Content Analysis of Online Library and Information Science Journals: A Study

Thesis submitted to the Mizoram University
for the award of Degree of

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in

Library and Information Science

By

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Ph. D. Regn. No. : MZU/Ph.D/486 of 15.05.2012

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D E C L A R A T I O N

Mizoram University
June, 2018

I Ashutosh Agrahari, hereby declare that the subject matter of the thesis entitled ***"Content Analysis of Online Library and Information Science Journals: A Study"***is the record of work done by ***me***, that the contents of this thesisdid not formthe basis of the award of any previous degree to me or to do the best of my knowledge to anybody else, and 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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C E R T I F I C A T E

This is to certify that the thesis entitled ***"Content Analysis of Online Library and Information Science Journals: A Study"*** submitted by ***Ashutosh Agrahari*** for the award of degree of ***Doctor of Philosophy*** in ***Library and Information Science*** is carried out under my guidance and incorporates the student's bonafide research.

The thesis is original work of the scholar and has not been submitted for any degree to any University/Institution.

Aizawl, Mizoram
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A C K N O W L E D G E M N E T

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Ashutosh Agrahari

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List of Abbreviations and Acronyms

Comp.-	Computer
Corp.-	Corporation
Cum.-	Cumulative
Lib.-	Library
Natl.-	National
Res.-	Research
Sci.-	Science
Tch.-	Technology
ANOVA-	Analysis of Variance
ARWU-	Academic Ranking of World University
BibTechMon-	Bibliometric Technology Monitoring
CAIR-	Content Analysis and Informational Retrieval
CC-	Collaboration Co-efficient
CI-	Collaboration Index
CNKI-	China National Knowledge Infrastructure
DC-	Degree of Collaboration
DCMI-	Dublin Core Metadata Initiative
DCs-	Developing Countries
DLIS-	Department of Library and Information Science
DOI-	Digital Object Identifier
EECs-	Eastern European Countries
HTML-	Hypertext Markup Language
ISBN-	International Standard Book Number
ISI-	Institute of Scientific Information
ISO-	International Standard Organisation
JCR-	Journal Citation Report
JOI-	Journal of Informaterics
LCSH-	Library of Congress of Subject Heading
LIS-	Library and Information Science
LISTA-	Library, Information Science and Technology
MARC-	Machine Readable Catalogue

MDS-	Multi Dimensional Scale
MZU-	Mizoram University
NEHU-	North Eastern Hill University
NSDL-	National Science Digital Library
OCLC-	Online Computer Library Center
OPAC-	Online Public Access Catalogue
PDF-	Portable Document Format
R&D-	Research and Development
SCI-	Science Citation Index
SJR-	Scimago Journal Rank
SLSH-	Sears List of Subject Heading
SPSS-	Statistical Package of Social Science
SSCI-	Social Science Citation Index
TIFF-	Tag Image File Format
UK-	United Kingdom
URL-	Universal Resource Locater
USA-	United State of America
WC-	Web of Science Subject Category
WOS-	Web of Science

Introduction

Journals play a very important role in scholarly communication. They are sensitive indicators of the emerging ideas in any discipline. Journals reveal the existing problems which require a solution, the research pattern to solve problems and the practices that fix various areas etc. through scientific papers. A scientific paper or text not only reveals the world building strategy of its author, but also the nature and force of the building blocks derived from the domain of science from which it draws and to which it contributes (Gupta & Kumar, 2001). It is a kind of published (written) material containing information with respect to scientific activities, either in its physical form or its electronic equivalent in a computerized database.

In Journal, the published literature shows the current concerns which add a new idea in any particular field of study. Analysis of the literature discloses the evolution of a particular discipline. It reveals the predominant areas of interest and the most popular methods of research being used during a particular period. Journal literature also provides specific information about the author or researcher which could be useful for analysing the authorship of journal's articles.

A careful evaluation of periodical literature may depict a complete picture of a discipline, many scholars and professions evaluate literature available in public domain regularly in order to ascertain the special trends prevailing in the professional literature. In the case of the literature of library and information science, many efforts have been made to systematically analyse and evaluate the essential nature of the literature, considering the rate at which the literature is growing today. It is vital to conduct a methodical and conceptual analysis of journal in order to understand the true nature of the present state of the library profession. When reasonable concepts are compared and analysed at regular intervals very useful conjectures can be arrived at regarding the profession's development in the light of its relationship with the past and predicted future trends.

In the assessment of scientific performance, bibliometric and citation indicators are among the most important measure of the impact of scientific literature. Most of the bibliometric approachs to science and technology are based on quantitative characteristics, attributes or objects of documentary flows. It is primarily based on the analysis of the bibliographic data

of publications. A principal assumption underlying the use of bibliometric indicators is that scholars publish their research findings in the publicly available literature and that one may obtain pictures of scholarly activities from a quantitative analysis of scholarly documents (Garfield, 1979).

The analysis of content available in any communication medium is known as content analysis. It is a technique that has been widely used by the social scientist. Co-word analysis is one of the best tools for the content analysis that is based on co-citation analysis whereas co-citation analysis is a tool of bibliometric analysis. Today, the co-word analysis is profusely applied by information scientists and scholars in the field of LIS to identify subject structure (intellectual structure) and trend, and evaluation of concepts in the different discipline. Co-word analysis uses co-occurrence of words and phrases in a corpus. It establishes a relation between idea and concept within the subject area, presented in the corpus. The occurrences of two keywords within the same paper indicate a relationship between the topics to which they refