	0.14		4.86	

(Source: calculation based on Scopus data)



**Figure-5.3.3: Relative growth rate of publications**

### 5.3.4 Time series analysis of publications

Time series analysis is the art of estimating future publications by anticipating what Authors are likely to do under a given set of conditions. Time series analysis is depicted in Table 5.3.4 and Figure 5.3.4. In this study, time series analysis is done for the next 5 and 10 years of growth of literature of source journals. It was observed that based on the present scenario the estimated publication in the year 2025 is 75.57 and in the year 2030 is 91.82. It shows a positive trend towards the growth of the literature.

**Table-5.3.4: Time series analysis of publications**

Year	Total No. of publications (Y)	X	X <sup>2</sup>	XY
2011	30	-4.5	20.25	-135
2012	30	-3.5	12.25	-105
2013	33	-2.5	6.25	-82.5
2014	41	-1.5	2.25	-61.5
2015	57	-0.5	0.25	-28.5
2016	43	0.5	0.25	21.5
2017	49	1.5	2.25	73.5
2018	48	2.5	6.25	120
2019	56	3.5	12.25	196
2020	60	4.5	20.25	270
	$\sum Y = 447$		$\sum X^2 = 82.5$	$\sum XY = 268.5$

(Source: calculation based on Scopus data)

Straight line equation  $Y=a+bX$

$$a = \frac{\sum Y}{N} = \frac{447}{10} = 44.7$$

$$b = \frac{\sum XY}{\sum X^2} = \frac{268.5}{82.5} = 3.25$$

Estimated literature in 2025 is when  $X = 9.5$

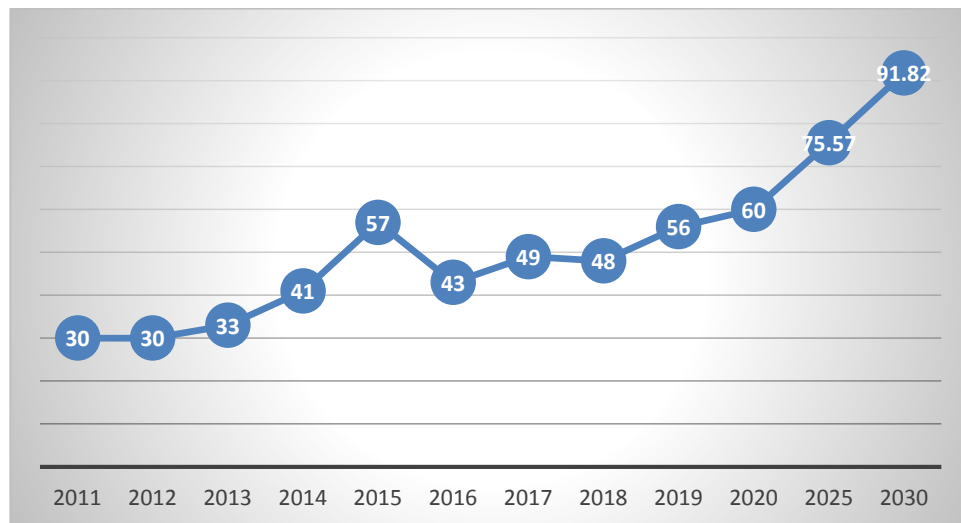
$$= 44.7 + 3.25 * 9.5$$

$$= 75.57$$

Estimated literature in 2030 is when  $X = 14.5$

$$= 44.7 + 3.25 * 14.5$$

$$= 91.82$$



**Figure-5.3.4: Time series analysis of publications**

### ***5.3.5 Year-wise authorship pattern of contributions***

Table 5.3.5 shows the year-wise authorship pattern of contributions. It was observed that in the year 2011, out of 36 publications single and double authored publications were 14 each, 3 authors' publications were 7, and only 1 publication of 6 authors. In the year 2012, there was a total of 27 publications where single-authored publications were 11, double authored publications were 10, 3 authors publications were 6. In the year 2013, the total publications were 37, where single-authored publications were 12, double authored publications were 18, triple authored publications were 5 and

five & six authored publications were 1 each. In the year 2014, the total publications were 35, where single-authored publications were 12, double authored publications were 18, triple authored publications were 3, and four authored publications were 2. In the year 2015, the total publications were 38, where single-authored publications were 18, double authored publications were 14, triple authored publications were 4 and four authored and five authored publications were 1 each. In the year 2016, the total publications were 32, where single-authored publications were 8, double authored publications were 18, triple authored publications were 3, four authored publications were 2 and five authored publications were only 1. In the year 2017, the total publications were 32, where single-authored publications were 9, double authored publications were 17 and triple authored publications were 6. In the year 2018, the total publications were 28, where single-authored publications were 8, double authored publications were 16, triple authored and four authored publications were 2 each. In the year 2019, the total publications were 20, where single-authored publications were 5, double authored publications were 6, triple authored publications were 4 and four authored publications were 5 and in the year 2013, the total publications were 27, where single-authored publications were 7, double authored publications were 12, triple authored publications were 3, four authored publications were 4 and five authored publication was 1. In the year 2015 highest single-authored publications were observed and in the years 2013, 2014, and 2016 highest double-authored publications were observed.

**Table- 5.3.5: Year-wise authorship pattern of contributions**

Year	Number of authors								Total
	1	2	3	4	5	6	7	More than 7	
2011	9	14	3	3	0	0	1	0	30
2012	12	11	5	1	1	0	0	0	30
2013	9	15	4	2	2	1	0	0	33
2014	13	12	9	5	0	1	0	1	41
2015	23	19	10	3	0	1	1	0	57
2016	14	16	9	2	1	1	0	0	43

2017	14	15	15	2	1	2	0	0	49
2018	15	15	9	4	3	2	0	0	48
2019	22	18	8	5	2	1	0	0	56
2020	24	20	6	4	4	1	1	0	60
Total	155	155	78	31	14	10	3	1	447

(Source: calculation based on Scopus data)

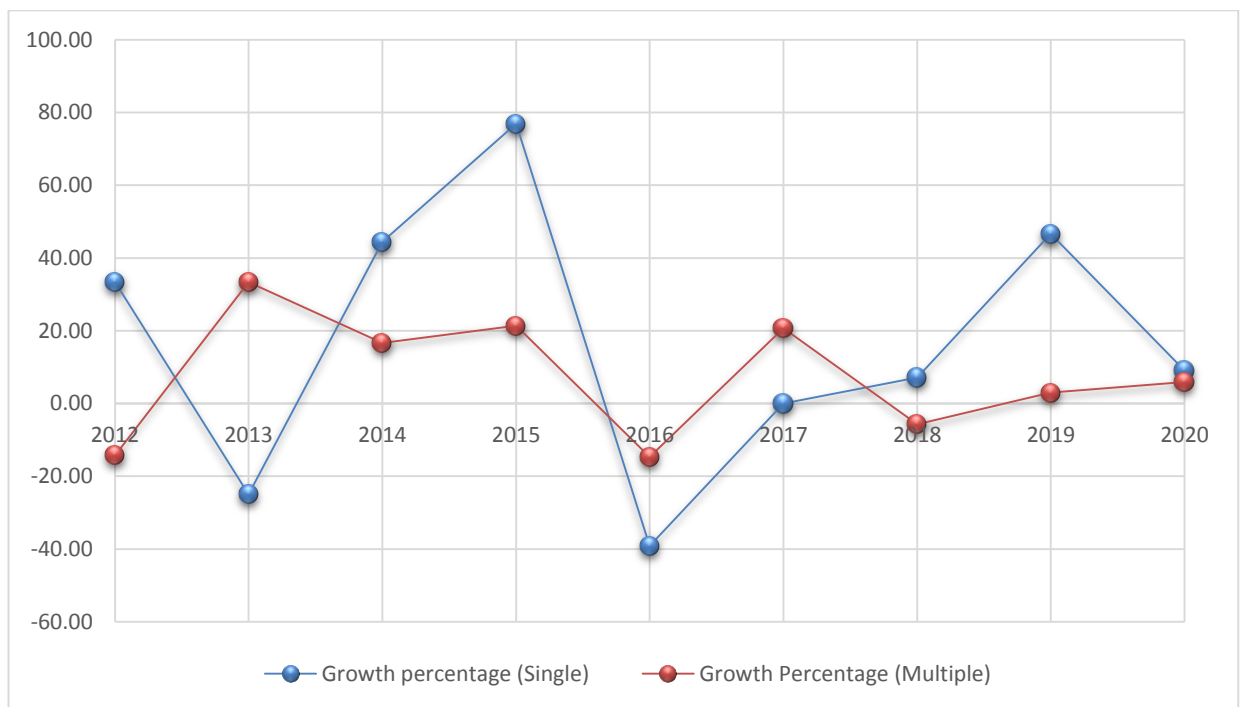
### ***5.3.6 Growth of single and multiple authorship***

Table 5.3.6 and Figure 5.3.5 show the growth of single and multiple authorship patterns. It was analyzed that in the year 2012, single-author publications were increased by 3 (33.33%) whereas multiple-authored publications were decreased by 3 (-14.29%) publications. In the year 2013, in the single authorship pattern, 3 (-25%) publications decreased from the previous year whereas in the multiple authorship patterns 6 (33.33%) publications increased from the previous year. In 2014, 4 (44.44%) publications increased in single authorship patterns, and in multiple authorship, pattern growth increased by 4 (16.67%). In the year 2015, the highest number 10 (76.92%) growth was observed and in multiple authorship patterns also it was increasing by 6 (21.43%). In 2016, the lowest growth was observed in the single authorship pattern having a decline of 9 (-39.13%) publications whereas in multiple authorship patterns also it was decreased by 5 (14.71%) publications. In 2017, there was no change in the single authorship pattern and 6 (20.69%) publications increased in multiple authorship patterns. In 2018, 1(7.14%) publication increased in single authorship pattern and 2 (-5.71%) publications decreased in multiple authorship pattern. In 2019, 7 (46.67%) publications increased in single authorship and 1 (3.03) publications increased in multiple authorship pattern. In 2020, Single authorship has increased by 2 (9.09%) publications and 2 (5.88%) increased by multiple authorship patterns.

**Table- 5.3.6: Growth of Single and multiple authorship**

Year	Single authored publications	Growth	Growth percentage (Single)	Multiple authored publications	Growth	Growth Percentage (Multiple)
2011	9			21		
2012	12	3	33.33	18	-3	-14.29
2013	9	-3	-25.00	24	6	33.33
2014	13	4	44.44	28	4	16.67
2015	23	10	76.92	34	6	21.43
2016	14	-9	-39.13	29	-5	-14.71
2017	14	0	0.00	35	6	20.69
2018	15	1	7.14	33	-2	-5.71
2019	22	7	46.67	34	1	3.03
2020	24	2	9.09	36	2	5.88
	155			292		

(Source: calculation based on Scopus data)



**Figure- 5.3.5: Growth of Single and multiple authorship**

### 5.3.7 Time series analysis of single-author publication

Time series analysis of single-author publication is shown in Table 5.3.7. In this study, time series analysis is done for the next 5 and 10 years of single-author

publication of source journals. It was observed that based on the present scenario the estimated publication in the year 2025 is 24.61 and in the year 2030 is 31.51. It shows a positive trend towards the single author publication in the future.

**Table-5.3.7: Time series analysis of single-author publication**

Year	Single author publication (Y)	X	X <sup>2</sup>	XY
2011	9	-4.5	20.25	-40.5
2012	12	-3.5	12.25	-42
2013	9	-2.5	6.25	-22.5
2014	13	-1.5	2.25	-19.5
2015	23	-0.5	0.25	-11.5
2016	14	0.5	0.25	7
2017	14	1.5	2.25	21
2018	15	2.5	6.25	37.5
2019	22	3.5	12.25	77
2020	24	4.5	20.25	108
	<b>∑Y = 155</b>		<b>∑X<sup>2</sup> = 82.5</b>	<b>∑XY = 114.5</b>

(Source: calculation based on Scopus data)

Straight line equation  $Y=a+bX$

$$a = \frac{\sum Y}{N} = \frac{115}{10} = 11.5$$

$$b = \frac{\sum XY}{\sum X^2} = \frac{114.5}{82.5} = 1.38$$

Estimated single authors publication in 2025 is when  $X = 9.5$

$$= 11.5 + 1.38 * 9.5$$

$$= 24.61$$

Estimated single authors publication in 2030 is when  $X = 14.5$

$$= 11.5 + 1.38 * 14.5$$

$$= 31.51$$

### **5.3.8 Time series analysis of multi-author publication**

Time series analysis of Multi-authored publications is shown in Table 5.3.8. In this study, time series analysis is done for the multi-author publication in the years 2025 and 2030. It was observed that based on the present scenario the estimated multi-



authored publication in the year 2025 is 46.87 and in the year 2030 is 56.17. It shows a positive trend towards multi-authored publication in the future.

**Table-5.3.8: Time series analysis of multi-author publications**

Year	Multi-author Publications (Y)	X	X <sup>2</sup>	XY
2011	21	-4.5	20.25	-94.5
2012	18	-3.5	12.25	-63
2013	24	-2.5	6.25	-60
2014	28	-1.5	2.25	-42
2015	34	-0.5	0.25	-17
2016	29	0.5	0.25	14.5
2017	35	1.5	2.25	52.5
2018	33	2.5	6.25	82.5
2019	34	3.5	12.25	119
2020	36	4.5	20.25	162
	<b>ΣY = 292</b>		<b>ΣX<sup>2</sup> = 82.5</b>	<b>ΣXY = 154</b>

(Source: calculation based on Scopus data)

Straight line equation  $Y=a+bX$

$$a = \frac{\sum Y}{N} = \frac{292}{10} = 29.2$$

$$b = \frac{\sum XY}{\sum X^2} = \frac{154}{82.5} = 1.86$$

Estimated multi authors publication in 2025 is when  $X = 9.5$

$$= 29.2 + 1.86 * 9.5$$

$$= 46.87$$

Estimated multi authors publication in 2030 is when  $X = 14.5$

$$= 29.2 + 1.86 * 14.5$$

$$= 56.17$$

### **5.3.9 Authorship pattern trend-wise distribution**

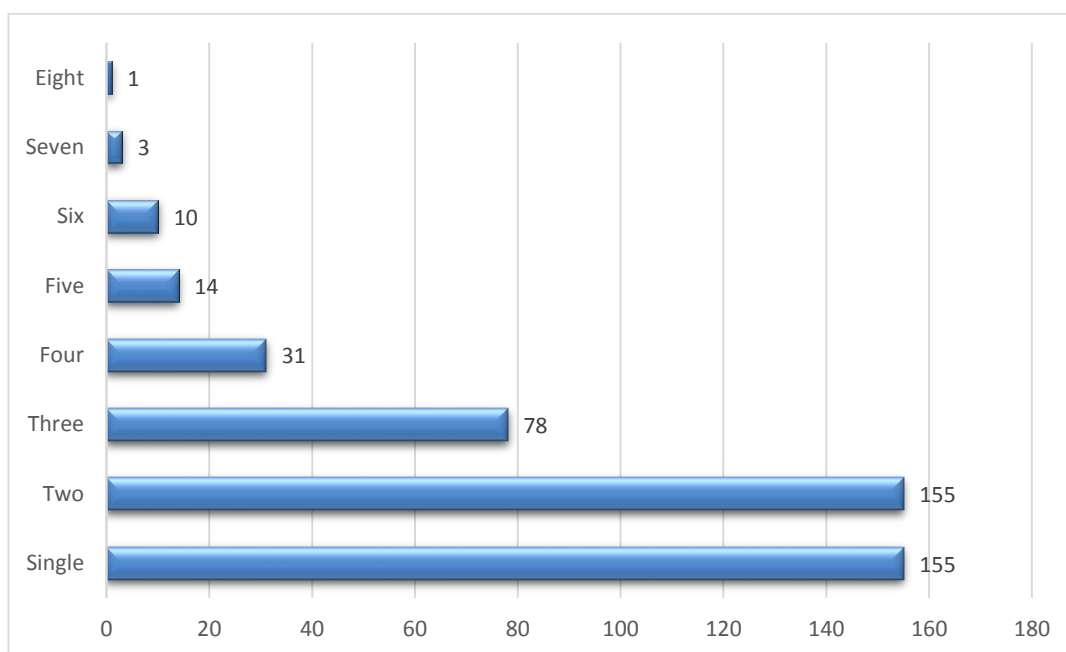
The authorship pattern shows the number of publications published by authors as a single author or multiple authors. Table 5.3.9 and Figure 5.3.6 revealed the authorship pattern trend where it was found that out of a total of 447 publications single and double authored publications were dominating over others. There were

155 (34.68%) publications were contributed by single and two authored patterns individually, followed by three authored publications having 78 (17.45) publications, four authored publications were 31 (6.94 %), five authored publications were 14 (3.13%), six authored publications were 10 (2.24%), seven authored publications were 3 (0.67%) and lowest number of publications contributed by eight authored pattern having only 1 (0.22%) publications.

**Table-5.3.9: Authorship pattern trend-wise distribution**

Sl. No	Authors	No. of publications	Cumulative Publication	Percentage	Cumulative percentage
1	Single	155	155	34.68	34.68
2	Two	155	310	34.68	69.36
3	Three	78	388	17.45	86.81
4	Four	31	419	6.94	93.74
5	Five	14	433	3.13	96.87
6	Six	10	443	2.24	99.11
7	Seven	3	446	0.67	99.78
8	Eight	1	447	0.22	100.00

(Source: Data extracted from Scopus)



**Figure-5.3.6: Authorship pattern trend-wise distribution**

### 5.3.10 Frequency distribution of the number of papers published

Table 5.3.10 portrays the frequency distributions of the number of the paper published. It was observed that there was a total of 927 authors who contributed to the College and research libraries journal during 2011-2020. Total of 813 (87.70%) authors written 1 paper each, 94 (10.14%) authors written 2 papers each, 14 (1.51%) authors written 3 papers each, 2 (0.22%) authors written 4 papers each, 1 (0.11%) author-written 6,7,8,18 papers individually.

**Table-5.3.10: Frequency distribution of the number of papers published**

<b>Paper published</b>	<b>No. of authors</b>	<b>Percentage</b>
1	813	87.70
2	94	10.14
3	14	1.51
4	2	0.22
6	1	0.11
7	1	0.11
8	1	0.11
18	1	0.11
Total	927	

(Source: Data extracted from Scopus)

### 5.3.11 Lotka's law of scientific productivity

Lotka's formula for scientific productivity of authors is as follows:

$$Y=C/X^n$$

Where,

X = Number of Publications

Y = Relative Frequency of Authors with X publications

C = Constants depending on the specified field

Calculations of n:

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

Where N is the number of data pairs considered;

X is the logarithm of x (x=number of articles); and

Y is the logarithm of y (y=number of authors)

The constant C is calculated using the formula:

$$C = \frac{1}{\sum 1/x^n}$$

Table- 5.3.11 depicts the productivity of the researchers in Annals of library and information studies journal and it is tested to find whether it will follow Lotka's law. To verify whether the author's productivity frequency sustains Lotka's law, the Chi-square test is applied to the data set when

$$C = 813$$

$$n = 0.11$$

The Chi-square test for observed and hypothetical authors are calculated.

To get the Chi-Square value, calculating the sum of all the difference between the square of observed and expected frequency (fo-fe)<sup>2</sup> and dividing it by the expected frequency i.e. (fo-fe)<sup>2</sup>/fe. The Chi-square test was calculated at a degree of freedom 7, and a level of significance of 5%. The critical value at the 5% significance level is 14.06 and The Chi-Square value obtained is 4518.05, which is highly significant and greater than the critical value. Hence it found that the law is not in conformity with the present data set.

**Table-5.3.11: Appropriateness of Lotka's Law**

Paper published	No. of authors (fo)	No. of expected authors (fe)	X	Y	XY	X <sup>2</sup>	fo-fe	(fo-fe) <sup>2</sup>	(fo-fe) <sup>2</sup> /fe
1	813	813	0	6.70	0.00	0.00	0	0	0
2	94	753.32	0.69	4.54	3.15	0.48	-659.31	434697.7	577.05
3	14	720.46	1.10	2.64	2.90	1.21	-706.45	499079.5	692.73
4	2	698.01	1.39	0.69	0.96	1.92	-696.01	484435.1	694.02
6	1	667.57	1.79	0.00	0.00	3.21	-666.56	444309.6	665.57
7	1	656.34	1.95	0.00	0.00	3.79	-655.34	429472.3	654.34
8	1	646.77	2.08	0.00	0.00	4.32	-645.77	417020.4	644.77
18	1	591.58	2.89	0.00	0.00	8.35	-590.57	348780	589.58
	927		11.89	14.58	7.01	141.27			
								<b>Chi<sup>2</sup></b>	<b>4518.05</b>

(Source: calculation based on Scopus data)

### 5.3.12 Most prolific author of CRL

Table 5.3.12 shows the most prolific authors of the source journal College and research libraries during the period of study. Based on the data retrieved from the Scopus database on 5<sup>th</sup> March 2021 a total of 927 authors contributed to the journal out of this only those authors were considered who have 3 or more than 3 contributions. It was observed that Walter S. has contributed the highest number of contributions having 18 documents with 41 citations and CPP of 2.28. For the remaining authors, the first number indicates document, the second number indicates citations and the third number indicates citation per paper. The authors are Kaspar W.A. (8; 5;0.63), Galbraith Q. (7;61;8.71), Branin J. (6;6;1), Gross M. (4;54;13.50), Robbins S. (4;62;15.50), Hurst S. (5;50;16.67), Messner K. (3; 50; 16.67), Revelle A. (3;50;16.67), Latham D. (3;52;17.33), Kulp C. (3;43;14.33), Aharony N. (3;61;20.33), Beile P. (4;4;1.33), Dempsey P.R. (3;22;7.33), Gilbert J. (3;51;17), Lewis D.W. (3;118; 39.33), Lowe M.S. (3;41;13.67), Luo L. (3;58;19.33), Xia J. (3; 58; 19.33), Yakel E. (3;36;12).

**Table-5.3.12: Most prolific authors**

Rank	Author	Documents	Citations	Citation per paper
1	Walter S.	18	41	2.28
2	Kaspar W.A.	8	5	0.63
3	Galbraith Q.	7	61	8.71
4	Branin J.	6	6	1.00
5	Gross M.	4	54	13.50
5	Robbins S.	4	62	15.50
6	Hurst S.	3	50	16.67
6	Messner K.	3	50	16.67
6	Revelle A.	3	50	16.67
6	Latham D.	3	52	17.33
6	Kulp C.	3	43	14.33
6	Aharony N.	3	61	20.33
6	Beile P.	3	4	1.33
6	Dempsey P.R.	3	22	7.33
6	Gilbert J.	3	51	17.00
6	Lewis D.W.	3	118	39.33

6	Lowe M.S.	3	41	13.67
6	Luo L.	3	11	3.67
6	Xia J.	3	58	19.33
6	Yakel E.	3	36	12.00

(Source: Data extracted from Scopus)

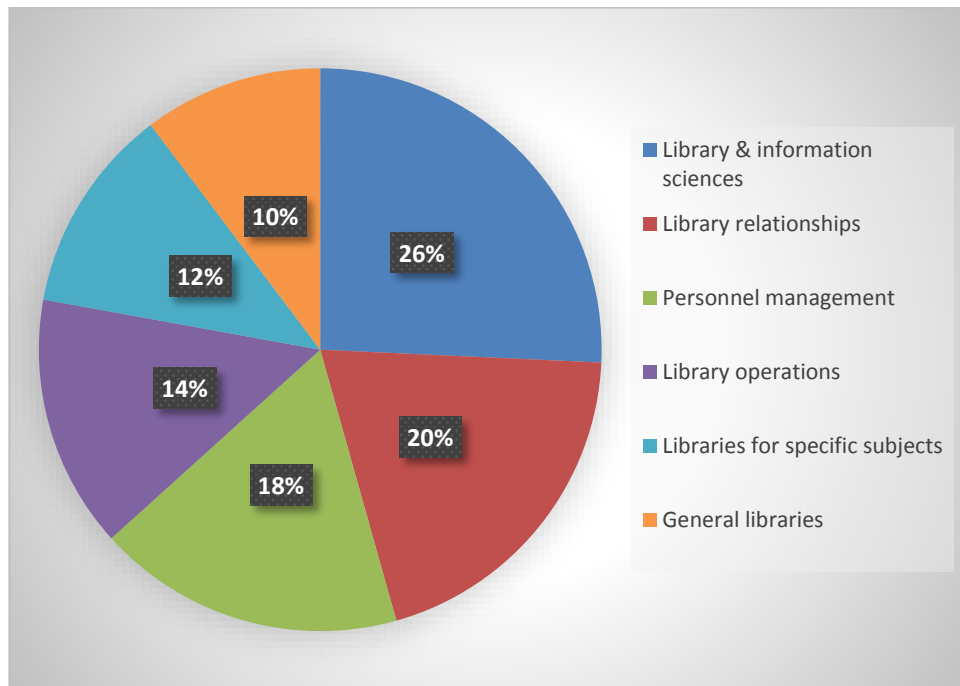
### 5.3.13 Topic-wise distribution of publications

The publications of the source journals are scattered in various topics of library and information science. Table 5.3.13 and Figure 5.3.7 demonstrates the topic-wise distribution of publications, where it was observed that the topic "Library & information sciences" has the highest number of publications having 115 (25.73%) publications, followed by "Library relationships" having 89 (19.91%) publications, "Personnel management" having 79 (17.67%) publications, "Library operations" having 65 (14.54%) publications, "Libraries for specific subjects" having 53 (11.86%) publications and least publication was from the topic: "General libraries" having 46 (10.29%) publications out total 447 publications published during the period of study.

**Table-5.3.13: Topic-wise distribution of publications**

Topic	No. of Publications	Percentage	Cumulative percentage
Library & information sciences	115	25.73	25.73
Library relationships	89	19.91	45.64
Personnel management	79	17.67	63.31
Library operations	65	14.54	77.86
Libraries for specific subjects	53	11.86	89.71
General libraries	46	10.29	100.00
	447		

(Source: Data extracted from Scopus)



**Figure-5.3.7: Topic-wise distribution of publications**

#### ***5.3.14 Country wise distributions of articles***

In the journal of College and research libraries, a total of 20 countries contributed 447 publications from 2011 to 2020. Table 5.3.14 shows the country-wise distribution of the articles. It was observed that the United States of America has contributed the highest number of publications 342 (76.51%) and received the highest citations having 4445, followed by Canada having 47 (10.51%) contributions and 421 citations. Australia has contributed 14 (3.13%) publications having citations 20. Spain has contributed 6 (1.34%) publications having citations 33. China, Israel, Norway, and Poland have contributed 4 (0.89%) each having citations of 28, 77, 10, and 14 respectively. Iran and Japan have contributed 3(0.76%) each having 5 citations in each. countries the Netherlands, Brazil, Finland, Ghana, Nigeria, and United Kingdom have contributed only 2 (0.45%) publications each. The other four countries have contributed only 1 publication.

**Table-5.3.14: Country-wise distributions of articles**

Country	No. of documents	Percentage	Cumulative percentage	Citations
UNITED STATES OF AMERICA	342	76.51	76.51	4445
CANADA	47	10.51	87.02	421
AUSTRALIA	14	3.13	90.16	20
SPAIN	6	1.34	91.50	33
CHINA	4	0.89	92.39	28
ISRAEL	4	0.89	93.29	77
NORWAY	4	0.89	94.18	10
POLAND	4	0.89	95.08	14
IRAN	3	0.67	95.75	5
JAPAN	3	0.67	96.42	5
NETHERLANDS	2	0.45	96.87	17
BRAZIL	2	0.45	97.32	18
FINLAND	2	0.45	97.76	4
GHANA	2	0.45	98.21	1
NIGERIA	2	0.45	98.66	1
UK	2	0.45	99.11	85
KAZAKHSTAN	1	0.22	99.33	19
SINGAPORE	1	0.22	99.55	68
SOUTH AFRICA	1	0.22	99.78	1
SOUTH KOREA	1	0.22	100.00	1
Total	447			

(Source: Data extracted from Scopus)

**5.3.15 Most publishing institutions**

Table 5.3.15 and Figure 5.3.8 discuss the most publishing institutions. The top 14 institutions were ranked based on their contribution to source journal College and Research libraries during 2011-2020. Out of a total of 447 publications, Depaul University has contributed the highest 22 (4.92%) publications followed by Harold B. Lee library having contributed 20 (4.47%) publications. Kent State University has contributed 16 (3.58%) publications is in 3<sup>rd</sup> rank, OCLC Research, School of Information, and Texas A and M University have contributed 8 (1.79%) publications each are in 4<sup>th</sup> rank. The University of Colorado Boulder and the University of Illinois at Urbana-Champaign have contributed 7 (1.57%) publications each is in 5<sup>th</sup> rank. Department of information science, Bar-Ilan University, Folke Bernadotte

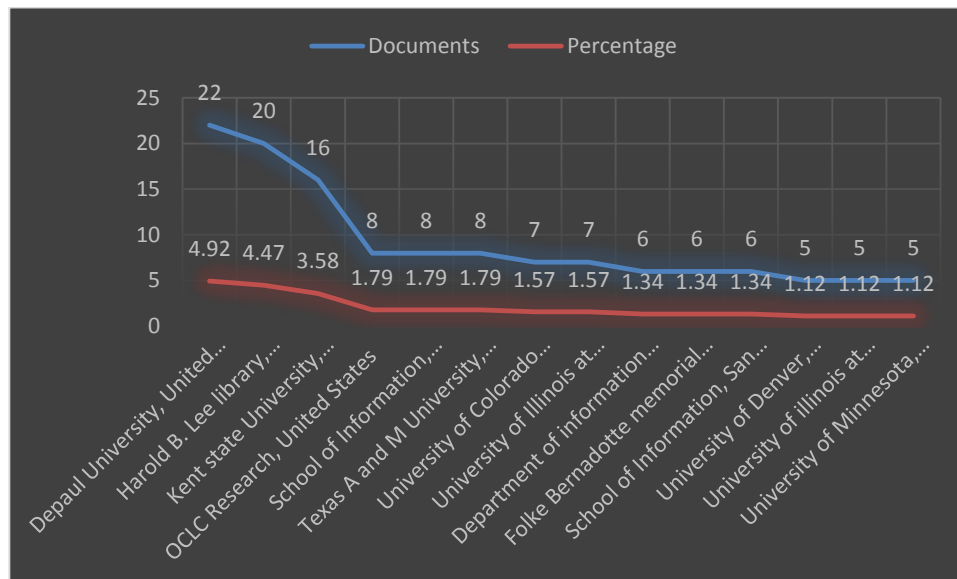


memorial library, and School of Information, San Jose State has contributed 6 (1.34%) publications each are in 6<sup>th</sup> rank. The University of Denver, the University of Illinois at Chicago, and the University of Minnesota individual contributed 5 (1.12%) publications are in 7<sup>th</sup> rank.

**Table-5.3.15: Most publishing institutions**

<b>Institutions</b>	<b>Documents</b>	<b>Percentage</b>	<b>Citations</b>	<b>Rank</b>
Depaul University, United States	22	4.92	17	1
Harold B. Lee Library, Brigham Young University, United States	20	4.47	47	2
Kent State University, United States	16	3.58	65	3
OCLC Research, United States	8	1.79	26	4
School of Information, University of Michigan, United States	8	1.79	49	4
Texas A and M University, United States	8	1.79	4	4
University of Colorado Boulder, United States	7	1.57	24	5
The University of Illinois at Urbana-Champaign, United States	7	1.57	17	5
Department of information science, Bar-Ilan University, Israel	6	1.34	72	6
Folke Bernadotte memorial library, Gustavus Adolphus College, United States	6	1.34	51	6
School of Information, San Jose State University, United States	6	1.34	11	6
University of Denver, United States	5	1.12	28	7
The University of Illinois at Chicago, United States	5	1.12	14	7
University of Minnesota, United States	5	1.12	56	7

(Source: Data extracted from Scopus)



**Figure-5.3.8: Most publishing institutions**

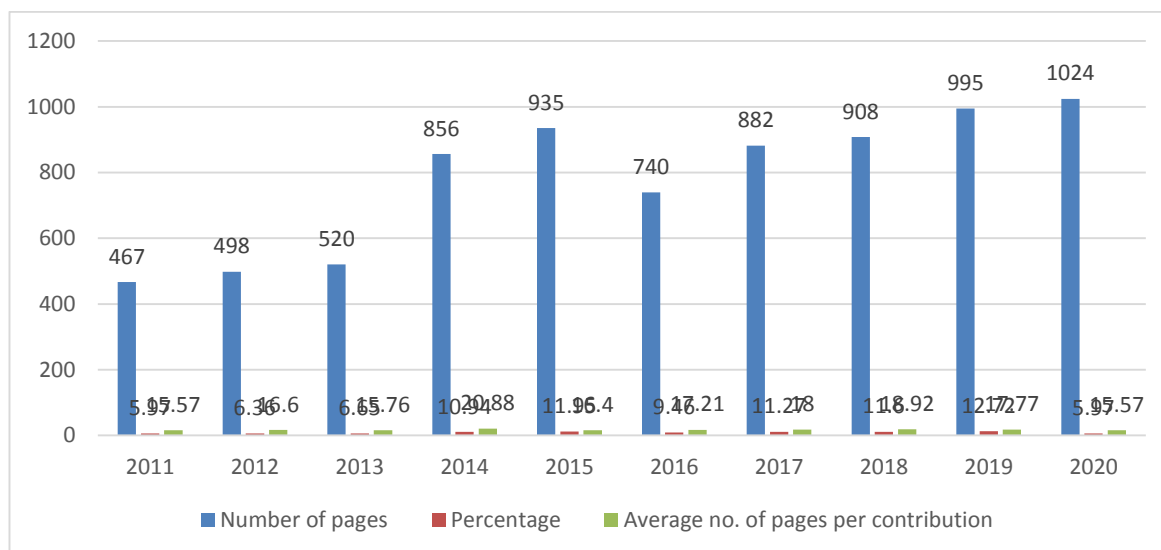
### 5.3.16 Year-wise distribution of pages

Table 5.3.16 and Figure 5.3.9 depict the year-wise distribution of pages of publications. The total number of pages counted as 7825 from a total of 447 publications during 2011-2020. It was observed that the highest 1024 (5.97%) pages were there in the year 2020 in a total of 60 publications and the average number of pages per contribution is 15.57. For remaining years, year 2011 (30; 467; 5.97; 15.57), for the year 2012 (3; 498; 6.36; 16.60), for the year 2013 (33; 520; 6.65; 15.76), for the year 2014 (41; 856; 10.94; 20.88), for the year 2015 (57; 935; 11.95; 16.40), for the year 2016( 43; 740; 9.46; 17.21), and for the year 2019 (56; 995; 12.72; 17.77). (Note- the first number indicates the number of publications, the second number indicates the total number of pages, the third number indicates the percentage and the fourth number indicates the average number of pages per contribution). The least number of pages were found in the year 2011. In the average number of pages per contribution, the highest was in the year 2014, and the least was in 2011. Considering the total number of pages and total publications of the study period, the average number of pages per contribution is 17.50 which is a very decent number of pages for any publication.

**Table-5.3.16: Year-wise distribution of pages**

Year	Number of publications	Number of pages	Percentage	Average no. of pages per contribution
2011	30	467	5.97	15.57
2012	30	498	6.36	16.60
2013	33	520	6.65	15.76
2014	41	856	10.94	20.88
2015	57	935	11.95	16.40
2016	43	740	9.46	17.21
2017	49	882	11.27	18.00
2018	48	908	11.60	18.92
2019	56	995	12.72	17.77
2020	60	1024	5.97	15.57
Total	447	7825		Average: 17.50

(Source: Data extracted from Scopus)



**Figure-5.3.9: Year-wise distribution of pages**

### **5.3.17 Relative growth rate and double-time of publication pages**

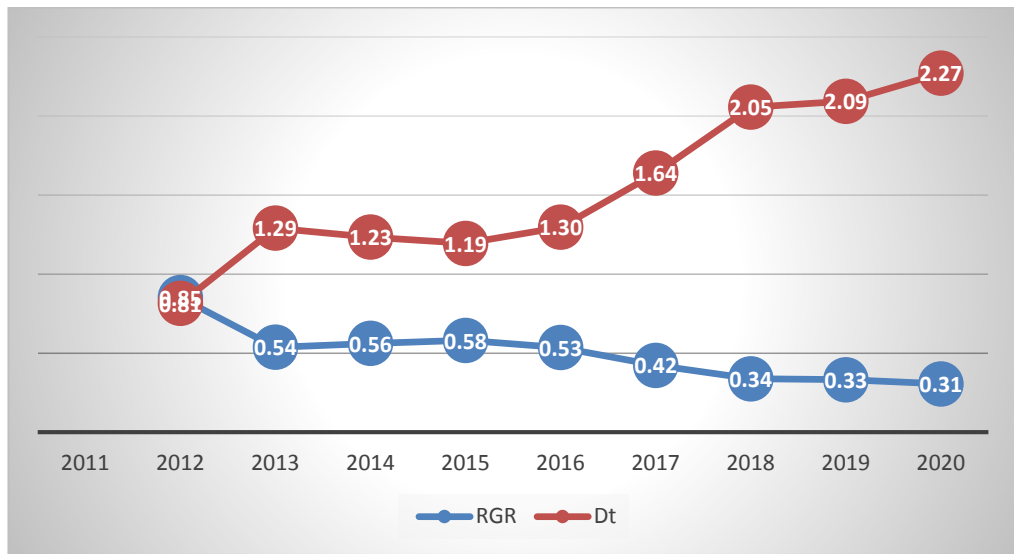
Table 5.3.17 and Figure 5.3.10 show the relative growth rate and doubling time of the pages of publications. It was perceived that the highest relative growth rate was observed in the year 2012 having RGR 0.85, followed by the year 2015 having RGR

0.58, in the year 2014 having RGR 0.56, in the year 2013 having RGR 0.54, in the year 2016 having RGR 0.53, in the year 2017 having RGR 0.42, in the year 2018 having RGR 0.34, in the year 2019 having RGR 0.33 and in the year 2020 having RGR 0.31. It was observed that the relative growth rate of pages was gradually decreasing from the early period to the later period of the study. The Mean RGR for the first block of 5 years was 0.93 and the last block was 0.39. After the analysis of relative growth rate, the doubling time was also calculated where it was observed that the highest doubling time was in the year 2020 having Dt 2.27, followed by the years 2019, 2018, 2017, 2016, 2012, 2013, 2015, and 2011 having Dt 2.09, 2.05, 1.64, 1.30, 1.29, 1.23, 1.19 and 0.81 respectively. The mean doubling time for the first block is 1.13 and the second block is 1.87. This shows that the doubling time of pages increased in the last five years block as compared to the first five years block during the period of study.

**Table- 5.3.17: Relative growth rate and double-time of publication pages**

Year	Publications	pages	Cumulative no. of pages	W1	W2	Relative Growth Rate (RGR)	Mean RGR	Double Time (Dt)	Mean Dt
2011	30	467	467		6.15		0.93		1.13
2012	30	498	965	6.02	6.87	0.85		0.81	
2013	33	520	1485	6.77	7.30	0.54		1.29	
2014	41	856	2341	7.20	7.76	0.56		1.23	
2015	57	935	3276	7.51	8.09	0.58		1.19	
2016	43	740	4016	7.76	8.30	0.53	0.39	1.30	1.87
2017	49	882	4898	8.07	8.50	0.42		1.64	
2018	48	908	5806	8.33	8.67	0.34		2.05	
2019	56	995	6801	8.49	8.82	0.33		2.09	
2020	60	1024	7825	8.66	8.97	0.31		2.27	

(Source: calculation based on Scopus data)



**Figure- 5.3.10: Relative growth rate and double-time of publication pages**

### ***5.3.18 Degree of collaboration***

Table 5.3.18 shows the degree of collaboration of publications published during 2011- 2020 in the College and research libraries journal. Out of a total of 447 publications, a total of 155 publications are single-authored and 292 publications are multiple-authored. In the year 2013 degree of collaboration is found to be highest (0.73), followed by the year 2017 having the degree of collaboration is 0.71, in the year 2011 degree of collaboration was observed 0.70, similarly in the year 2018 it was 0.69, in the year 2014 it was 0.68, in the year 2016 it was 0.67, in the year 2019 it was 0.61 and there were 3 more years 2012, 2015 and 2020 whose degree of collaboration is 0.60 each. From the study, it was found that the average degree of collaboration is 0.60, which means multiple authors are dominating over the single author publications during the period of study. The value of the degree of collaboration increases means the domination of joint author papers increases.

**Table-5.3.18: Degree of collaboration**

Year	Single authored publications (N <sub>s</sub> )	Multiple authored publications (N <sub>m</sub> )	Total(N <sub>s</sub> +N <sub>m</sub> )	Degree of collaboration (DC)
2011	9	21	30	0.70
2012	12	18	30	0.60
2013	9	24	33	0.73
2014	13	28	41	0.68
2015	23	34	57	0.60
2016	14	29	43	0.67
2017	14	35	49	0.71
2018	15	33	48	0.69
2019	22	34	56	0.61
2020	24	36	60	0.60
Total	155	292	447	Average:0.60

(Source: calculation based on Scopus data)

### **5.3.19 Collaboration index**

Collaboration Index has been calculated by using the formula given by Lawani in 1980. “The Collaboration Index (CI) is the simplest index presently used to explore the literature, which is to be interpreted as the mean number of authors per paper”.

Table 5.3.19 portrays the collaboration index of the publications which are published in College and Research libraries journal during the study period. It was observed that the highest (2.40) CI was in the year 2018, followed by the year 2014 having CI 2.39, in the year 2017, the CI was 2.33, in the year 2013 CI was 2.27, in the year 2020 CI was 2.18, in the year 2011 CI was 2.17, in the year 2016 CI was 2.14, in the year 2019 CI was 2.11, in the year 2015 CI was 2.04 and lowest CI 1.93 was in the year 2012. The collaboration index depends upon the frequency of publication collaborated by the authors. The average collaboration index of 2.20 has been recorded during the study period 2011-2020. From the table, the study tells that the average Collaboration index is 2.20, which means the average collaborative author per paper is 2.20.

**Table-5.3.19: Collaboration index**

Year	Number of authors									Collaboration Index(CI)
	1	2	3	4	5	6	7	More than 7	Total	
2011	9	14	3	3	0	0	1	0	30	2.17
2012	12	11	5	1	1	0	0	0	30	1.93
2013	9	15	4	2	2	1	0	0	33	2.27
2014	13	12	9	5	0	1	0	1	41	2.39
2015	23	19	10	3	0	1	1	0	57	2.04
2016	14	16	9	2	1	1	0	0	43	2.14
2017	14	15	15	2	1	2	0	0	49	2.33
2018	15	15	9	4	3	2	0	0	48	2.40
2019	22	18	8	5	2	1	0	0	56	2.11
2020	24	20	6	4	4	1	1	0	60	2.18
Total	155	155	78	31	14	10	3	1	447	Average: 2.20

(Source: calculation based on Scopus data)

### 5.3.20 Collaborative coefficient

The collaborative coefficient was detected by Ajiferuke, that “the value of CC will be zero when single-authored papers dominant. This implication shows that the higher the value of CC means the higher the probability of multi-authored papers.”

Table 5.3.20 shows a better understanding of the collaborative coefficient during the period of study. The highest collaborative coefficient of 0.44 was counted in the year 2017, followed by the years 2013, 2014, and 2018 with CC 0.43 individually. In the years 2011 and 2016, the CC was the same with 0.40 each. In the year 2019, CC was 0.37. In the years 2012 and 2015, CC was the same with 0.35 each which was found to be the lowest. The average CC was observed as 0.40. As the result shows that the value of the collaborative coefficient lies between 0 and 1, and it is tending

towards the 1, which clearly shows that multi-author papers are more dominating over the single-author paper.

**Table-5.3.20: Collaborative coefficient**

Year	Number of authors									Collaborative Coefficient(CC)
	1	2	3	4	5	6	7	More than 7	Total	
2011	9	14	3	3	0	0	1	0	30	0.40
2012	12	11	5	1	1	0	0	0	30	0.35
2013	9	15	4	2	2	1	0	0	33	0.43
2014	13	12	9	5	0	1	0	1	41	0.43
2015	23	19	10	3	0	1	1	0	57	0.35
2016	14	16	9	2	1	1	0	0	43	0.40
2017	14	15	15	2	1	2	0	0	49	0.44
2018	15	15	9	4	3	2	0	0	48	0.43
2019	22	18	8	5	2	1	0	0	56	0.37
2020	24	20	6	4	4	1	1	0	60	0.36
Total	155	155	78	31	14	10	3	1	447	Average: 0.40

(Source: calculation based on Scopus data)

### ***5.3.21 Modified collaborative coefficient***

Table 5.3.21 shows a better understanding of the modified collaborative coefficient during the period of study. It was observed that the highest (0.45) MCC was in the year 2017, followed by the years 2013, 2014, and 2018 having MCC 0.44. In the year 2011 having MCC 0.42, in the year 2016 having MCC 0.41. In the years 2019 and 2020 the MCC calculated was 0.37 in each year and the lowest MCC 0.36 was observed in the years 2012 and 2015. The average modified collaborative coefficient of 0.40 was counted during the period of study 2011-2020. Figure 5.3.11 shows the

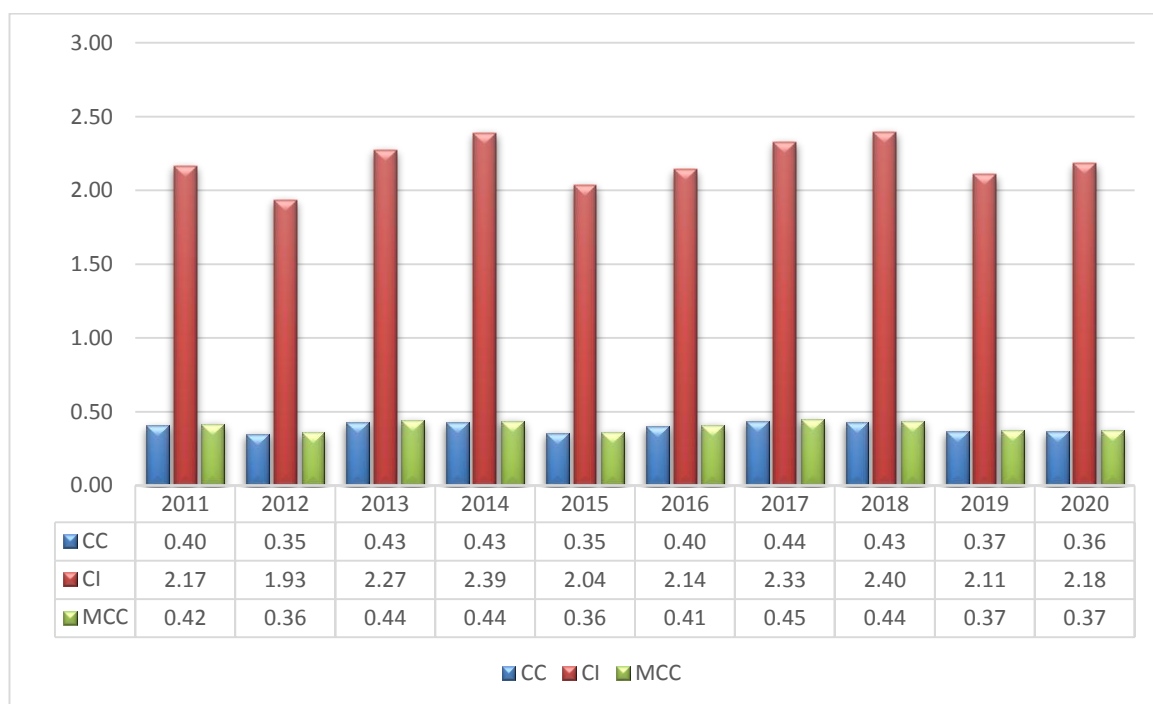


graphical representation of the Collaborative coefficient, modified collaborative coefficient, and collaboration index.

**Table-5.3.21: Modified collaborative coefficient**

Year	Number of authors									Modified Collaborative Coefficient(MCC)
	1	2	3	4	5	6	7	More than 7	Total	
2011	9	14	3	3	0	0	1	0	30	0.42
2012	12	11	5	1	1	0	0	0	30	0.36
2013	9	15	4	2	2	1	0	0	33	0.44
2014	13	12	9	5	0	1	0	1	41	0.44
2015	23	19	10	3	0	1	1	0	57	0.36
2016	14	16	9	2	1	1	0	0	43	0.41
2017	14	15	15	2	1	2	0	0	49	0.45
2018	15	15	9	4	3	2	0	0	48	0.44
2019	22	18	8	5	2	1	0	0	56	0.37
2020	24	20	6	4	4	1	1	0	60	0.37
Total	155	155	78	31	14	10	3	1	447	Average: 0.40

(Source: calculation based on Scopus data)



**Figure-5.3.11: Collaboration pattern**

### **5.3.22 Co-authorship index (CAI)**

Table 5.3.22 specifies the calculated values of the Co-authorship index (CAI) for publications having single authors, two authors, three authors, four authors, five authors, six authors, seven and more than seven authors. From the table, we can see that the value of CAI for single authors was increasing in the years 2012, 2013, 2015, 2018, 2019, and 2020. The highest CAI 115.20 was observed in the year 2015 and the lowest CAI 77.87 was observed in the year 2013. This means there is a decrease in the single authorship concerning the overall output. In the case of two authorship, the highest (137.21) CAI was found in the year 2011 and the lowest (86.06) was in the year 2014, and it was gradually going down except in some of the years. In the case of three authorship, the highest (158.7) CAI was found in the year 2017 and the lowest (51.84) was in the years 2011 and 2020. In the case of four authorship, the highest (192.2) CAI was found in the year 2014 and the lowest (52.53) was in the year 2012. In the case of five authorship, the highest (265.32) CAI was found in the year 2013. In the case of six authorship highest (205.21), CAI was found in the year 2018. In the case of seven authors highest (437.78), CAI was found in the year 2011, and in many years there was no contribution by seven authors and in more than seven authors only 1 publication was there in the year 2014 having CAI 960.98. The highest (960.98) CAI among all was found in the year 2014 concerning authors' contribution. From the overall analysis, it can be seen that CAI for single authorship gradually increases from later to early period except in some of the years of study which shows an average trend in single authorship pattern, in 2 authors, 3 authors, and 4 authors, CAI fluctuating in some years it was increasing and in some years it was decreasing and not showing any proper trend, which means that there is no such growth in publication pattern of 2, 3,4 authorship pattern. In 5 authors publication, CAI gradually increases but still high fluctuation is there due to increase and decrease in publications but the trend can be considered as positive, which mean that 5 authors contribution slightly increasing towards the later period of study. In 6 author's publications, there were very fewer publications and CAI was also fluctuating but due in the middle of the period, it was increasing as the contribution increased from 1 to 2. In 7 author's publications, only 3 publications were having 1

paper in each different year, so CAI was slightly increased due to the number of publications increased. And in more than 7 authored papers, there was only 1 paper so, by only 1 paper the trend can't be decided.

**Table-5.3.22: Co-authorship index (CAI)**

Years	1 -Authored Paper	CAI for 1 Author	2 -Authored Paper	CAI for 2 Author	3-Authored Paper	CAI for 3 Author	4-Authored Paper	CAI for 4 Author	5-Authored Paper	CAI for Five Author	6-Authored Paper	CAI for Six Author	7-Authored Paper	CAI for seven Author	More than 7 authored	CAI for More than seven	Total
2011	9	85.65	14	137.21	3	51.84	3	157.60	0	0.00	0	0.00	1	437.78	0	0.00	30
2012	12	114.20	11	107.81	5	86.40	1	52.53	1	145.93	0	0.00	0	0.00	0	0.00	30
2013	9	77.87	15	133.65	4	62.84	2	95.52	2	265.32	1	149.24	0	0.00	0	0.00	33
2014	13	90.53	12	86.06	9	113.80	5	192.20	0	0.00	1	120.12	0	0.00	1	960.98	41
2015	23	115.20	19	98.01	10	90.95	3	82.95	0	0.00	1	86.40	1	230.41	0	0.00	57
2016	14	92.96	16	109.41	9	108.51	2	73.30	1	101.81	1	114.53	0	0.00	0	0.00	43
2017	14	81.57	15	90.01	15	158.70	2	64.33	1	89.34	2	201.02	0	0.00	0	0.00	49
2018	15	89.22	15	91.88	9	97.20	4	131.33	3	273.61	2	205.21	0	0.00	0	0.00	48
2019	22	112.16	18	94.51	8	74.06	5	140.71	2	156.35	1	87.95	0	0.00	0	0.00	56
2020	24	114.20	20	98.01	6	51.84	4	105.07	4	291.85	1	82.08	1	218.89	0	0.00	60
Total	155		155		78		31		14		10		3		1		447

(Source: calculation based on Scopus data)

### 5.3.23 Most cited publications of CRL

Citation is the most important aspect to measure the quality of productivity. Most cited publications are presented in Table 5.3.23 and Figure 5.3.12 with visualization. The visualization is done through the VOS viewer software. A publications' minimum number of citations was considered 40 in this analysis. Out of the total 447 documents, 17 met the threshold. For all the publications, the number of citations, Author, and year of publication was extracted from the Scopus database on 5<sup>th</sup> March 2021. The publication "Reframing information literacy as a meta-literacy" by

(Mackey & Jacobson, 2011) got the highest 177 citations. Followed by the publication “The inevitability of open access” by (Lewis, 2012) having 93 citations, the publication “Paths of Discovery: Comparing the search effectiveness of Ebsco discovery service” (by Asher & duke, 2013) got 89 citations placed in 3rd rank. The publication “Library impact data project: looking for the link between library usage and student attainment.” (by Stone & Ramsden, 2013) got 84 citations and placed in 4<sup>th</sup> rank followed by the publication “Uncovering meaningful correlation between students’ academic performance and library material usage by (Wong, 2011) got 70 citations and placed in 5<sup>th</sup> rank. The publication “Undergraduates’ use of social media as information sources.” by (Kim & Joanna, 2014) got 68 citations and placed in 6<sup>th</sup> rank followed by the publication “Facebook as a library tool: perceived vs. actual Use by (Jacobson, 2011) got 59 citations and placed in 7<sup>th</sup> rank. The publication "Why one-shot information literacy sessions are not the future of instruction" by (Mery, 2012) got 58 citations and placed in 8<sup>th</sup> rank followed by the publication “The academic library impact on student persistence” by (Emmons & Wilkinson, 2011) got 57 citations and placed in 9<sup>th</sup> rank and the publication “Students reading practices in print and electronic media” (by Foasberg, 2014) got 55 citations placed in 10<sup>th</sup> rank. Collectively most of the top-cited papers were published in the year 2012. In the visualization figure, different colors indicate the different clusters. The documents are categorized in 14 different clusters under association normalization methods. In visualization, weight is given to the citation and font used open Sans. In cluster 1 illustrated by red color, the publications are Mackey & Jacobson (2011) and Kim (2014). In cluster 2 illustrated by green color, the publications are Stone (2013) and Emmons (2011). In cluster 3 illustrated by blue color, the publication is Wong (2011). There are also more than 13 clusters having different colures which are shown in the figure.

**Table-5.3.23: Most cited publications**

Sl. No	Rank	Total Citations	Title	Author
1	1	177	Reframing information literacy as a meta-literacy.	(Mackey & Jacobson, 2011)
2	2	93	The inevitability of open access.	(Lewis, 2012)
3	3	89	Paths of Discovery: Comparing the search effectiveness of Ebsco discovery service.	(Asher & duke, 2013)
4	4	84	Library impact data project: looking for the link between library usage and student attainment.	(Stone & Ramsden, 2013)
5	5	70	Uncovering meaningful correlation between students' academic performance and library material usage.	(Wong, 2011)
6	6	68	Undergraduates' use of social media as information sources.	(Kim & Joanna, 2014)
7	7	59	Facebook as a library tool: perceived vs. actual Use	(Jacobson, 2011)
8	8	58	Why one-shot information literacy sessions are not the future of instruction	(Mery, 2012)
9	9	57	The academic library impact on student persistence	(Emmons & Wilkinson, 2011)
10	10	55	Students reading practices in print and electronic media	(Foasberg, 2014)
11	11	54	Library on the go: a focus group study of the mobile web and the academic library.	(Seeholzer & Salem , 2011)
12	12	52	Academic librarian research: a survey of attitudes, involvement and perceived capabilities.	(Kennedy & Brancolini , 2012)
13	13	51	A review of citation analysis methodologies for collection management.	(Hoffman & Doucette, 2012)
14	14	47	How users search the library from a single search box.	(Lown et. al, 2013)
15	15	46	Give 'em what they want: a one-year study of the unmediated patron-driven acquisition of e-books.	(Fischer et.al , 2012)
16	16	44	Why some students continue to value individual face to face research consultations in a	(Magi & Mardeusz 2013)

			technology rich world.	
17	17	40	Dealing with data science librarians' participation in data management at association of research libraries institution.	(Antell et.al , 2014)

(Source: Data extracted from Scopus)



**Figure-5.3.12: Most Cited publications (Visualization)**

### 5.3.24 Most cited Authors of CRL

Citation is the most significant aspect to measure the quality of the productivity of an author. Table 5.3.24 and Figure 5.3.13 show the Citation impact of the authors contributed in the source Journal College and research libraries and with the help of visualization software VOS viewer network visualization map plotted. An author's minimum number of documents was considered 3 in this analysis. Of the 927 authors, 20 met the threshold. It was observed that author Lewis D.W. has the highest number of citations having 118 citations in 3 documents having CPP 39.33. Although Walter S. has the highest 18 number of publications but his citation is 41, CPP is 2.28 got the 10th position. Remaining other authors are, Robbins S. (62;4;15.50), followed by Galbraith Q. (61; 7; 8.71), Aharony N. (61;3; 20.33), Xia J. (58; 3; 19.33), Gross M. (54;4;13.50), Latham D. (52; 3; 17.33), Gilbert J. (51; 3;

17), Hurst S. (50; 3; 16.67), Messner K. (50; 3; 16.67), Revelle A.(50; 3; 16.67), Kulp C. (43; 3; 14.33), Lowe M.S. (41; 3; 13.67), Yakel E. (36; 3; 12), Dempsey P.R. (22; 3; 7.33), Luo L. (11; 3; 3.67), Branin J. (6; 6; 1), Kaspar W.A. (5; 8; 0.63), and Beile P. (4; 3; 1.33). (Note:-For all the authors' first number stands for the number of citations, the second number stands for the number of documents and the third number stands for citation per paper). In-network visualization of the most cited authors, the most cited 20 authors are distributed in 13 clusters based on their citation they are illustrated in different colors under association normalization methods. The authors in the same cluster are highly connected based on their topic of research. In cluster 1 illustrated by red color are Gilbert J., Hurst S., Messner K., and Revelle A. In cluster 2 illustrated by green color are Lewis D.W., Walter S., and Branin J. In cluster 3 illustrated by blue color are Gross M. and Latham D. Other 10 clusters comprised of the remaining 11 authors according to their citations are shown in the figure.

**Table-5.3.24: Most cited authors**

<b>Author</b>	<b>Citations</b>	<b>Documents</b>	<b>Citation per paper (CPP)</b>
Lewis D.W.	118	3	39.33
Robbins S.	62	4	15.50
Galbraith Q.	61	7	8.71
Aharony N.	61	3	20.33
Xia J.	58	3	19.33
Gross M.	54	4	13.50
Latham D.	52	3	17.33
Gilbert J.	51	3	17.00
Hurst S.	50	3	16.67
Messner K.	50	3	16.67
Revelle A.	50	3	16.67
Kulp C.	43	3	14.33
Walter S.	41	18	2.28
Lowe M.S.	41	3	13.67
Yakel E.	36	3	12.00
Dempsey P.R.	22	3	7.33
Luo L.	11	3	3.67
Branin J.	6	6	1.00
Kaspar W.A.	5	8	0.63
Beile P.	4	3	1.33

(Source: Data extracted from Scopus)



**Figure-5.3.13: Most cited authors (visualization)**

### 5.3.25 Co-authorship analysis of authors

Co-authorship analysis of the authors is presented in Table 5.3.25 and Figure 5.3.14 with network visualization. An author's minimum number of documents was considered 3 in this analysis. Of the 927 authors, 20 met the threshold. For all the authors, the number of documents, the number of citations, and their total link strengths were evaluated. In the analysis, only 7 authors were found to have total link strength which means only those authors were connected with other authors. The strongest author was Hurst S. with 3 documents, 50 citations, and 6 total link strengths. Although Walter S. has the highest number of publications with 18 documents with 41 citations but it is not connected with any other. For all the authors, the first number stands for the number of documents, the second one is the number of citations, and the third one is the total link strengths. The remaining of the authors are presented in order; Messner K. (3; 50; 6), Revelle A. (3; 50; 6), Gross M. (4; 55; 3), Latham D. (3; 52; 3), Robbins S. (4; 62; 2) and Kulp C. (3; 43; 2). 7 authors are distributed in 3 different clusters under association normalization methods. In visualization, weight is given to the total link strength of the authors and



font used open Sans. The authors in the same cluster are highly connected based on their related topics of research. In cluster 1 illustrated by red color, the authors are Hurst S., Messner K., and Revelle A. In cluster 2 illustrated by green color, the authors are Gross M. and Latham D. In cluster 3 illustrated by blue color, the authors are Robbins S. and Kulp C.

**Table-5.3.25: Co-authorship analysis of authors**

Author	Documents	Citations	Total link strength
Hurst S.	3	50	6
Messner K.	3	50	6
Revelle A.	3	50	6
Gross M.	4	54	3
Latham D.	3	52	3
Robbins S.	4	62	2
Kulp C.	3	43	2

(Source: Data extracted from Scopus)



**Figure-5.3.14: Co-authorship analysis (Network visualization)**

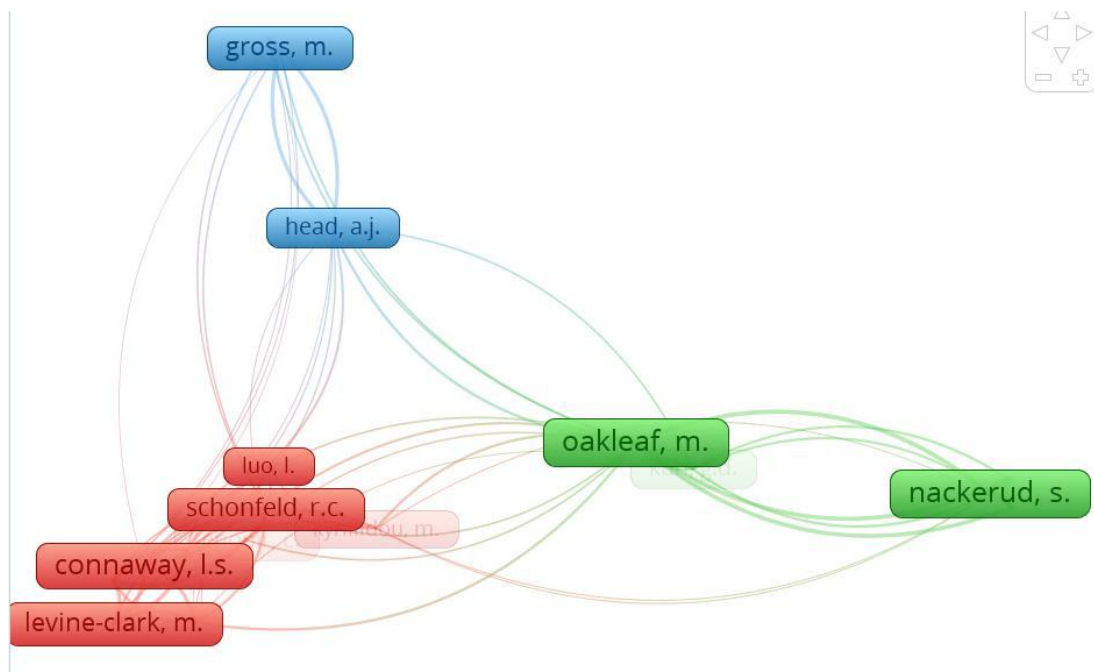
### 5.3.26 Co-citation analysis of cited authors

Co-citation analysis of the cited authors is presented in Table 5.3.26 and Figure 5.2.15 with network visualization. A cited author's minimum number of citations was considered 25 in this analysis. Of the 12691 cited authors, 13 met the threshold. For all the authors, the number of citations and their total link strengths was evaluated. The authors with the highest total link strengths were selected. The strongest author was Soria, K.M. with 30 citations and 205 total link strength. For all the authors, the first number stands for the number of citations and the second one is the total link strengths. The remaining of the authors are presented in order; Nackerud, S. (31; 199), Fransen, J. (30; 190), Oakleaf, M. (66; 152), Connaway, L.S. (36; 56), Kuh, G.D. (25;55), Schonfeld, R.C. (30; 51), Head, A.J. (32; 43), Levine-Clark, M. (28; 43), Gross, M. (27; 41), Walters, W.H. (32; 38), Hernon, P. (26;37) and Tenopir, C. (41;36). All the 14 authors are distributed in 3 different clusters illustrated with different colors that were frequently linked with each other. In cluster 1 illustrated by red color, the authors are Schonfeld, R.C., Connaway, L.S., Levine-Clark, M. Tenopir, C., Walters, W.H and Hernon, P. In cluster 2 illustrated by green color, the authors are Soria, K.M., Nackerud, S., Fransen, J., Oakleaf, M. Kuh, G.D., in the cluster 3 illustrated by blue color, the authors are Gross, M., Head, A.J.

**Table-5.3.26: Co-citation analysis of cited authors**

Author	Citations	Total link Strength
Soria, K.M.	30	205
Nackerud, S.	31	199
Fransen, J.	30	190
Oakleaf, M.	66	152
Connaway, L.S.	36	56
Kuh, G.D.	25	55
Schonfeld, R.C.	30	51
Head, A.J.	32	43
Levine-Clark, M.	28	43
Gross, M.	27	41
Walters, W.H.	32	38
Hernon, P.	26	37
Tenopir, C.	41	36

(Source: Data extracted from Scopus)



**Figure-5.3.15: Co-citation analysis of cited authors (Network visualization)**

### *5.3.27 Co-citation analysis of cited sources*

Co-citation of the cited sources is presented in Table 5.3.27 with network visualization in Figure 5.3.16. A cited journal's minimum number of citations was considered 60. Out of the total 5117 journals, 19 met the threshold. For those 19 journals, the number of publications, their citations, and their total strength of the bibliographic coupling links with other journals were calculated. The journals with the highest total link strength were selected. In the figure, each frame stands for a journal, the network of the journal was demonstrated over different colors. This network visualization was weighted by the number of citations for each journal. The top one is college & research libraries with 907 citations and 7549 total link strength. For all the sources, the first number stands for the number of citations, and the second one is the total link strength. The other journals are; Journal of academic librarianship (551; 6234), Portal: Libraries and the academy (254; 1885), Reference services review (184; 2262), Library & information science research (123;1571), Journal of library administration (136; 1353), College & undergraduate libraries (85, 1062), College & research libraries news (93; 1016), Reference & user services

quarterly (95; 1012), Library trends (100; 940), Journal of documentation (73; 934), Reference librarian (62; 864), Journal of the American Society for information science and technology (101; 822), Research strategies (61; 818), Collection management (89; 739), Library management (62; 702), Library quarterly (68; 639), Library Journal (64; 555) and Library hi-tech (62; 510). In the figure, each frame shows the most cited sources were categorized in 4 different clusters. In cluster 1 illustrated by red color, the journals are College & research libraries, Collection management, Library management, Journal of library administration, Library trends, Library Journal, Library hi-tech. In cluster 2 illustrated by green color, the journals are Reference librarian, College & undergraduate libraries, Research strategies, Reference services review, Reference & user services quarterly, College & research libraries news. In cluster 3 illustrated by blue color, the journals are Journal of documentation, Library quarterly, Library & information science research, Journal of the American Society for information science and technology. In cluster 4 illustrated by yellow color, the journal is Portal: libraries and the academy. The journals in the same cluster are highly co-cited with other journals.

**Table-5.3.27: Co-citation analysis of cited sources**

Source	Citations	Total link strength
College & research libraries	907	7549
Journal of academic librarianship	551	6234
Portal: libraries and the academy	254	2885
Reference services review	184	2261
Library & information science research	123	1571
Journal of library administration	136	1353
College & undergraduate libraries	85	1062
College & research libraries news	93	1016
Reference & user services quarterly	95	1012
Library trends	100	940
Journal of documentation	73	934
Reference librarian	62	864
Journal of the American Society for information science and technology	101	822
Research strategies	61	818
Collection management	89	739
Library management	62	702
Library quarterly	68	639

Library journal	64	555
Library hi-tech	62	510

(Source: Data extracted from Scopus)



**Figure-5.3.16: Co-citation analysis of cited sources**

### 5.3.28 Bibliographic coupling of the countries

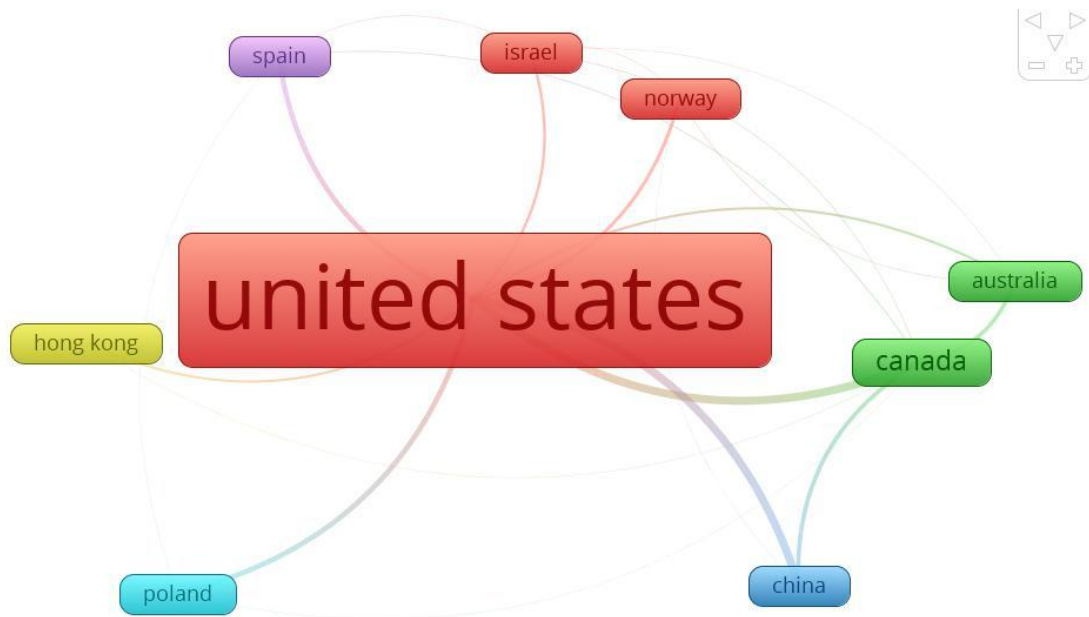
Bibliographic coupling of the countries are presented in Table 5.3.28 and Figure 5.3.17 with network visualization. A country's minimum number of publications was 3. Of the 31 countries, 9 met the threshold. For each of the 9 countries, the total link strength with other countries was calculated. For all of the countries, the number of documents, the number of citations, and the total link strength were calculated. The countries with the highest total link strengths were considered. The top one was the United States of America with 410 documents, 4445 citations, and 1311 total link strength. The other countries were; Canada (34; 421; 609), Hong Kong (3; 121; 62), Israel (4; 77; 53), Spain (4; 33; 163), China (5; 28; 336), Australia (6; 20; 182),

Poland (4;14;337) and Norway (4;10;59). (Note: the first numbers stand for the number of publications, the second one is the number of citations and the third one is the total link strengths.) In Figure 5.3.17 in network visualization, different colors show different clusters that were more commonly connected. It means that the studies initiated from the countries in the same cluster cite each other more regularly. 6 clusters formed by software Vos viewer is under association normalization methods, weight is given to the number of citations they have got and font used openSans. In cluster 1 illustrated by red color are the United States of America, Israel, and Norway. In cluster 2 illustrated by green color, the countries are Canada and Australia. In cluster 3, cluster 4, cluster, 5 and cluster 6 there is only 1 country in each cluster are China, Poland, Hong Kong, and Spain respectively.

**Table-5.3.28: Bibliographic coupling of the countries**

<b>Country</b>	<b>Documents</b>	<b>Citations</b>	<b>Total link strength</b>
United States of America	410	4445	1311
Canada	34	421	609
Hong Kong	3	121	62
Israel	4	77	53
Spain	4	33	163
China	5	28	336
Australia	6	20	182
Poland	4	14	337
Norway	4	10	59

(Source: Data extracted from Scopus)



**Figure-5.3.17: Bibliographic coupling of the countries (Network visualization)**

### ***5.3.29 Bibliographic coupling of the publications***

Bibliographic coupling of the publications is presented in Table 5.3.29 and Figure 5.3.18 with network visualization. Only the publications that have a minimum number of 60 citations were included in this analysis. Of the 447 documents, 6 met the threshold. For all the publications, the number of citations and their total link strengths was calculated. The documents with the greatest total link strength were selected. The strongest one was Kim (2014) with 68 citations and 4 total link strengths. Although Mackey (2011) has the highest 177 citations but total link strength is less as compared to the previous one so it is in the second position in the list. The remaining authors are Stone (2013) having 84 citations and total link strength 1. Publication Wong (2011) has 70 citations and the total link strength is 1. Publications Asther (2013) and Lewis (2012) have 89 and 93 citations respectively but there is no connectivity with other publications so their total link strength is 0. The network visualization shown in the Figure demonstrates the connectivity of the publications in the cluster. The network of highly bibliographically coupled publications was considered by the software. 4 cluster formed by software

VOSviewer is under association normalization methods, weight is given to the number of citation they have got and font used open Sans. In cluster 1, demonstrated by red color, the publications are Stone (2013) and Wong (2011). In cluster 2 demonstrated by green color, the publications are Kim (2014) and Mackey (2011). In cluster 3 and cluster 4, there is only 1 publication in each are Asher (2013) and Lewis (2012) respectively.

**Table-5.3.29: Bibliographic coupling of the publications**

Document	Citations	Total link strength
Kim (2014)	68	5
Mackey (2011)	177	4
Stone (2013)	84	1
Wong (2011)	70	1
Asher (2013)	89	0
Lewis (2012)	93	0

(Source: Data extracted from Scopus)



**Figure-5.3.18: Bibliographic Coupling of the Publications**



### 5.3.30 Bibliographic coupling of the authors

Bibliographic coupling of the authors is presented in Table 5.3.30 and Figure 5.3.19 with overlay visualization. An author's minimum number of publications was 4 to be included in this analysis. Of the 927 authors, 6 met the threshold. For all the authors, the number of documents, the number of citations, and their total link strengths were evaluated. The authors with the greatest total link strengths were considered. The highest total link strength was observed in the author Galbraith Q. (7; 61; 1), the author Walter S. (18; 41; 1) has the highest number of documents but the citation is less than the first one and total link strength is the same as the first one, it is in 2<sup>nd</sup> position. For the other authors, the first numbers stand for the number of publications, the second one is the number of citations and the third one is the total link strengths. The other authors were, Branin J. (6; 6; 0), Gross M. (4; 54; 0), Kaspar W.A. (8.5; 0), Robbins S. (4; 62; 0). The authors are divided into 5 clusters according to their link strength. The network visualization shown in the figure demonstrates the connectivity of the authors in the cluster. The network of highly bibliographically coupled authors was considered by the software. 5 cluster formed by software VOSviewer is under association normalization methods, weight is given to the number of citations they have got and font used open Sans. In cluster 1, demonstrated by red color, the authors are Galbraith Q. and Walter S. In cluster 2, cluster 3, cluster 4, and cluster 5 the there is only 1 author in each cluster are Branin J., Gross M., Kaspar W.A., and Robbins S. respectively.

**Table-5.3.30: Bibliographic coupling of the authors**

<b>Author</b>	<b>Documents</b>	<b>Citations</b>	<b>Total link strength</b>
Galbraith Q.	7	61	1
Walter S.	18	41	1
Branin J.	6	6	0
Gross M.	4	54	0
Kaspar W.A.	8	5	0
Robbins S.	4	62	0

(Source: Data extracted from Scopus)



**Figure-5.3.19: Bibliographic coupling of the authors**

***5.3.31 Year-wise citation appended***

Table 5.3.31 shows the year-wise citation appended in the documents of the journal. It was found that the highest 2533 citations appended in the year 2020 having CPP of 42.22. Followed by the year 2019 with 2488 citations appended having CPP 44.43, the year 2018 with 2464 citations appended having CPP 51.33, the year 2015 with 2013 citations appended having CPP 35.32, the year 2014 with 1868 citations appended having CPP 45.56, in the year 2017 with 1810 citation appended having CPP 36.94, the year 2016 with 1515 citation appended having CPP 35.23. The lowest citation was observed in the year 2012 with 1011 citations having CPP of 33.70. The average citation per paper is 40.07. From the table, it can be observed that the highest number of the paper published in the year 2020 and lowest was in 2011 and 2012. The highest number of citations appended in the year 2020 and the lowest was in

2012. If we consider Citation per paper then the highest was observed in the year 2018 and the lowest was in 2012. Overall we can say that in 10 years number of citations increases gradually from the later to the early period of the study. In the former 7 years except in 2013, the CPP was below the average CPP and in the later 3 years, CPP was above average CPP.

**Table-5.3.31: Year-wise citation appended**

Year	TP	TC	Citation per paper (CPP)
2011	30	1053	35.10
2012	30	1011	33.70
2013	33	1155	35.00
2014	41	1868	45.56
2015	57	2013	35.32
2016	43	1515	35.23
2017	49	1810	36.94
2018	48	2464	51.33
2019	56	2488	44.43
2020	60	2533	42.22
Total	447	17910	Average- 40.07

(TP=Total paper, TC= Total citation, CPP=citation per paper)

(Source: Data extracted from Scopus)

### **5.3.32 Form of cited documents**

Table 5.3.32 shows the year-wise distribution of different cited documents. In college and research libraries journal during the period of study, a total of 17910 cited documents were recognized. In 2011 total cited documents were 1053, out of which the highest 601 documents were cited as journals followed by books having 187 cited documents. In 2012 total cited documents were 1011, out of which the highest 615 documents were cited as journals followed by books having 146 cited documents. In 2013 total cited documents were 1155, out of which the highest 680 documents were cited as journals followed by web pages having 167 cited documents. In the year 2014 total cited documents were 1868, out of which the highest 1056 documents were cited as journals followed by web pages having 256 cited documents. In the year 2015 total cited documents were 2013, out of which the

highest 1145 documents were cited as journals followed by web pages having 270 cited documents. In the year 2016 total cited documents were 1515, out of which the highest 987 documents were cited as journals followed by books having 168 cited documents. In the year 2017 total cited documents were 1810, out of which the highest 985 documents were cited as journals followed by books having 267 cited documents. In the year 2018 total cited documents were 2464, out of which the highest 1245 documents were cited as journals followed by web pages having 378 cited documents. In the year 2019 total cited documents were 2488, out of which the highest 1260 documents were cited as journals followed by web pages having 384 cited documents, and in the year 2020 total cited documents were 2533, out of which the highest 1265 documents were cited as journals followed by web pages having 384 cited documents. The most cited document was journals having 10440 (58.29%), followed by books having 2620 (14.63%) documents, and followed by web pages having 2568 (14.34%) documents. The less cited document was catalog and other materials having 30 (0.17%) and 10 (0.06%) respectively. Overall it was found that, the highest number of citations appended in the year 2020, followed by the year 2019, and the lowest number of citations appended in the year 2012. In the case of the form of cited documents journals were the most cited documents, followed by books and web pages which shows that researchers are much more interested to cite journal articles, books, and web pages in this digital era as compared to other sources. The less cited documents were catalogs, directories, dictionaries, and manuals as these types of documents are not sufficient to provide fresh ideas for any further research.

**Table-5.3.32: Form of cited documents**

Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Percent age
Journals	601	615	680	1056	1145	987	985	1245	1260	1265	10440	58.29
Books	187	146	157	234	223	168	267	345	351	355	2620	14.63

Web pages	102	136	167	256	270	145	246	378	382	384	2568	14.34
Reports	80	56	65	76	67	37	65	76	78	82	762	4.25
Communications	15	13	14	45	58	19	43	59	62	65	408	2.28
Conference proceedings	34	17	18	34	48	23	32	73	56	59	428	2.39
Unpublished	12	8	10	3	12	18	5	9	8	10	107	0.60
Thesis	5	5	7	45	67	58	62	90	93	96	533	2.98
Standards	4	3	5	8	4	7	8	15	23	21	102	0.57
Encyclopedias	3	1	2	9	24	4	3	23	20	24	116	0.65
Catalog	1	0	1	3	2	0	2	7	6	7	30	0.17
Newsletters	2	3	5	27	31	16	24	36	39	42	227	1.27
Newspapers	2	4	8	34	27	11	39	47	49	52	275	1.54
Archives	2	2	4	8	5	3	8	5	7	9	55	0.31
Directories	2	1	0	4	5	2	3	8	6	7	40	0.22
Monographs	1	0	8	5	7	5	4	14	15	18	78	0.44
Dictionary	0	0	2	9	4	3	2	11	9	8	48	0.27
Manuals	0	1	0	2	8	6	8	15	13	15	68	0.38
Reprints	0	0	1	3	4	3	4	8	11	14	48	0.27
others	0	0	1	7	2	0	0	0	0	0	10	0.06
	1053	1011	1155	1868	2013	1515	1810	2464	2488	2533	17910	

(Source: Data extracted from source journal)

### 5.3.33 Top cited journals

Table 5.3.33 shows the top-cited journals, out of all the journals participated in citation only 19 journals were found the whose the minimum number of citation is 64 and were considered for the study. It was observed that the journal "COLLEGE & RESEARCH LIBRARIES" has got the highest number of citations having 897 citations, followed by "JOURNAL OF ACADEMIC LIBRARIANSHIP" having 538 citations, journal "PORTAL: LIBRARIES AND THE ACADEMY" having 245 citations, journal "REFERENCE SERVICES REVIEW" having 184 citations, journal "JOURNAL OF LIBRARY ADMINISTRATION" having 132 citations,

journal “LIBRARY & INFORMATION SCIENCE RESEARCH” having 111 citations, journal “JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY” having 105 citations, journal “LIBRARY TRENDS” having 103 citations. More than 11 journals have less than 100 citations and more than 63 citations. . Based on top-cited journals it can be observed that the source journal College and research journal itself is rank 1 in the list of top-cited journals. This means that the authors are more interested to cite the source journals article in their publications. Besides this, the researchers highly cite the journal ‘Journal of academic librarianship’ after the source journals documents.

**Table-5.3.33: Top cited journals**

<b>Sources</b>	<b>No. of citations</b>
COLLEGE & RESEARCH LIBRARIES	897
JOURNAL OF ACADEMIC LIBRARIANSHIP	538
PORTAL: LIBRARIES AND THE ACADEMY	245
REFERENCE SERVICES REVIEW	184
JOURNAL OF LIBRARY ADMINISTRATION	132
LIBRARY & INFORMATION SCIENCE RESEARCH	111
JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY	105
LIBRARY TRENDS	103
COLLEGE & RESEARCH LIBRARIES NEWS	95
REFERENCE & USER SERVICES QUARTERLY	95
COLLECTION MANAGEMENT	87
COLLEGE & UNDERGRADUATE LIBRARIES	80
LIBRARY JOURNAL	76
JOURNAL OF DOCUMENTATION	72
LIBRARY HI-TECH	72
RESEARCH STRATEGIES	72
LIBRARY QUARTERLY	68
LIBRARY MANAGEMENT	65
REFERENCE LIBRARIAN	64

(Source: Data extracted from Scopus)

### 5.3.34 Co-word network analysis of the title of the documents

Co-word network analysis is a content analysis method that practices patterns of co-occurrence of substances. Table 5.3.34 and Figure 5.3.20 describes the Co-word network analysis of the title of the documents. Biblioshiny software was used to calculate the betweenness and closeness among the words. In the software network layout kept as "Automatic network", normalization as "association" and clustering algorithm used Louvain. The number of nodes used was 50, but out of them, 30 keywords were considered based on their betweenness. Betweenness means, how many times they have occurred in the title and closeness means how they are connected with other words. Based on betweenness and closeness strength, the total 30 title keywords were again divided into 5 clusters according to their betweenness strength. The word "academic" is used highly in the title of the documents having betweenness 69.36 and closeness 0.03. Followed by the word "Library" having betweenness is 61.11 and closeness is 0.03, the word "study" shows a betweenness 18.59 and closeness of 0.03. The remaining words are shown in the table having betweenness and closeness. The analysis displays the connectivity among the different words used by the authors in the title of the documents. The different 5 clusters are shown in different colors in the figure. In the figure, it can be seen that the highest font size of the word is highly connected with other words. Accordingly, the word 'academic' is highly connected with other words, followed by the word 'library', 'study', 'libraries', and so on.

**Table-5.3.34: Co-word network analysis of the title of the documents**

<b>Words</b>	<b>Cluster</b>	<b>Betweenness</b>	<b>Closeness</b>
academic	1	69.36	0.03
library	3	61.11	0.03
study	2	18.59	0.03
libraries	1	17.27	0.03
literacy	3	15.63	0.03
librarians	1	13.17	0.03
analysis	4	11.13	0.02
faculty	1	6.72	0.02

impact	3	4.33	0.02
scholarly	5	4.12	0.02
survey	5	2.93	0.02
journals	5	2.62	0.02
collections	5	2.23	0.02
student	3	2.20	0.02
learning	3	1.86	0.02
students	3	1.82	0.02
assessment	3	1.66	0.02
science	4	1.61	0.02
instruction	3	1.46	0.02
case	2	1.04	0.02
citation	4	1.02	0.02
university	2	0.79	0.02
open	5	0.63	0.02
digital	5	0.63	0.02
data	2	0.44	0.02
access	5	0.30	0.02
college	1	0.18	0.02
education	3	0.08	0.02
reference	3	0.07	0.02
perceptions	1	0.00	0.02

(Source: Data extracted from Scopus)

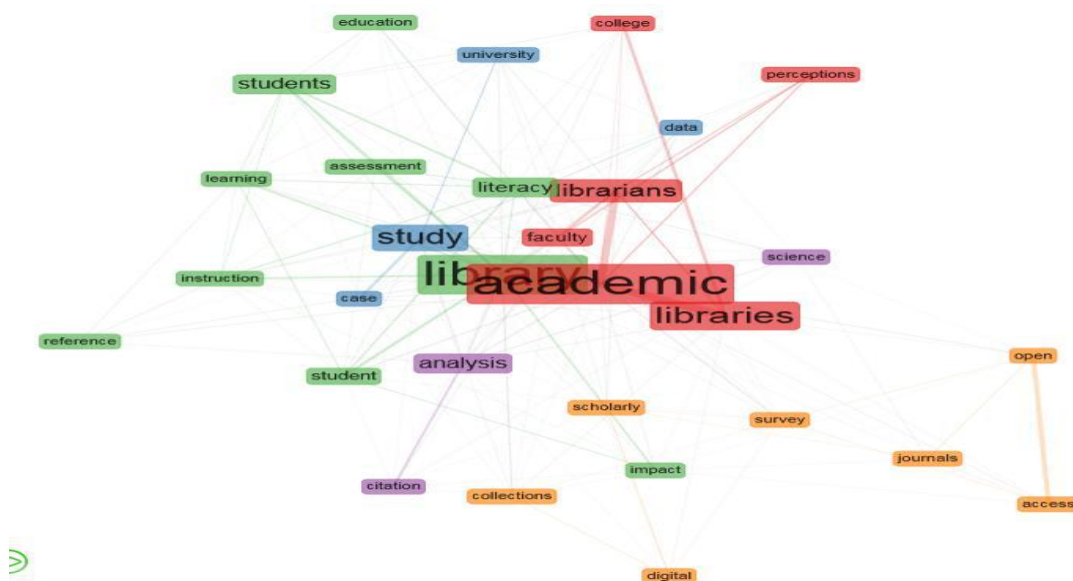


Figure-5.3.20: Co-word network analysis of the title of the documents



### 5.3.35 Word cloud of title keyword

Word Cloud is a pictorial representation of word occurrence in a data set. The bigger the font size of the word denotes the more occurrence of the words. It gives an insight into the most occurred words. Word cloud formed by a cloud of most occurred words occurred in the title of the document. Table 5.3.35 and Figure 5.3.21 describes the word cloud of title keywords, where title keywords were considered for the study. To select the words, the words that occurred having 16 or more than 16 times were considered. A total of 25 words were found to fulfill the conditions. The different words are shown in different colors in the figure. In the figure, it can be seen that the highest font size of the word has more occurrence in the title of the document. It was observed that the keyword “academic” highly occurred having a frequency of 140, followed by “library” occurred 126 times. The keyword “libraries” occurred 86 times and so on. From this analysis, it can recognize that maximum publications have the word “academic”, “library”, “libraries”, and “librarians” and so on in the title of the document. As the journal college and research of library science is a journal of library science so, in the title of the documents the word related to the library has occurred most.

**Table-5.3.35: Word cloud of title keyword**

<b>Words</b>	<b>Frequency</b>
Academic	140
Library	126
Libraries	86
Librarians	62
Study	62
Students	49
Literacy	41
Student	41
Analysis	35
Faculty	35
Data	27
Instruction	27
Assessment	25
Learning	25
Impact	24

College	23
Open	23
Access	22
University	22
Perceptions	18
Scholarly	18
Citation	17
Review	17
Collections	16
Digital	16

(Source: Data extracted from Scopus)

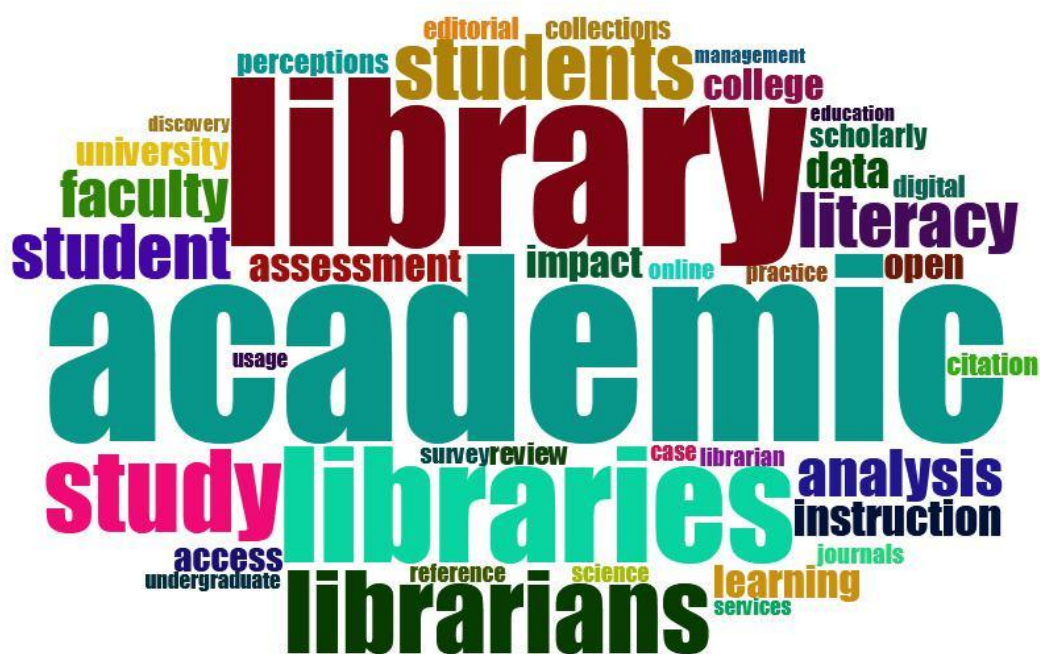


Figure-5.3.21: Word cloud of title keyword

### 5.3.36 Word cloud of abstract keyword

Word cloud formed by a cloud of most occurred words in abstract of the document. Table 5.3.36 and Figure 5.3.22 describe the word cloud of abstract keywords, where abstract keywords were considered for the study. The different words are shown in different colors in the figure. In the figure, it can be seen that the highest font size of the word has more occurrence in the abstract of the document. It was observed that the keyword “library” highly occurred having a frequency of 509, followed by

“academic” occurred 415 times. The keyword “study” occurred 387 times and so on. From this analysis, it can recognize that maximum publications are having the highly occurred words library, academic, study, students, etc. in the abstract of the document.

**Table-5.3.36: Word cloud of abstract keyword**

<b>Words</b>	<b>Frequency</b>
Library	509
Academic	415
Study	387
Students	383
Librarians	355
Libraries	339
Data	227
Faculty	154
University	150
Survey	143
Literacy	133
Student	128
Learning	120
Findings	117
Analysis	109
Attribution non-commercial	106
Instruction	104
Services	99
Studies	99
Access	98
Institutions	96
Article	95
College	87
Skills	87
Journals	86

(Source: Data extracted from Scopus)



**Figure-5.3.22: Word cloud of abstract keyword**

### *5.3.37 Word dynamics analysis of abstract keyword*

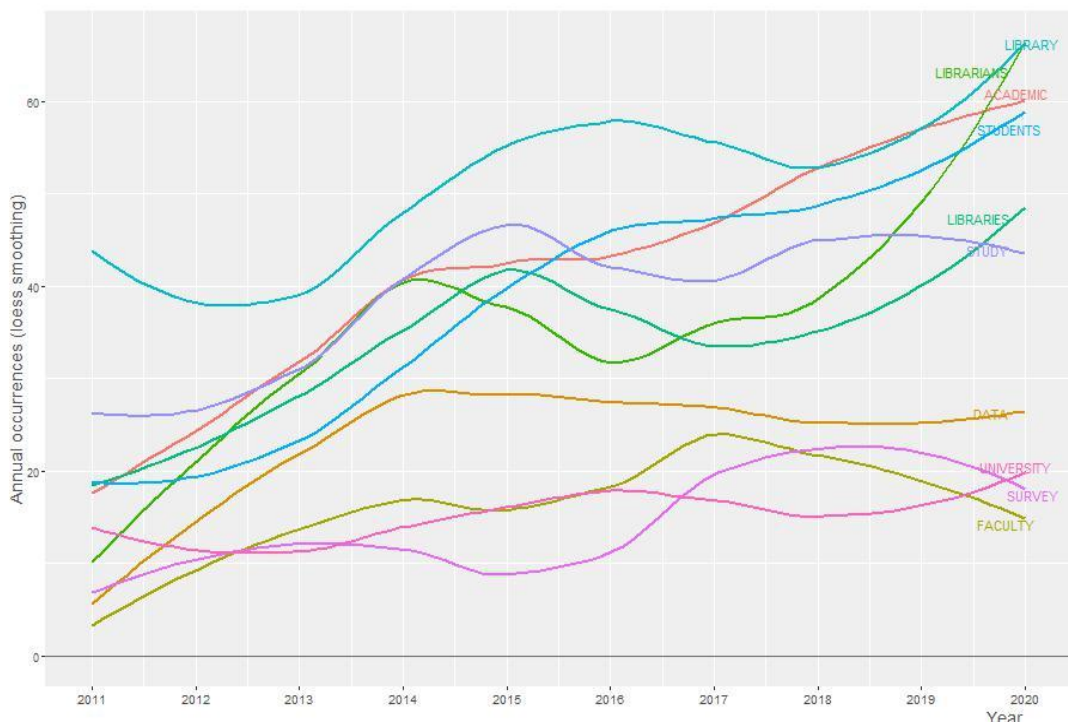
Table 5.3.37 and Figure 5.3.23 show the word dynamics analysis of abstract keywords. It means the analysis will identify the year-wise most occurred abstract keywords among all the words of the abstract published by the College and research libraries journal during the period of study. It was found that in the years 2011, 2012, 2013, 2015, 2017, 2018, and 2020 the word “Library” highly occurred with a count of 45, 35, 43, 73, 61, 59, and 72 respectively. In the year 2014, the word “Librarians” highly occurred with a count of 54. In the year 2016, the word “Students” occurred highest 53 times. In the year 2019, the keywords “Academics” occurred highest 58 times. In the figure, it can be easily seen that different colors show the year-wise variations of its occurrence. By the overall analysis, it was cleared that word 'Library' shown in the deep blue line, followed by the word ‘Librarians’ in the green line, the word ‘Academic’ in brown line and the word ‘students’ are the leading keywords dynamically changes their occurrence from 2011 to 2020 in abstract of the documents published in college and research libraries journal. If we see the overall

trend then it can be said that the word “Library” occurred highly followed by the word ‘Librarians’, ‘Academic’ and ‘students’ in the abstract section of the article of College and research libraries journal during the period of study.

**Table-5.3.37: Word dynamics analysis of abstract keyword**

Word	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Library	45	35	43	34	73	44	61	59	43	72
Academic	18	25	27	39	51	31	57	49	58	60
Study	28	25	24	44	48	40	41	45	51	41
Students	21	15	22	37	32	53	45	44	56	58
Librarians	15	12	25	54	25	39	33	38	46	68
Libraries	17	28	20	35	48	31	37	35	39	49
Data	7	12	20	31	27	26	30	22	25	27
Faculty	5	6	12	24	8	22	24	20	17	16
University	15	9	12	13	17	17	18	14	14	21
Survey	6	13	9	14	9	7	24	22	20	19

(Source: Data extracted from Scopus)



**Figure-5.3.23: Word dynamics analysis of abstract keyword**

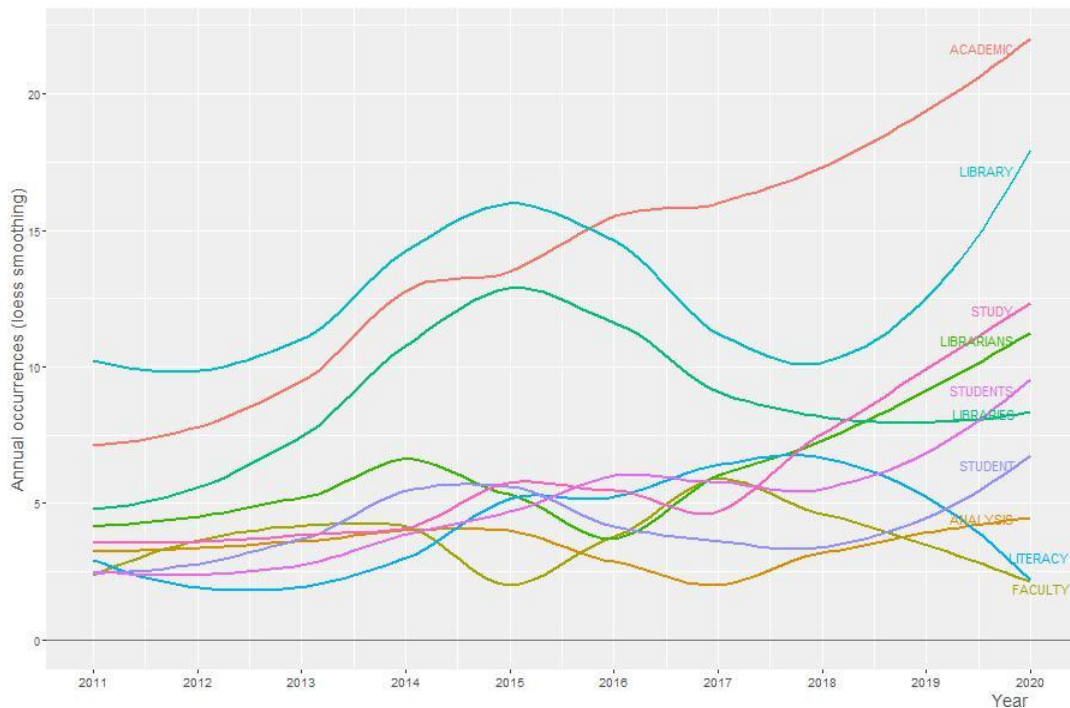
### 5.3.38 Word dynamics analysis of title keyword

Table 5.3.38 and Figure 5.3.24 show the word dynamics analysis of title keywords. It means the analysis will identify the year-wise most occurred title keywords among all the words of the titles of the documents published by the ALIS journal during the period of study. It was found that in the years 2011, 2012, 2014, 2015, and 2016 the word “Library” was highly occurred with a count of 11, 8, 11, 20, and 12 respectively in each year. In the year 2013, 2015, 2017, 2018, 2019 and 2020, keyword “Academic” occurred highest 13, 20, 2017, 18, 17 and 23 respectively. In the figure, it can be easily seen that different colors show the year-wise variations of its occurrence. By the overall analysis, it was cleared that word 'Academic' shown in brown line, followed by the word 'Library' in the deep blue line, the word 'study' in pink line, and the word 'librarians' in green line are the leading keywords dynamically changes their occurrence from 2011 to 2020 in the title of the documents published in college and research libraries journal. If we see the overall trend then it can be said that the word “Academic” occurred highly followed by the word 'Library', 'study' and 'librarians' in the title of the articles published in College and research libraries journal during the period of study.

**Table-5.3.38: Word dynamics analysis of title keyword**

Word	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Academic	8	5	13	7	20	10	19	18	17	23
Library	11	8	12	11	20	12	12	11	10	19
Libraries	5	5	8	7	18	8	10	10	6	9
Librarians	5	3	4	8	5	3	6	9	7	12
Study	3	5	2	4	6	6	4	7	13	11
Students	3	1	4	3	5	6	6	5	6	10
Literacy	3	2	1	4	4	7	4	9	5	2
Students	3	2	2	7	5	4	4	3	4	7
Analysis	3	4	3	3	6	1	3	3	5	4
Faculty	3	2	5	5	1	3	8	3	2	3

(Source: Data extracted from Scopus)



**Figure-5.3.24: Word dynamics analysis of title keyword**

### ***5.3.39 Trend topics based on abstract keywords***

Trend topics show the most growing topics, but here the discussion is based on the keywords. For the study purpose, the top 15 keywords are considered based on their occurrence in the abstract of the different documents. Table 5.3.39 depicts the trend topics based on abstract keywords. It was observed that the keyword "Library" occurred highest 509 times in the year 2016 among all the abstract keywords, followed by "Academic" occurred 415 times in the year 2017, the word "Study" occurred 387 times in the year 2016, keyword "Students" occurred 383 times in the year 2017. Instead of this in the table more 11 keywords are having more than 75 occurrences. Based on title keywords, overall we can say that the most trending researches are from academic libraries, librarians, and students are highly included in the research. And most of the researches is conducted by colleges and universities.

**Table-5.3.39: Trend topics based on abstract keywords**

<b>Word</b>	<b>Occurrence</b>	<b>Year</b>
LIBRARY	509	2016
ACADEMIC	415	2017
STUDY	387	2016
STUDENTS	383	2017
LIBRARIANS	355	2017
LIBRARIES	339	2016
DATA	227	2016
FACULTY	154	2016
SURVEY	143	2017
LITERACY	133	2017
ATTRIBUTION	106	2018
COLLEGE	87	2018
JOURNALS	86	2014
EDUCATION	78	2018
PAPER	76	2015

(Source: Data extracted from Scopus)

#### **5.3.40 Trend topics based on title keywords**

Trend topics show the most growing topics, but here the discussion is based on the keywords. For the study purpose, the top 16 keywords are considered based on their occurrence in the title of the different documents. Table 5.3.40 depicts the trend topics based on title keywords. It was observed that the keyword "Academic" occurred highest 140 times in the year 2017 among all the title keywords, followed by "Library" occurred 126 times and "Libraries" occurred 86 times in the year 2016, keyword "Librarians" occurred 62 times in the year 2017. Instead of this in the table, more than 12 keywords are having more than 21 occurrences. Based on title keywords, overall we can say that the most trending researches are from academic libraries, librarians, and students are highly included in the research. And most of the researches is conducted by colleges and universities.



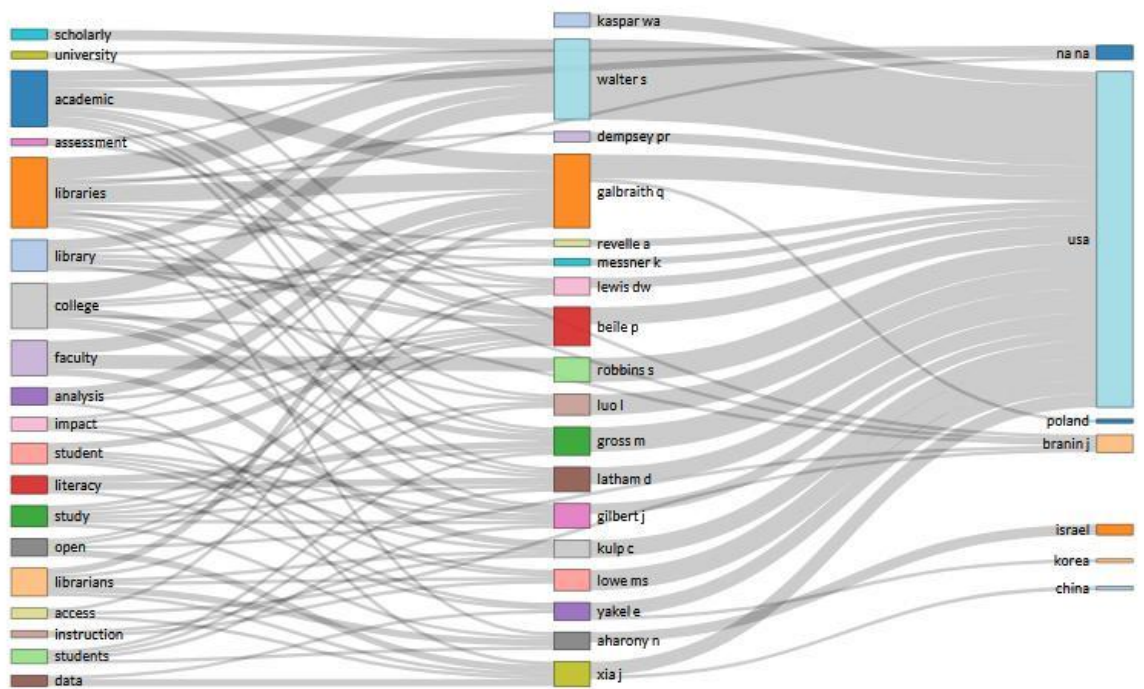
**Table-5.3.40: Trend topics based on title keywords**

<b>Word</b>	<b>Occurrence</b>	<b>Year</b>
ACADEMIC	140	2017
LIBRARY	126	2016
LIBRARIES	86	2016
LIBRARIANS	62	2017
STUDY	62	2018
STUDENTS	49	2017
LITERACY	41	2016
STUDENT	41	2016
ANALYSIS	35	2015
FACULTY	35	2016
DATA	27	2017
INSTRUCTION	27	2015
LEARNING	25	2015
COLLEGE	23	2014
UNIVERSITY	22	2017
ACCESS	22	2015

(Source: Data extracted from Scopus)

#### ***5.3.41 Three field plot analysis***

Three field plot analysis in the Figure 5.3.25 shows the visual representation of connections of different 3 fields of bibliometric data. It is analyzed by Biblioshiny software. For the study, the different three fields were considered namely title keywords on the left, authors' field in the middle, and country on the right. It was observed that in the left field, the word libraries in orange color, academic in blue color, college in grey color are highly connected with the authors in the middle field. In the middle field author, Walter S in sky blue color and Galbraith Q in orange color are highly connected with the other two fields. In the right, field the country United States of America in sky blue color is the leading country to contribute the highest number of publications thus highly connected with the other two fields in the plot.



**Figure-5.3.25: Three-fields plot analysis**

#### 5.4 Hypotheses of the study

A hypothesis is a statement of the researcher's expectancy or estimates about the relationship among study variables. The researcher question recognizes the study concepts and asks how the concepts might be linked to a hypothesis is the predicted answer. In this study, null and alternative hypotheses were calculated by using MS excel.

The Null Hypothesis (also called a statistical hypothesis) assumes that there is no connection between two variables. In the null hypothesis, the researcher tries to explain the relationship is by chance, there is no statistically significant relationship between two variables and the relationship occurred just because of chance. Though in alternative hypothesis, the researcher tries to prove that there is a relationship between two variables. Finally, when we accept alternative hypothesis then null hypothesis automatically get rejected and vice versa

Hypothesis: 1

H<sub>10</sub>: There is no significant difference in the distribution pattern of articles between selected journals.

H<sub>1a</sub>: Annals of library and information studies journal published fewer articles than College and research libraries journal.

Descriptive statistics of the distribution pattern of articles of “Annals of library and information studies” and “College and research libraries” journals are represented in Table 5.4.1

**Table-5.4.1: Descriptive statistics of the distribution pattern of articles**

<b>Annals of Library and Information Studies</b>		<b>College and Research Libraries</b>	
Parameters	Statistics	Parameters	Statistics
Mean	31.2	Mean	44.7
Standard Error	1.793817	Standard Error	3.540402
Median	32	Median	45.5
Mode	27	Mode	30
Standard Deviation	5.672546	Standard Deviation	11.19573
Sample Variance	32.17778	Sample Variance	125.3444
Kurtosis	-0.02392	Kurtosis	-1.46683
Skewness	-0.69231	Skewness	-0.09991
Range	18	Range	30
Minimum	20	Minimum	30
Maximum	38	Maximum	60
Sum	312	Sum	447
Count	10	Count	10

The t-Test data for both the journals dataset is shown in Table 5.4.2. The distribution of the articles in Annals of Library and Information journal (M=31.2, SD=5.672546, n=10) was hypothesized to be lesser than the distribution of the articles in college and research libraries journal (M=44.7, SD= 11.19573, n=10). This difference is significant,  $t(18) = -3.40$ ,  $p=0.002$  (1 tail hypothesis). So, alternative hypothesis **H<sub>1a</sub> is supported** i.e Annals of library and information studies journal published fewer

articles than College and research libraries journal. Since the value of p is  $< 0.05$  (the alpha value), **the null hypothesis is rejected for H1<sub>0</sub>**.

**Table-5.4.2: t-Test: Two-sample assuming equal variances, distribution of articles**

Parameters	ALIS	CRL
Mean	31.2	44.7
Variance	32.17778	125.3444
Observations	10	10
Pooled Variance	78.76111	
Hypothesized Mean Difference	0	
df	18	
t Stat	-3.40144	
P(T<=t) one-tail	0.001591	
t Critical one-tail	1.734064	
P(T<=t) two-tail	0.003181	
t Critical two-tail	2.100922	

Hypothesis: 2

H2<sub>0</sub>: There is no significant difference in the collaborative research between selected journals

H2<sub>a</sub>: Annals of library and Information studies journal has less collaborative research than College and research libraries journal.

Descriptive statistics of multi-authored publications of "Annals of library and information studies" and "College and research libraries" journals are represented in Table 5.4.3

**Table-5.4.3: Descriptive statistics of the multi-authored publications**

Annals of Library and Information Studies		College and Research Libraries	
Mean	20.8	Mean	29.2
Standard Error	1.041367	Standard Error	2.00444

Median	21	Median	31
Mode	20	Mode	34
Standard Deviation	3.29309	Standard Deviation	6.338594
Sample Variance	10.84444	Sample Variance	40.17778
Kurtosis	-0.38875	Kurtosis	-0.88757
Skewness	-0.68978	Skewness	-0.71609
Range	10	Range	18
Minimum	15	Minimum	18
Maximum	25	Maximum	36
Sum	208	Sum	292
Count	10	Count	10

The t-Test data for both the journals dataset is shown in Table 5.4.4. The distribution of multi-authored publications in Annals of Library and Information journal (M=20.8, SD=3.29309, n=10) was hypothesized to be lesser multi-authored publications than the multi-authored publications in college and research libraries journal (M=29.2, SD= 6.338594, n=10). This difference is significant,  $t(18) = -3.71$ ,  $p=0.0007$  (1 tail hypothesis). So, alternative hypothesis **H2<sub>a</sub> is supported** i.e Annals of library and information studies journal published less multi-authored publication than College and research libraries journal. Since the value of p is  $< 0.05$  (the alpha value), **the null hypothesis is rejected for H2<sub>0</sub>**.

**Table-5.4.4: t-Test: Two-sample assuming equal variances, multi-authored publication**

Parameters	ALIS	CRL
Mean	20.8	29.2
Variance	10.84444	40.17778
Observations	10	10
Pooled Variance	25.51111	
Hypothesized Mean Difference	0	
df	18	
t Stat	-3.71877	

P(T<=t) one-tail	0.000786	
t Critical one-tail	1.734064	
P(T<=t) two-tail	0.001572	
t Critical two-tail	2.100922	

### **5.5 Conclusion**

In this chapter, the data collected from source journals and the Scopus database are analyzed by using different scientometric indicators and interpreted. The outcomes are represented in the form of tables, graphs, and charts to make a clear visualization of findings that is more understandable to the readers.

**CHAPTER 6**  
**MAJOR FINDINGS, CONCLUSION, AND SUGGESTION**

## **6.1 Introduction**

The chapter deals with major findings, suggestions from the researchers' view, and the conclusion of the study. This chapter is divided into five parts i.e. (i) findings based on objectives of the study, (ii) General findings, (iii) Conclusion, (iv) suggestions, and (v) Direction for future research.

## **6.2 Findings based on the objectives of the study**

**The first objective of the study is to find out distribution pattern and authors' productivity of articles in selected LIS Journals**

*For Annals of Library and Information Studies (ALIS) journal*

1. The study finds that in the year-wise distribution of publications of Annals of Library and Information Studies (ALIS) journal, there are a total of 312 articles published in 10 volumes during the study period out of which the highest 38 (12.18%) articles published in the year 2015 and lowest 20 (6.41%) articles published in the year 2019. The publications got decreased almost by 50% in the year 2019 which shows a negative trend in publication. (Table-5.2.1)
2. In the year-wise authorship distribution pattern, the single-authored paper was highly published in 2015 whereas the lowest was observed in the year 2019. Among all the patterns of authorship, two authored papers were dominating overall in the ALIS journal during the period of study. This trend shows that authors are interested to work on jointly authored papers and they are not that much interested to add more than two authors in their publications. (Table-5.2.9)



***For College and Research Libraries (CRL) journal***

1. The study finds that in the year-wise distribution of publications of College and research libraries (CRL), there are a total of 447 articles published in 10 volumes during the study period out of which the highest 60 (13.42%) articles were published in the year 2020 and lowest 30 (6.71%) articles published in the year 2011, 2012. The publications got increased by 50% in the latest year which shows a positive trend in publication. (Table-5.3.1)
2. In the year-wise authorship distribution pattern, single-authored papers were highly published in 2020 whereas the lowest was observed in the year 2011. In joint authored paper highest was observed in 2020 and the lowest in 2012. But both the authorship pattern contributed an equal number of publications in the CRL journal during the period of study. This type of trend shows that authors are equally interested to work individually or with joint authorship. (Table-5.3.9)

**The second objective of the study is to evaluate the growth of publication and relative growth rate with doubling time**

***For Annals of Library and Information studies journal***

1. In terms of annual growth of publication, it was observed that the highest 10 (37.04%) growth in the publication was observed in the year 2013 and the lowest -8 (-28.57%) was observed in the year 2019. Thus, there is no uniformity in the growth of publication in ALIS. (Table-5.2.2)
2. The analysis reveals that the relative growth rate and doubling time of publication was decreasing over the years, which means that the trend of publication is declining from later to the early period of study. (Table-5.2.3)

***For College and research libraries journal***

1. The annual growth of publication reveals, the highest 16 (39%) growth in the publication was observed in the year 2015 and the lowest -14 (-24.56%) was

observed in the year 2016. It shows a fluctuation in the growth of publication in CRL during the study period. (Table 5.3.2)

2. The analysis reveals that the relative growth rate and doubling time of publication was increasing over the years, which means that the trend of publications is going upward from later to the early period of study. (Table 5.3.3)

**The third objective of the study is to analyse the collaboration pattern of authors by using different parameters of collaboration**

*For Annals of Library and Information studies journal*

1. The study finds that in the ALIS journal the authors are interested to work collaboratively, the multi-authored publications are double that of single-authored publications. (Table-5.2.18)
2. The collaboration index is interpreted as the mean number of authors. In the journal ALIS, it was observed that mean of all the individual years is near to 2. It means that the average number of authors per publication is 2 during the period of study. (Table-5.2.19)
3. The probability of authorship pattern is calculated by collaborative coefficient (CC). Highest CC and modified collaborative coefficient (MCC) was observed in the year 2019, and the lowest was observed in the year 2015. It means that the probability of multi-authored papers from the later to early period is more in ALIS during the period of study. (Table-5.2.20)
4. In the co-authorship index of ALIS, the highest CAI (1832.79) was observed in the year 2015 concerning all the authors' contributions. In the year 2015, there were 18 publications by single-authored out of 38 publications. For that reason, CAI is highest this year (Table-5.2.22)

### ***For College and research libraries journal***

1. The study finds that in the CRL journal the authors are interested to work collaboratively, the multi-authored publications are nearly double that of single-authored publications. (Table-5.3.18)
2. The collaboration index is interpreted as the mean number of authors. In the journal CRL, it was observed that mean of all the individual years is near 0.60. It means that the average number of authors per publication is 1 (publication can't be an irrational number) during the period of study. (Table-5.3.19)
3. The probability of authorship pattern is calculated by collaborative coefficient (CC). Highest CC and modified collaborative coefficient (MCC) was observed in the year 2017 and 2019 respectively, and the lowest was observed in the year 2012, 2015. It shows that the probability of multi-authored papers from the later to early period is more in CRL during the period of study. (Table-5.3.21)
4. In the co-authorship index, the highest CAI (960.98) was observed in the year 2014 concerning all authors' contributions. In the year 2014 there was only 1 paper having 8 co-authors and for that reason Co-authorship also got increased. (Table-5.3.22)

### **The fourth objective of the study is to examine the subject coverage, topic-wise distribution, and geographical distribution of published articles in selected journals**

#### ***For Annals of Library and Information Studies Journal***

1. The study examined that the journal ALIS highly published the article on topic library and information science, Library relationship and there were very few articles from personnel management. The journal highly focused on core topics rather than optional topics. (Table-5.2.13)
2. India has highly contributed to ALIS compared to other contributed countries. In some of the countries, only 1 contribution was there namely United Arab

Emirates, Sudan, Tanzania, Brazil, Fiji, Russia, California, and China. India is the leading contributor in the journal ALIS with 234 (75%) contributions followed by Nigeria (24), Sri Lanka (14) during the study period. (Table-5.2.14)

3. Most publishing institutions contribution to ALIS. Some of the leading institutions are CSIR-NISTADS, CSIR-NISCAIR, and the University of Mysore from India, and the only University of Dhaka and the University of Colombo were the out of Indian institutions in the top 10 publishing institutions. (Table-5.2.15)

#### ***For College and research libraries journal***

1. The highly published topics in CRL are from Library & information sciences followed by the topic general libraries. (Table-5.3.13)
2. The study finds that in the country-wise distribution of the publications of CRL, the highest 342 (76.51%) publications were published from the United States of America, and the lowest 1 (0.22%) publications were published from each of the countries Kazakhstan, Singapore, South Africa, and South Korea. While the other major contributing countries are Canada (47), Australia (14), Spain (6). (Table-5.3.14)
3. It was observed that Most of the publishing institutions were from the United States of America. Some of the leading institutions are Depaul University (22) and Harold B. Lee Library, Brigham Young University (20), Kent State University (16). (Table-5.3.15)

**The fifth objective of the study is to visualize Co-citation analysis and bibliographic coupling of authors as well as published documents.**

#### ***For Annals of Library and Information studies journal***

1. Out of 6907 cited authors who have more than 30 citations, the highly co-cited author is Gupta B.M. with 173 citations and 38632 total link strength. This shows that the author has highly connected in citation with other authors

in a particular publication while Thelwal, M. found the lowest co-cited author with 39 citations and 25 total link strength. (Table-5.2.26)

2. The study analysed that, in co-citation analysis of cited sources, journal *Annals of library and information studies* is highly cited with other journals with 450 citations and 114646 total link strength. The authors of ALIS are more interested to cite the source journal in their publication as compared to other journals. (Table-5.2.27)
3. In terms of Bibliographic coupling of countries of ALIS, it was observed that out of 21 contributed countries having minimum publications 3. Out of 21 contributed countries having minimum publications 3, highly bibliographically coupled country was India with 234 documents, 845 citations, and 85 total link strength. It means that publications from India and other countries both are highly cited by the same article. And the least bibliographically coupled country was South Africa with 4 documents, 4 citations, and 9 total link strengths. (Table-5.2.28)
4. The study found that publication “Comparative analysis of scientific output of BRIC countries” by Garg K.C. (2011) with 14 citations and 15 total link strength is highly cited with others in the same article. So, it can be said that this publication is highly bibliographically coupled in the publication of ALIS during the study period (Table-5.2.29)
5. The authors highly cited along with others can be said as highly bibliographically coupled authors. It was found that the strongest bibliographically coupled author was Garg K.C. with 11 documents, 57 citations, and 1318 total link strength. And the least bibliographically coupled author was Das A.K. with 4 documents, 7 citations, and 1 total link strength. (Table-5.2.30)

#### ***For College and research libraries journal***

1. Out of 12691 cited authors having more than 25 citations, the highly co-cited author is Soria, K.M. with 30 citations and 205 total link strength. This shows that the author has highly connected in citation with other authors in a

particular publication and the lowest was Thelwal, M. with 39 citations and 25 total link strength. And lowest was Tenopir, C. with 41 citations and 36 total link strength. (Table-5.3.26)

2. The study analysed, in co-citation analysis of cited sources, College & research libraries with 907 citations and 7549 total link strength is the most co-cited journal. The authors of CRL are more interested to cite the source journal in their publication as compared to other journals. (Table-5.3.27)
3. In terms of bibliographic coupling of countries, it was observed that out of 31 contributed countries having minimum publications 3, the United States of America having 410 documents, 4445 citations, and 1311 total link strength is highly bibliographically coupled. It means that publications from the United States of America and other countries both are highly cited by the same article. And the least bibliographically coupled country is Norway with 4 documents, 10 citations, and 59 total link strength. (Table-5.3.28)
4. The study found that publication Undergraduates' use of social media as information sources by Kim (2014) with 68 citations and 5 total link strengths is the strongest bibliographically coupled publication, and the least bibliographically coupled publication was Wong (2011) with 70 citations and 1 total link strength. (Table-5.3.29)
5. The authors highly cited along with others can be said as the highly bibliographically coupled author. In CRL, it was found that the strongest bibliographically coupled author was Galbraith Q. with 7 documents, 61 citations, and 01 total link strength. And the least bibliographically coupled author Walter S. with 18 documents, 41 citations, and 1 total link strength. (Table-5.3.30)

**The sixth objective of the study is to examine the Lotka's Law of scientific productivity on selected journals output**

***For Annals of Library and Information studies journal***

- 1 To test the conformity of lotka's law, the Chi-square test was calculated at a degree of freedom 10, and a level of significance of 5%. The critical value at

the 5% significance level is 18.30 and The Chi-Square value obtained is 24.05, which is highly significant and greater than the critical value. Hence it was found that the lotka's law is not in conformity with the present data set. (Table-5.2.11)

#### ***For College and research libraries journal***

- 1 To test the conformity of lotka's law, the Chi-square test was calculated at a degree of freedom 7, and a level of significance of 5%. The critical value at the 5% significance level is 14.06 and The Chi-Square value obtained is 4518.05, which is highly significant and greater than the critical value. Hence it was found that the lotka's law is not in conformity with the present data set. (Table-5.3.11)

### **6.3 General findings of the study**

#### ***6.3.1 Annals of Library and Information Studies (ALIS) journal***

1. The study found that a total of 312 documents were published in the Annals of library and information studies (ALIS) journal LIS during the study period from 2011 to 2020. (Table 5.2.1)
2. It is predicted that in 2025 total number of estimated publications is 20.27 and in 2030 it is 14.52. This shows a negative trend towards the growth of literature in the journal of ALIS and in terms of single and multi-authored publication the predicted values are also showing a negative trend. (Table 5.2.4)
3. The study found that out of 414 authors, the highest 321 number of authors written 1 paper each. And Sen B.K was found as the most prolific author contributed 19 publications. (Table 5.2.10)
4. The growth in pages of publication was decreasing except in some years. The highest 361pages were observed in the year 2011 and the lowest 263 pages were observed in the year 2016. As the number of pages is decreasing so, the relative growth rate doubling time was also decreasing. The overall trend is negative from later to the early period of study. (Table 5.2.16)

5. The study found that the publication “Comparative analysis of scientific output of BRIC countries.” by (Kumar, 2011) is the most cited publication. And Pujar S.M is the most cited author. (Table 5.2.23)
6. In form of cited documents, a total of 5969 cited documents were recognized in 312 publications. It was observed that journals are the most cited documents followed by web resources, books in ALIS. *Scientometrics* and *Annals of library and information studies* were the most cited journals during the study period. (Table 5.2.32)
7. The analysis of co-occurrence of authors' keywords reveals that the keyword 'Scientometrics' occurred highest with 26 occurrences and 18 total link strength. Followed by the keyword 'Bibliometrics' with 24 occurrences and 18 total link strengths. The words *Scientometrics* and *Bibliometrics* highly occurred together in the author's keyword of the publication in ALIS. (Table 5.2.34)
8. The Co-word network analysis of the title of ALIS shows the connectivity among the different words used by the authors in the title of the documents. More the betweenness more association of the word with other words. Accordingly, the word 'study' is strongly connected with other words having a betweenness value of 96.13 and a closeness value of 0.03. Followed by the word 'Library' having a betweenness value of 38.89 and a closeness value of 0.03. And the word 'impact' is very weakly connected with other words having a betweenness value of 0.11 and a closeness value of 0.02. (Figure 5.2.21)
9. To understand the occurrence of the keyword of ALIS, word cloud analysis was conducted. In the word cloud of author keywords, the minimum occurrence of author keywords was considered 11. It was observed that the keyword "Scientometric" highly occurred having a frequency of 27, followed by "Bibliometrics" occurred 24 times. (Table 5.2.36)
10. In terms of trend topics, the analysis was done on abstract keywords, title keywords, and authors' keywords. It was observed that *Scientometric*, *bibliometric*, *study* was the most trending topic of research in ALIS. (Table 5.2.44)



11. In three field plot analyses of ALIS, three fields were considered namely author keywords in the left, authors' field in the middle, and country in the right. It was observed that the word in left field scientometrics, bibliometrics, and India are highly connected with the authors in the middle field. The highly connected authors in the middle field author are Sen B.K, Garg K.C, and Gupta B.M is highly connected with the other two fields. In the third field, the country India is the leading country to contribute the highest number of publications thus highly connected with the other two fields in the plot. (Figure 5.2.28)

### ***6.3.2 College and Research Libraries (CRL) journal***

1. The study found that a total of 447 documents were published in College and research library journals during the study period from 2011 to 2020. (Table 5.3.1)
2. It is predicted that in 2025 total number of estimated publications is 75.57 and in 2030 it is 91.82 which shows a positive trend towards the growth of literature in the journal CRL and terms of single and multi-authored publication, also shows a negative trend prediction. (Table 5.3.4)
3. The study finds that out of 927 authors, the highest 813 number of authors written 1 paper each. And Walter S. has was found as the most prolific author contributed 18 publications. (Table 5.3.10)
4. The growth in pages of publication was gradually increasing except in some years. The highest 1024 pages were observed in the year 2020 and the lowest 467 pages were observed in the year 2017. As the number of pages is increasing so, the relative growth rate doubling time was also slightly increasing. The overall trend is positive from later to the early period of study. (Table 5.3.16)
5. The study finds that the publication “Reframing information literacy as a meta-literacy.” by (Mackey & Jacobson, 2011) is the most cited. And Lewis D.W. is found to be the most cited author on CRL. (Table 5.3.23)
6. In form of cited documents, a total of 17910 cited documents were recognized in 447 publications. It was observed that journals are the most

cited documents followed by, books, and web resources in CRL. 'College and research libraries' and 'Journal of Academic Librarianship' were the most cited journals during the study period. (Table 5.3.32)

7. The Co-word network analysis of the title shows the connectivity among the different words used by the authors in the title of the documents. More the between-ness more association of the word with other words. Accordingly, the word 'academic' is strongly connected with other words having a betweenness value of 69.36 and a closeness value of 0.03. Followed by the word 'Library' having a betweenness value of 61.11 and a closeness value of 0.03. And the word 'reference' is very weakly connected with other words having a betweenness value of 0.07 and a closeness value of 0.02. (Figure 5.3.34)
8. To understand the occurrence of the keyword of CRL, word cloud analysis was conducted. In the word cloud of title keywords, it was observed that the keyword "Academic" highly occurred having a frequency of 27, followed by "Study" occurred 24 times. (Table 5.3.35)
9. In terms of trend topics, the analysis was done on abstract keywords, title keywords, and authors' keywords. It was observed that the Academic library is the most trending topic followed by Literacy study in CRL. (Table 5.3.37)
10. In three field plot analyses, three fields were considered namely author keywords on the left, authors' field in the middle, and country on the right. It was observed that the word in left field 'Libraries', 'college' are highly connected with the authors in the middle field. The highly connected authors in the middle field author are Walter S, Galbraith Q are highly connected with the other two fields. In the third field, the country United States of America is the leading country to contribute the highest number of publications thus highly connected with the other two fields in the plot. (Figure 5.3.25)

## **6.4 Conclusion**

Scientific communication deals with different practices that communicate scientific thoughts, approaches, ideas, and research to non-expert spectators in a comprehensible or convenient way. Research publications play an important role in disseminating knowledge and ideas of different fields through scientific communication. It is very important to understand the quality of a publication. In the emergent technical world of information and communication technology, scientific exploration, and expansion, a huge number of academic articles are publishing on regular basis by researchers around the globe. For that reason, a large amount of information in many formats is generated daily. After the start of Computer Technology electronic data processing become popular among researchers and then scientometric tools were introduced to map and visualize scientific communication. Scientometric is a form of research technique used in Library and Information Science. It uses quantitative investigation and statistics to make understand patterns of publication inside a given arena.

Open Access (OA) has given an innovative platform to scholarly communication and the publication world. Due to the increase in the cost of journals subscription, most of the libraries are not able to provide sufficient support to their researchers in their research and innovative works. Open access has somehow tried to eradicate this problem by publishing the journal in the open domain through web access and made it free of cost for everyone. OA helps to grow the citation impact of publications, journals and supports the scientific research more evident and accessible. As OA articles are freely available so their use is also gradually increasing and getting more citations. For that reason, the researchers are mostly interested to publish their articles in open access environment and sometimes they get more citations in open access platforms than that in closed access platforms. In general, we can say that more preference is given to open access journals over print journals. The future trend of open access is inclining and the print journal will face a challenge in the coming days.

This study examined the literature on ‘Annals of Library and information studies’ and ‘College and research libraries’ journals by scientometric approaches.

The journal ‘Annals of library and Information studies’ is of Indian origin published by the National Institute of Science Communication and Information Resources (NISCAIR) since 2002. Top library science research organizations from various parts of the countries highly contributed their publications in ALIS, but the global contribution is not that much as compared to national contribution. CSIR-NISTADS, CSIR-NISCAIR are the most contributed organizations of this journal. On the other hand, College and research libraries journal is a journal published in the United States of America since 1956. The published country itself is a highly contributed country among all other countries. Depaul University, Harold B. Lee Library, Brigham young University of United States of America, are among the top organizations contributed in this journal. Both the journals are Scopus indexed open access journals present in the directory of open access journals that are intended to help researchers, academic librarians build an intellectual framework to serve the needs of collegiate users.

The analysis of the current study was carried out by the application of scientometrics techniques with the help of different statistical techniques and tools. Different formulae and equations used in this research facilitate the future users and academicians to augment their future studies and can take the right decisions while selecting appropriate journals to publish their articles and to keep in their library as well. This Scientometrics quantitative study helps to measure the competitive situation and evaluate the efforts needed to preserve or to increase scientific potential. The study provides many interesting and important outcomes concerning the different information sources used by scholars. Some of the important indicators such as annual growth of journals, DC, CC, MCC, CI, CAI were applied to find authorship patterns. Network visualizations by using VOS viewer and Biblioshiny software showed the pictorial representations of connectivity among different authors, documents, and citations as well.

The study intends to find out distribution pattern, authors productivity, growth of publications, subject coverage, topic and geographical distributions, co-authorship, co-citation, bibliographic visualization, keyword analysis, of 'Annals of library and

information science' and 'College and research libraries' journals to fulfill the objectives of the study. It was found that college and research libraries' journal published more documents than Annals of library and information studies within the period of the study. Although the number of publications was more in the CRL journal, the contribution of single-author publication is more in ALIS. This means that multi-authored publications were dominating over single-authored publications in the CRL journal. The number of contributed authors is more than double in CRL as compared to ALIS, which shows that the average author per publication is higher in CRL. The annual growth rate of publication was highly fluctuating in both the journals but the difference of doubling time was found more in the CRL journal. The future publication trend of both the journals reveals that CRL journal is in uptrend whereas ALIS showing a negative trend for next 5 and 10 years which means that incoming one decade, CRL has positive growth while ALIS have negative growth rate. Due to the more number of publication in CRL, the length of the publications are higher in CRL as compared to ALIS. But if we consider the year-wise length of publication then the highest pages were found in ALIS in the early period of study and in CRL it was observed in the later period of study. Because, from later to early period of study, ALIS shows negative growth in publication and it gradually decreases the number of pages while in CRL the publication was increasing from later to the early period of study and the number of pages also increased gradually. Both the journals have cited numerous documents but CRL has cited more than thrice as compared to ALIS. This shows that authors in CRL are highly interested to consult more previous literature for their study. And it makes a large difference in the review of past literature between both the journals. The coverage of the core topic in both journals is somehow very close. Regarding geographical distribution, both the journals highly published from their native countries i.e India has highly contributed in the ALIS journal and the United States of America highly contributed in CRL journal. But in international contribution, a total of 30 other countries have contributed in CRL, and in ALIS, 20 other countries have contributed. CRL has more co-cited authors than ALIS but if it minutely observed, their citations and association, then there is a high association among the co-cited authors of ALIS. In co-citation analysis of cited sources, CRL has cited more journals than ALIS. But in

both the journals, the source journal itself was found as the highly co-cited journal. In the study co-citation analysis counted in terms of total link strength. In the bibliographic coupling of the countries, both the native publisher countries are highly bibliographically coupled, which shows that researchers are more interested cite the same article what the previous authors have cited for their articles. The Co-word network analysis title of both the journals reveals that the connection of different words in the title of the documents published in ALIS is more than CRL. This means the pattern or structure of the title of the documents published in ALIS are much similar to CRL. Author keyword is a parameter to search a document very easily, but CRL does not include author keyword in their documents which may lead to less searchable of documents published in it. Finally, it can be concluded that both the journals "Annals of library and information studies" and "College and research libraries" are quality journals in open access platform to publish articles and to can make the publication more visible and accessible across the globe.

## **6.5 Suggestions**

Based on data analysis and findings of the study, the following suggestions are advocated:

1. The publication of documents in ALIS needs to increase the number of publications to increase the growth rate of the journal.
2. The number of the contributed author is relatively less in ALIS which cause a weak collaborations network visualization. Thus, need to be published more national and international collaborative research.
3. The journal CRL doesn't include authors' keywords in their publication, it may be led to a decrease the visibility during the search. It is recommended to include authors' keywords in the CRL journal in the future.
4. Both the journals have maximum publications from their own native countries. So, both the journals need to improve international contributions to justify as an International journal.

5. In both the journal, most of the joint articles were written in local collaboration. So, contributors of journals try to do a national and international collaboration to increase the coverage of the journal.
6. Both the journal should bring out some special issues on different subject areas LIS to enhance the subject coverage of the journal.

### **6.6 Direction for future research**

The present study was limited to only two open access journals based on the ranking of the Scopus database. It is felt that the records from multiple databases like, Web of Science, PubMed, Google Scholar, and other bibliographical databases would provide an exhaustive number of data in the relevant field and can carry out better output. The researcher can choose the journal to conduct the scientometric study by using different criteria based on their statement of the problem. They can use different advanced software like 'R', 'Biblioshiny' to carry out advanced level data analysis to bring out a good result. This is a scientometric study of two LIS journals and the similar study can be done in other LIS as well as other discipline journals as well.

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### List of Publications

#### *Journal Articles (Accepted & Published)*

- 1) **Das, S.** (2017). **A study on e-resource usage pattern among the undergraduate college students of Karimganj district, Assam.** *Journal of Advances in Library and Information Science*, 6(4). 210-215. ISSN: 2277-2219.
- 2) **Gayan, M. A. & Das, S.** (2017). **Web content analysis of national library websites of South Asian region: A comparative study.** *International Journal of Next Generation Library and Technologies*, 3(4), 1-13. ISSN: 2395 – 5201
- 3) **Verma, M.K., Das, S. & Sinha, M.K.** (2019). **Research productivity of Computer Science Department of Assam University Silchar during 2010-2016: A Bibliometric analysis.** *Indian Journal of Information Library and Society*, 32 (2), 148-160. ISSN: 0971- 4286.

- 4) Mishra, V.K., Debbarma, R., **Das, S.** & Verma, M.K. (2019). **Awareness and use of e-learning open courseware among the students of Tripura University, Agartala: A case study.** *International Journal of Information Dissemination and Technology*, 9(4), 163-167. ISSN: 2229-5984 (P), 2249-5576 (e).
- 5) **Das, S.,** Yadav, S. & Verma, M.K. (2020). **Research productivity of Mizoram University, Aizawl during 2002-2018: A bibliometric analysis.** *Journal of Indian Library Association*, 56(3), 1-10. ISSN: 2277-5145 (P), 2456-513X (e)
- 6) Verma, M.K. & **Das, S.** (2020). **Authorship and collaboration pattern of research output published by researchers of Tripura University during 2010-2019: A scientometrics analysis.** *Library Philosophy and Practice (e-journal)*, 1-13. ISSN: 1522-0222.
- 7) **Das, S.,** Kaur, K. & Verma, M. K. (2021). **Publication and Collaboration Pattern of College and Research Libraries Journal during 2009-2018: A Scientometric Analysis.** *Library Philosophy and Practice (e-journal)*, 5118.
- 8) **Das, S.,** Zimik, A. & Verma, M. K. (2021). **Publication Pattern of Scientometric Literature Published in India during 2001-2020: A Scientometric Analysis.** *Saraswat the Tripura University Research Journal*, 1(1), 33-47.
- 9) **Das, S.,** & Verma, M. K. (2021). **Digital library research in BRICS countries during 2000-2019: Scientometric analysis.** *Annals of Library and Information Studies*, 68(2), 127-134.
- 10) Verma, M.K. & **Das, S.** (2021). **Authorship and collaboration pattern of Annals of Library and Information Studies journal during 2009-2018:**

**Scientometrics Mapping.** *Library Philosophy and Practice (e-journal)*, 1-17. 5605

***Edited Book(s)***

- 1) Gayan, M. A. & **Das, S.** (2018). *Library and Information Services in Digital Environment: Challenges and Prospects*. New Delhi: Omsons Publishers. ISBN: 978-93-81981-11-5.

***Book Chapter(s)***

- 1) **Das, S.** & Verma, M.K. (2019). **Application of QR Code Technology in Modern libraries to enhance library services: A practical approach.** In the book *Libraries and Information services: Emerging Digital Paradigm*. ISBN: 978-93-88181-11-2.

***Conference / Seminar Paper (s) (National)***

- 1) Gayan, M. A. & **Das, S.** (2017). **Awareness and perception towards e-learning among faculty members of Tripura University: A case study.** In proceeding of 11<sup>th</sup> International CALIBER, 2017 held at Anna University, Chennai. ISBN: 978-93-81232-07-1.
- 2) **Das, S.** & Verma, M.K. (2019). **Application of QR Code Technology in Modern libraries to enhance library services: A practical approach.** In proceedings of National Conference on “Libraries and Information services: Emerging Digital trends” organized by Integrated Academy of Management and Technology (INMANTEC), Ghaziabad in association with Asian Library Association (ASIALA) New Delhi, during 9<sup>th</sup> -10<sup>th</sup> August, 2019. ISBN: 978-93-881811-1-2



### ***Conference / Seminar Paper (s) (International)***

1. Attended and presented a paper entitled “**Authorship and Collaboration pattern on Jaundice research published by SAARC countries during 1999-2018: A Scientometric Analysis**” at First International Conference on Science & Technology Metrics, Kasetsart University, Bangkok, Thailand from 2<sup>nd</sup> - 4<sup>th</sup> December, 2019.

### **Workshops Attended/ Participated**

- 1) Capacity Building Programme of National Mission on Libraries for Public Library Personnel organized by Raja Rammohun Roy Library Foundation (RRRLF) at Tripura University during 14<sup>th</sup> May to 18<sup>th</sup> May, 2018.
- 2) Three days National Workshop on Library Automation using Koha organized by Tripura University, Agartala in collaboration with INFLIBNET Center, Gandhinagar during 4<sup>th</sup> – 6<sup>th</sup> July, 2018.
- 3) Five days National workshop on Trends in LIS Research: Approaches and Methods organized by Department of LIS, Mizoram University during 11<sup>th</sup> - 15<sup>th</sup> March, 2019.

### **Conference / Seminar Attended and Presented paper (s)**

- 1) Attended and presented a paper entitled “**Empowering Library Management Competency among LIS professionals in Digital Era vis-à-vis Role of LIS Curriculum in North-East Region**” at UGC sponsored National Seminar on “LIS Curricula in Indian Universities” organized by Department of Library and Information Science, Jadavpur University, Kolkata from 3<sup>rd</sup> - 4<sup>th</sup> February, 2017.

- 2) Attended and presented a paper entitled “**Web Content Analysis of Selected Library Consortia Websites of India; An Evaluative Study**” at National Seminar on “Comparative Librarianship” organized by Department of Library and Information Science, Gauhati University, Guwahati from 27<sup>th</sup> - 28<sup>th</sup> March, 2017.
- 3) Attended and presented a paper entitled “**Awareness and Perception towards E-learning among Faculty Members of Tripura University: A Case Study**” in 11<sup>th</sup> International CALIBER-2017 held at Anna University, Chennai from 2<sup>nd</sup> – 4<sup>th</sup> August, 2017.
- 4) Attended and presented a paper entitled “**Status of Public Library System of South Tripura: A Study**” in 31<sup>st</sup> IASLIC National Seminar 2017 held at Banaras Hindu University, Varanasi.
- 5) Attended and presented a paper entitled “**Application of QR Code Technology in Modern libraries to enhance library services: A practical approach**” at National Conference on “Libraries and Information services: Emerging Digital trends” organized by Integrated Academy of Management and Technology (INMANTEC), Ghaziabad in association with Asian Library Association (ASIALA) New Delhi, during 9<sup>th</sup> -10<sup>th</sup> August, 2019
- 6) Attended and presented a paper entitled “**Authorship and Collaboration pattern of research Output Published by Researchers of Tripura University During 2010-2019: A Scientometric Analysis**” at National Seminar on Social Media and Librarianship connecting the communities organized by Department of Library and Information Science Mizoram University from 26<sup>th</sup> - 28<sup>th</sup> February, 2020.

### **PARTICULARS OF THE CANDIDATE**

NAME OF CANDIDATE	:	SAUMEN DAS
DEGREE	:	Ph.D.
DEPARTMENT	:	Library and Information Science
TITLE OF THESIS	:	Publication Pattern of Selected Open Access LIS Journals in Directory of Open Access Journals (DOAJ): A Scientometric Analysis
DATE OF ADMISSION	:	03.08.2018
APPROVAL OF RESEARCH PROPOSAL		
1. DRC	:	08.04.2019
2. BOS	:	22.04.2019
2. SCHOOL BOARD	:	07.05.2019
3. MZU REGISTRATION NO.	:	1800216
4. REGISTRATION NO. & DATE	:	MZU/Ph.D./1259 of 03.08.2018
EXTENSION (IF ANY)	:	N/A

**Head**

**Department of Library and Information Science**

# **ABSTRACT**

**ON**

**PUBLICATION PATTERN OF SELECTED OPEN ACCESS LIS  
JOURNALS IN DIRECTORY OF OPEN ACCESS JOURNALS (DOAJ):  
A SCIENTOMETRIC ANALYSIS**

**SAUMEN DAS**

MZU REGISTRATION NO.: 1800216

Ph.D. REGISTRATION NO.: MZU/Ph.D./1259 of 03.08.2018



**DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE  
SCHOOL OF ECONOMICS, MANAGEMENT AND  
INFORMATION SCIENCE**

**AUGUST, 2021**

## **1.1 Introduction**

Data is important in any scholarly research. Practically all, scholarly journals play an indispensable character in scattering outcomes to study among individuals from different communities dependent on their academic field. It is very significant for an analyst to search for past examination and to assemble it to settle on a shrewd choice concerning the best spot to publish the article. In the educational field, Journal plays a significant role in distributing the output of research amongst the community members of that particular field. To understand a subject and to conduct further study journal articles are considered as the most important part by seeing the previous study, gathering a summary of past study it helps to choose the finest place to publish the study results. Scientific journals signify the most dynamic ways for distributing research outcomes and are generally focused on various academic disciplines or sub-disciplines. Based on the guidelines of a journal, publications may comprise of reports of unique studies, re-analyses of others' studies, and assessments of the literature of a particular field. The terms periodical & serial are most general and refer to all kinds of those resources. The proposed research is shown to analyze the bibliographical data of the two journals namely 'Annals of library and information studies' and 'College and research libraries' through scientometric approaches, which have been identified as the important journal resources in the field of library and information science.

The terms Scientometrics Bibliometrics, Informetrics, and Webometrics came from of a mixture or grouping of the terms with science, bibliographic information, and web correspondingly. These terms are similar or identical to each other; in other words, all these thoughts are supplementary or complementary to each other. All these terms are interrelated to measure the generated and collected knowledge; these terms are connected with the study of growth patterns of literature or recorded knowledge (Hood & Wilson, 2001).

## **1.2 Significance of the study**

The publications are the pointers of works growth in any subject of knowledge. They occur as the key passage for spreading knowledge. Due to the increasing price of the journals and lack of sufficient library budgets the collection of any particular journal

for a library should be done more cautiously. Therefore, the library authorities are more focused to acquire only quality journals for their researchers. It could be seen clearly that scientometric analysis is an important tool in analyzing any discipline. Scientometric analysis has many applications in the Library and Information science field in identifying the research trends in the subject, core journals, etc., and thereby framing a new subscription policy for tomorrow. The proposed study conceives to examine the publication pattern based on scientometrics aspect in selected journals which is an important area of Library and Information Science research at present. The study will be helpful and provide strengths and weaknesses of publication pattern, subject coverage of articles, Collaboration and Collaborative coefficient, the geographical distribution of published articles, etc., and will be helpful for librarians to plan a better collection development.

### **1.3 Scope and limitations of the study**

The scope of the present study is limited to analyse the publication pattern of two selected open-access LIS journals- "**Annals of Library and Information Studies**" and "**College and Research Libraries**" on the basis of scientometric parameters. The Annals of Library and Information Studies is a Scopus index open access journal of Library and Information Science, published from India since 1954 and many individual studies (Mahapatra, 1994; Kherde, 2003 and Sen, 2014), found this journal was ranked at 1<sup>st</sup> position among the Indian LIS Journal on the basis of different parameters. And "College and Research Libraries", is also a Scopus index first ranked open access journal published from the USA since 1939. In the Scopus database, College and Research Libraries journal is in the 4<sup>th</sup> ranked journal out of 48 listed open-access journal category under the subject of Library and information science but in the core LIS field, it is in the first rank because the first three listed journals (1. Journal of cheminformatics, 2. Scientific data, and 3. Big data and society) are not belonging to core LIS subject (Source: <https://www.scopus.com/sources.uri> ; Access on: 25<sup>th</sup> November 2018 and shown in Figure 1.7.1). The scope of the present study is further limited for the period of 10 years i.e. from the year 2011 to 2020.

#### **1.4 Statement of the problem**

Research in any area generates an innovative idea, method, and explanation for a problem. The researcher requires sources of information to conduct research. At this point, sources of information refer to periodicals such as journals, books, and other forms of documents associated with their study field in print form or electronic form. Amongst all the information resources, journals are considered as the more relevant sources of efficient and updated information and used as the primary resource of Information by the majority of the researchers. Which shows that journals are the significant carrier of innovative information and provides reliable information both in print form and in electronic form by providing current innovations, approach, and analysis. Scientometric analysis of research output is a kind of practice to find the growth and development of published research output in a particular subject domain by using various scientometric indicators. The present study aims at analyzing the research trends and output based on scientometric tools in the open access journals "**Annals of Library and Information Studies**" and "**College and Research Libraries**". There is several studies have already done on the research productivity of the different journals of different fields. Individually also many researchers conducted on both the journals but none has done any research by taking two top open access journals of Library and Information Science subject in the directory of open access journal from two different countries. In academic and scientific work, the publication is the main source of research output. Therefore, it is through periodical the researchers get professional recognition, advancement, and funding for more researches. After publication only, it can be called research and can be fixed or judged and acknowledged by the scientists in the society. By this thought the researcher aims to conduct the study on "**Publication Pattern of Selected Open Access LIS Journals in Directory of Open Access Journals (DOAJ): A Scientometric Analysis**". This study attempts to analyze the performance of researchers working in the field of science and technology in terms of growth rate, areas of research concentration, author productivity, and authorship pattern.

## **1.5 Objectives of the study**

1. To find out distribution pattern and authors productivity of articles in selected LIS Journals
2. To evaluate the growth of publication and relative growth rate with doubling time of publications.
3. To Analyse the collaboration pattern of authors by using different parameters of collaboration
4. To examine the subject coverage, topic-wise distribution, and geographical distribution of published articles in selected journals
5. To visualize Co-citation analysis and bibliographic coupling of authors as well as published documents
6. To examine the Lotka's Law of scientific productivity on selected journals output

## **1.6 Hypotheses of the study**

In observation of the above objectives, the subsequent hypothesis has been formulated:

### ***1.10.1 Hypothesis: 1***

H1<sub>0</sub>: There is no significant difference in the distribution pattern of articles between selected journals.

H1<sub>a</sub>: Annals of library and information studies journal published less articles than College and research libraries journal.

### ***1.10.2 Hypothesis: 2***

H2<sub>0</sub>: There is no significant difference in the collaborative research between selected journals

H2<sub>a</sub>: Annals of library and Information studies journal has less collaborative research than College and research libraries journal.



## **1.7 Research methodology**

Research led to discover the new visions on a specified branch of a specific discipline. The research methodology comprises a series of routine phases such as recognizing of research technique, methods of data collection, and choosing the right techniques for analysis of the data collected. The study was designed to investigate the Publication Pattern of Selected Open Access LIS Journals in the Directory of Open Access Journals (DOAJ). The Two selected open access journals- Annals of Library and Information Studies and College and Research Libraries Journal were considered for this study and the time frame for the study was taken from 2011 to 2020. And additionally, some more bibliographic data were retrieved from the Scopus database for both the journals of the same period for visualization and network diagram. The search expression to retrieve the bibliographic data of Annals of library and information was used (TITLE(Annals of Library and Information Studies)), the source ID of ALIS is 09725423 and for the journal College and research libraries, the search expression used was (TITLE(College and research libraries)), the source ID of College and research libraries is 14238. A total of 312 publications and 447 publications were collected from 10 volumes of each source journals ‘Annals of library and information studies’ and ‘college and research libraries’ respectively during the study period year 2011 to 2020. Information about each contribution such as author, author's affiliation, length of contributions, citations, etc., were scanned, checked, and examine carefully. For data analysis and graphical representation of both journals publication MS excel, VOS viewer, and Biblioshiny software were used.

## **1.8 Chapter's Scheme**

The present study has been divided into the following chapters:

### **CHAPTER 1 – INTRODUCTION**

The first chapter introduces the topic of research and provides a brief description of the introduction, Bibliometrics, scientometrics, need and significance of the study, statement of the problem, objectives of the study, methodology, formula used, software used, and organization of the chapters.

## **CHAPTER 2 - REVIEW OF LITERATURE**

The second chapter gives the sights of various types of Scientometrics and bibliometrics related areas and delivers certain solid ideas for the present study. The reviews of the study are presented in the following heading such as Study based on General Bibliometrics and Scientometrics studies, Studies based on Authorship Pattern, Studies based on Authorship Pattern, Studies on collaboration pattern, Studies on the single journal, Studies on Global research, Studies on VOS viewer and biblioshiny. The study is further arranged in ascending chronological order. Though, this chapter deals with the studies on Scientometrics and bibliometrics to provide the researcher with a better understanding of the previous studies that happened on this topic and how this study could be improved.

## **CHAPTER 3 – SCINTOMETRICS: AN OVERVIEW**

This chapter provides definitions and examples of Scientometrics and uses of basic Scientometric terms in the field of information science and provides a framework for connecting new findings to preceding findings in the relevant field. There the concept of metrics and parameters used in scientometric studies were discussed broadly.

## **CHAPTER 4 – OPEN ACCESS INITIATIVES**

Chapter 4 provides a broad idea about Open access, open access initiatives by India, and world perspective. The advantage and characteristics of open access were deliberated. The information about open access journals with special regards to library and information science discipline were also discussed

## **CHAPTER 5 - DATA ANALYSIS AND INTERPRETATION**

Chapter 5 deals with the analysis and interpretation of the data. It portrays the Visualisation of the data and provides the summary of major findings. The researcher has presented findings based on the observation from the data analysis by using software like MS excel, VOS viewer and Biblioshiny app.

## **CHAPTER 6 - MAJOR FINDINGS, CONCLUSION, AND SUGGESTION**

Chapter 6 deals with the outcomes of the study and if there is any suggestion to improve the research, future research was discussed.

At the end of the thesis, bibliography and appendices have been given. The bibliography is given as per the rules provided by the APA style manual, 6th ed. (American Psychological Association, 2010)

### **1.9 Findings based on the objectives of the study**

#### **The first objective of the study is to find out distribution pattern and authors' productivity of articles in selected LIS Journals**

##### ***For Annals of Library and Information Studies (ALIS) journal***

1. The study finds that in the year-wise distribution of publications of Annals of Library and Information Studies (ALIS) journal, there are a total of 312 articles published in 10 volumes during the study period out of which the highest 38 (12.18%) articles published in the year 2015 and lowest 20 (6.41%) articles published in the year 2019. The publications got decreased almost by 50% in the year 2019 which shows a negative trend in publication. (Table-5.2.1)
2. In the year-wise authorship distribution pattern, the single-authored paper was highly published in 2015 whereas the lowest was observed in the year 2019. Among all the patterns of authorship, two authored papers were dominating overall in the ALIS journal during the period of study. This trend shows that authors are interested to work on jointly authored papers and they are not that much interested to add more than two authors in their publications. (Table-5.2.9)

##### ***For College and Research Libraries (CRL) journal***

1. The study finds that in the year-wise distribution of publications of College and research libraries (CRL), there are a total of 447 articles published in 10 volumes during the study period out of which the highest 60 (13.42%) articles were published in the year 2020 and lowest 30 (6.71%) articles published in

the year 2011, 2012. The publications got increased by 50% in the latest year which shows a positive trend in publication. (Table-5.3.1)

2. In the year-wise authorship distribution pattern, single-authored papers were highly published in 2020 whereas the lowest was observed in the year 2011. In joint authored paper highest was observed in 2020 and the lowest in 2012. But both the authorship pattern contributed an equal number of publications in the CRL journal during the period of study. This type of trend shows that authors are equally interested to work individually or with joint authorship. (Table-5.3.9)

**The second objective of the study is to evaluate the growth of publication and relative growth rate with doubling time**

***For Annals of Library and Information studies journal***

1. In terms of annual growth of publication, it was observed that the highest 10 (37.04%) growth in the publication was observed in the year 2013 and the lowest -8 (-28.57%) was observed in the year 2019. Thus, there is no uniformity in the growth of publication in ALIS. (Table-5.2.2)
2. The analysis reveals that the relative growth rate and doubling time of publication was decreasing over the years, which means that the trend of publication is declining from later to the early period of study. (Table-5.2.3)

***For College and research libraries journal***

1. The annual growth of publication reveals, the highest 16 (39%) growth in the publication was observed in the year 2015 and the lowest -14 (-24.56%) was observed in the year 2016. It shows a fluctuation in the growth of publication in CRL during the study period. (Table 5.3.2)
2. The analysis reveals that the relative growth rate and doubling time of publication was increasing over the years, which means that the trend of publications is going upward from later to the early period of study. (Table 5.3.3)

**The third objective of the study is to analyse the collaboration pattern of authors by using different parameters of collaboration**

***For Annals of Library and Information studies journal***

1. The study finds that in the ALIS journal the authors are interested to work collaboratively, the multi-authored publications are double that of single-authored publications. (Table-5.2.18)
2. The collaboration index is interpreted as the mean number of authors. In the journal ALIS, it was observed that mean of all the individual years is near to 2. It means that the average number of authors per publication is 2 during the period of study. (Table-5.2.19)
3. The probability of authorship pattern is calculated by collaborative coefficient (CC). Highest CC and modified collaborative coefficient (MCC) was observed in the year 2019, and the lowest was observed in the year 2015. It means that the probability of multi-authored papers from the later to early period is more in ALIS during the period of study. (Table-5.2.20)
4. In the co-authorship index of ALIS, the highest CAI (1832.79) was observed in the year 2015 concerning all the authors' contributions. In the year 2015, there were 18 publications by single-authored out of 38 publications. For that reason, CAI is highest this year (Table-5.2.22)

***For College and research libraries journal***

1. The study finds that in the CRL journal the authors are interested to work collaboratively, the multi-authored publications are nearly double that of single-authored publications. (Table-5.3.18)
2. The collaboration index is interpreted as the mean number of authors. In the journal CRL, it was observed that mean of all the individual years is near 0.60. It means that the average number of authors per publication is 1 (publication can't be an irrational number) during the period of study. (Table-5.3.19)
3. The probability of authorship pattern is calculated by collaborative coefficient (CC). Highest CC and modified collaborative coefficient (MCC) was observed in the year 2017 and 2019 respectively, and the lowest was observed in the year

2012, 2015. It shows that the probability of multi-authored papers from the later to early period is more in CRL during the period of study. (Table-5.3.21)

4. In the co-authorship index, the highest CAI (960.98) was observed in the year 2014 concerning all authors' contributions. In the year 2014 there was only 1 paper having 8 co-authors and for that reason Co-authorship also got increased. (Table-5.3.22)

**The fourth objective of the study is to examine the subject coverage, topic-wise distribution, and geographical distribution of published articles in selected journals**

***For Annals of Library and Information Studies Journal***

1. The study examined that the journal ALIS highly published the article on topic library and information science, Library relationship and there were very few articles from personnel management. The journal highly focused on core topics rather than optional topics. (Table-5.2.13)
2. India has highly contributed to ALIS compared to other contributed countries. In some of the countries, only 1 contribution was there namely United Arab Emirates, Sudan, Tanzania, Brazil, Fiji, Russia, California, and China. India is the leading contributor in the journal ALIS with 234 (75%) contributions followed by Nigeria (24), Sri Lanka (14) during the study period. (Table-5.2.14)
3. Most publishing institutions contribution to ALIS. Some of the leading institutions are CSIR-NISTADS, CSIR-NISCAIR, and the University of Mysore from India, and the only University of Dhaka and the University of Colombo were the out of Indian institutions in the top 10 publishing institutions. (Table-5.2.15)

***For College and research libraries journal***

1. The highly published topics in CRL are from Library & information sciences followed by the topic general libraries. (Table-5.3.13)

2. The study finds that in the country-wise distribution of the publications of CRL, the highest 342 (76.51%) publications were published from the United States of America, and the lowest 1 (0.22%) publications were published from each of the countries Kazakhstan, Singapore, South Africa, and South Korea. While the other major contributing countries are Canada (47), Australia (14), Spain (6). (Table-5.3.14)
3. It was observed that Most of the publishing institutions were from the United States of America. Some of the leading institutions are Depaul University (22) and Harold B. Lee Library, Brigham Young University (20), Kent State University (16). (Table-5.3.15)

**The fifth objective of the study is to visualize Co-citation analysis and bibliographic coupling of authors as well as published documents.**

*For Annals of Library and Information studies journal*

1. Out of 6907 cited authors who have more than 30 citations, the highly co-cited author is Gupta B.M. with 173 citations and 38632 total link strength. This shows that the author has highly connected in citation with other authors in a particular publication while Thelwal, M. found the lowest co-cited author with 39 citations and 25 total link strength. (Table-5.2.26)
2. The study analysed that, in co-citation analysis of cited sources, journal Annals of library and information studies is highly cited with other journals with 450 citations and 114646 total link strength. The authors of ALIS are more interested to cite the source journal in their publication as compared to other journals. (Table-5.2.27)
3. In terms of Bibliographic coupling of countries of ALIS, it was observed that out of 21 contributed countries having minimum publications 3. Out of 21 contributed countries having minimum publications 3, highly bibliographically coupled country was India with 234 documents, 845 citations, and 85 total link strength. It means that publications from India and other countries both are highly cited by the same article. And the least bibliographically coupled

country was South Africa with 4 documents, 4 citations, and 9 total link strengths. (Table-5.2.28)

4. The study found that publication “Comparative analysis of scientific output of BRIC countries” by Garg K.C. (2011) with 14 citations and 15 total link strength is highly cited with others in the same article. So, it can be said that this publication is highly bibliographically coupled in the publication of ALIS during the study period (Table-5.2.29)
5. The authors highly cited along with others can be said as highly bibliographically coupled authors. It was found that the strongest bibliographically coupled author was Garg K.C. with 11 documents, 57 citations, and 1318 total link strength. And the least bibliographically coupled author was Das A.K. with 4 documents, 7 citations, and 1 total link strength. (Table-5.2.30)

#### ***For College and research libraries journal***

1. Out of 12691 cited authors having more than 25 citations, the highly co-cited author is Soria, K.M. with 30 citations and 205 total link strength. This shows that the author has highly connected in citation with other authors in a particular publication and the lowest was Thelwal, M. with 39 citations and 25 total link strength. And lowest was Tenopir, C. with 41 citations and 36 total link strength. (Table-5.3.26)
2. The study analysed, in co-citation analysis of cited sources, College & research libraries with 907 citations and 7549 total link strength is the most co-cited journal. The authors of CRL are more interested to cite the source journal in their publication as compared to other journals. (Table-5.3.27)
3. In terms of bibliographic coupling of countries, it was observed that out of 31 contributed countries having minimum publications 3, the United States of America having 410 documents, 4445 citations, and 1311 total link strength is highly bibliographically coupled. It means that publications from the United States of America and other countries both are highly cited by the same article.



And the least bibliographically coupled country is Norway with 4 documents, 10 citations, and 59 total link strength. (Table-5.3.28)

4. The study found that publication Undergraduates' use of social media as information sources by Kim (2014) with 68 citations and 5 total link strengths is the strongest bibliographically coupled publication, and the least bibliographically coupled publication was Wong (2011) with 70 citations and 1 total link strength. (Table-5.3.29)
5. The authors highly cited along with others can be said as the highly bibliographically coupled author. In CRL, it was found that the strongest bibliographically coupled author was Galbraith Q. with 7 documents, 61 citations, and 01 total link strength. And the least bibliographically coupled author Walter S. with 18 documents, 41 citations, and 1 total link strength. (Table-5.3.30)

**The sixth objective of the study is to examine the Lotka's Law of scientific productivity on selected journals output**

***For Annals of Library and Information studies journal***

- 1 To test the conformity of lotka's law, the Chi-square test was calculated at a degree of freedom 10, and a level of significance of 5%. The critical value at the 5% significance level is 18.30 and The Chi-Square value obtained is 24.05, which is highly significant and greater than the critical value. Hence it was found that the lotka's law is not in conformity with the present data set. (Table-5.2.11)

***For College and research libraries journal***

- 1 To test the conformity of lotka's law, the Chi-square test was calculated at a degree of freedom 7, and a level of significance of 5%. The critical value at the 5% significance level is 14.06 and The Chi-Square value obtained is 4518.05, which is highly significant and greater than the critical value. Hence it was found that the lotka's law is not in conformity with the present data set. (Table-5.3.11)

## **1.10 General findings of the study**

### ***1.10.1 Annals of Library and Information Studies (ALIS) journal***

1. The study found that a total of 312 documents were published in the Annals of library and information studies (ALIS) journal LIS during the study period from 2011 to 2020. (Table 5.2.1)
2. It is predicted that in 2025 total number of estimated publications is 20.27 and in 2030 it is 14.52. This shows a negative trend towards the growth of literature in the journal of ALIS and in terms of single and multi-authored publication the predicted values are also showing a negative trend. (Table 5.2.4)
3. The study found that out of 414 authors, the highest 321 number of authors written 1 paper each. And Sen B.K was found as the most prolific author contributed 19 publications. (Table 5.2.10)
4. The growth in pages of publication was decreasing except in some years. The highest 361pages were observed in the year 2011 and the lowest 263 pages were observed in the year 2016. As the number of pages is decreasing so, the relative growth rate doubling time was also decreasing. The overall trend is negative from later to the early period of study. (Table 5.2.16)
5. The study found that the publication “Comparative analysis of scientific output of BRIC countries.” by (Kumar, 2011) is the most cited publication. And Pujar S.M is the most cited author. (Table 5.2.23)
6. In form of cited documents, a total of 5969 cited documents were recognized in 312 publications. It was observed that journals are the most cited documents followed by web resources, books in ALIS. Scientometrics and Annals of library and information studies were the most cited journals during the study period. (Table 5.2.32)
7. The analysis of co-occurrence of authors' keywords reveals that the keyword 'Scientometrics' occurred highest with 26 occurrences and 18 total link strength. Followed by the keyword 'Bibliometrics' with 24 occurrences and 18 total link strengths. The words Scientometrics and Bibliometrics highly occurred together in the author's keyword of the publication in ALIS. (Table 5.2.34)

8. The Co-word network analysis of the title of ALIS shows the connectivity among the different words used by the authors in the title of the documents. More the betweenness more association of the word with other words. Accordingly, the word 'study' is strongly connected with other words having a betweenness value of 96.13 and a closeness value of 0.03. Followed by the word 'Library' having a betweenness value of 38.89 and a closeness value of 0.03. And the word 'impact' is very weakly connected with other words having a betweenness value of 0.11 and a closeness value of 0.02. (Figure 5.2.21)
9. To understand the occurrence of the keyword of ALIS, word cloud analysis was conducted. In the word cloud of author keywords, the minimum occurrence of author keywords was considered 11. It was observed that the keyword "Scientometric" highly occurred having a frequency of 27, followed by "Bibliometrics" occurred 24 times. (Table 5.2.36)
10. In terms of trend topics, the analysis was done on abstract keywords, title keywords, and authors' keywords. It was observed that Scientometric, bibliometric, study was the most trending topic of research in ALIS. (Table 5.2.44)
11. In three field plot analyses of ALIS, three fields were considered namely author keywords in the left, authors' field in the middle, and country in the right. It was observed that the word in left field scientometrics, bibliometrics, and India are highly connected with the authors in the middle field. The highly connected authors in the middle field author are Sen B.K, Garg K.C, and Gupta B.M is highly connected with the other two fields. In the third field, the country India is the leading country to contribute the highest number of publications thus highly connected with the other two fields in the plot. (Figure 5.2.28)

### ***1.10.2 College and Research Libraries (CRL) journal***

1. The study found that a total of 447 documents were published in College and research library journals during the study period from 2011 to 2020. (Table 5.3.1)

2. It is predicted that in 2025 total number of estimated publications is 75.57 and in 2030 it is 91.82 which shows a positive trend towards the growth of literature in the journal CRL and terms of single and multi-authored publication, also shows a negative trend prediction. (Table 5.3.4)
3. The study finds that out of 927 authors, the highest 813 number of authors written 1 paper each. And Walter S. has was found as the most prolific author contributed 18 publications. (Table 5.3.10)
4. The growth in pages of publication was gradually increasing except in some years. The highest 1024 pages were observed in the year 2020 and the lowest 467 pages were observed in the year 2017. As the number of pages is increasing so, the relative growth rate doubling time was also slightly increasing. The overall trend is positive from later to the early period of study. (Table 5.3.16)
5. The study finds that the publication “Reframing information literacy as a meta-literacy.” by (Mackey & Jacobson, 2011) is the most cited. And Lewis D.W. is found to be the most cited author on CRL. (Table 5.3.23)
6. In form of cited documents, a total of 17910 cited documents were recognized in 447 publications. It was observed that journals are the most cited documents followed by, books, and web resources in CRL. ‘College and research libraries’ and ‘Journal of Academic Librarianship’ were the most cited journals during the study period. (Table 5.3.32)
7. The Co-word network analysis of the title shows the connectivity among the different words used by the authors in the title of the documents. More the between-ness more association of the word with other words. Accordingly, the word 'academic' is strongly connected with other words having a betweenness value of 69.36 and a closeness value of 0.03. Followed by the word 'Library' having a betweenness value of 61.11 and a closeness value of 0.03. And the word 'reference' is very weakly connected with other words having a betweenness value of 0.07 and a closeness value of 0.02. (Figure 5.3.34)
8. To understand the occurrence of the keyword of CRL, word cloud analysis was conducted. In the word cloud of title keywords, it was observed that the

keyword “Academic” highly occurred having a frequency of 27, followed by “Study” occurred 24 times. (Table 5.3.35)

9. In terms of trend topics, the analysis was done on abstract keywords, title keywords, and authors' keywords. It was observed that the Academic library is the most trending topic followed by Literacy study in CRL. (Table 5.3.37)
10. In three field plot analyses, three fields were considered namely author keywords on the left, authors' field in the middle, and country on the right. It was observed that the word in left field ‘Libraries’, ‘college’ are highly connected with the authors in the middle field. The highly connected authors in the middle field author are Walter S, Galbraith Q are highly connected with the other two fields. In the third field, the country United States of America is the leading country to contribute the highest number of publications thus highly connected with the other two fields in the plot. (Figure 5.3.25)

### **1.11 Conclusion**

Scientific communication deals with different practices that communicate scientific thoughts, approaches, ideas, and research to non-expert spectators in a comprehensible or convenient way. Research publications play an important role in disseminating knowledge and ideas of different fields through scientific communication. It is very important to understand the quality of a publication. In the emergent technical world of information and communication technology, scientific exploration, and expansion, a huge number of academic articles are publishing on regular basis by researchers around the globe. For that reason, a large amount of information in many formats is generated daily. After the start of Computer Technology electronic data processing become popular among researchers and then scientometric tools were introduced to map and visualize scientific communication. Scientometric is a research method in the field of Library and Information Science. It uses quantitative study and measurements to make clear the patterns of publication inside a particular arena.

Open Access (OA) has given an innovative platform to scholarly communication and the publication world. Due to the increase in the cost of journals subscription, most of the libraries are not able to provide sufficient support to their researchers in their

research and innovative works. Open access has somehow tried to eradicate this problem by publishing the journal in the open domain through web access and made it free of cost for everyone. OA helps to grow the citation impact of publications, journals and supports the scientific research more evident and accessible. As OA articles are freely available so their use is also gradually increasing and getting more citations. For that reason, the researchers are mostly interested to publish their articles in open access environment and sometimes they get more citations in open access platforms than that in closed access platforms. In general, we can say that more preference is given to open access journals over print journals. The future trend of open access is inclining and the print journal will face a challenge in the coming days.

This study examined the literature on ‘Annals of Library and information studies’ and ‘College and research libraries’ journals by scientometric approaches.

The journal ‘Annals of library and Information studies’ is of Indian origin published by the National Institute of Science Communication and Information Resources (NISCAIR) since 2002. Top library science research organizations from various parts of the countries highly contributed their publications in ALIS, but the global contribution is not that much as compared to national contribution. CSIR-NISTADS, CSIR-NISCAIR are the most contributed organizations of this journal. On the other hand, College and research libraries journal is a journal published in the United States of America since 1956. The published country itself is a highly contributed country among all other countries. Depaul University, Harold B. Lee Library, Brigham young University of United States of America, are among the top organizations contributed in this journal. Both the journals are Scopus indexed open access journals present in the directory of open access journals that are intended to help researchers, academic librarians build an intellectual framework to serve the needs of collegiate users.

The analysis of the current study was carried out by the application of scientometrics techniques with the help of different statistical techniques and tools. Different formulae and equations used in this research facilitate the future users and academicians to augment their future studies and can take the right decisions while selecting appropriate journals to publish their articles and to keep in their library as well. This Scientometrics study helps to measure the present situation and assess the

efforts required to preserve or to increase scientific perspective. The study provides many interesting and important outcomes concerning the different information sources used by scholars. Some of the important indicators such as annual growth of journals, DC, CC, MCC, CI, CAI were applied to find authorship patterns. Network visualizations by using VOS viewer and Biblioshiny software showed the pictorial representations of connectivity among different authors, documents, and citations as well.

The study intends to find out distribution pattern, authors productivity, growth of publications, subject coverage, topic and geographical distributions, co-authorship, co-citation, bibliographic visualization, keyword analysis, of 'Annals of library and information science' and 'College and research libraries' journals to fulfil the objectives of the study. It was found that college and research libraries' journal published more documents than Annals of library and information studies within the period of the study. Although the number of publications was more in the CRL journal, the contribution of single-author publication is more in ALIS. This means that multi-authored publications were dominating over single-authored publications in the CRL journal. The number of contributed authors is more than double in CRL as compared to ALIS, which shows that the average author per publication is higher in CRL. The annual growth rate of publication was highly fluctuating in both the journals but the difference of doubling time was found more in the CRL journal. The future publication trend of both the journals reveals that CRL journal is in uptrend whereas ALIS showing a negative trend for next 5 and 10 years which means that incoming one decade, CRL has positive growth while ALIS have negative growth rate. Due to the more number of publication in CRL, the length of the publications are higher in CRL as compared to ALIS. But if we consider the year-wise length of publication then the highest pages were found in ALIS in the early period of study and in CRL it was observed in the later period of study. Because, from later to early period of study, ALIS shows negative growth in publication and it gradually decreases the number of pages while in CRL the publication was increasing from later to the early period of study and the number of pages also increased gradually. Both the journals have cited numerous documents but CRL has cited more than thrice as compared to ALIS. This shows that authors in CRL are highly interested to consult more previous literature for their study. And it

makes a large difference in the review of past literature between both the journals. The coverage of the core topic in both journals is somehow very close. Regarding geographical distribution, both the journals highly published from their native countries i.e India has highly contributed in the ALIS journal and the United States of America highly contributed in CRL journal. But in international contribution, a total of 30 other countries have contributed in CRL, and in ALIS, 20 other countries have contributed. CRL has more co-cited authors than ALIS but if it minutely observed, their citations and association, then there is a high association among the co-cited authors of ALIS. In co-citation analysis of cited sources, CRL has cited more journals than ALIS. But in both the journals, the source journal itself was found as the highly co-cited journal. In the study co-citation analysis counted in terms of total link strength. In the bibliographic coupling of the countries, both the native publisher countries are highly bibliographically coupled, which shows that researchers are more interested cite the same article what the previous authors have cited for their articles. The Co-word network analysis title of both the journals reveals that the connection of different words in the title of the documents published in ALIS is more than CRL. This means the pattern or structure of the title of the documents published in ALIS are much similar to CRL. Author keyword is a parameter to search a document very easily, but CRL does not include author keyword in their documents which may lead to less searchable of documents published in it. Finally, it can be concluded that both the journals "Annals of library and information studies" and "College and research libraries" are quality journals in open access platform to publish articles and to can make the publication more visible and accessible across the globe.

### **1.12 Suggestions**

Based on data analysis and findings of the study, the following suggestions are advocated:

1. The publication of documents in ALIS needs to increase the number of publications to increase the growth rate of the journal.
2. The number of the contributed author is relatively less in ALIS which cause a weak collaborations network visualization. Thus, need to be published more national and international collaborative research.



3. The journal CRL doesn't include authors' keywords in their publication, it may be led to a decrease the visibility during the search. It is recommended to include authors' keywords in the CRL journal in the future.
4. Both the journals have maximum publications from their own native countries. So, both the journals need to improve international contributions to justify as an International journal.
5. In both the journal, most of the joint articles were written in local collaboration. So, contributors of journals try to do a national and international collaboration to increase the coverage of the journal.
6. Both the journal should bring out some special issues on different subject areas LIS to enhance the subject coverage of the journal.

### **1.13 Direction for future research**

The present study was limited to only two open access journals based on the ranking of the Scopus database. It is felt that the records from multiple databases like, Web of Science, PubMed, Google Scholar, and other bibliographical databases would provide an exhaustive number of data in the relevant field and can carry out better output. The researcher can choose the journal to conduct the scientometric study by using different criteria based on their statement of the problem. They can use different advanced software like 'R', 'Biblioshiny' to carry out advanced level data analysis to bring out a good result. This is a scientometric study of two LIS journals and the similar study can be done in other LIS as well as other discipline journals as well.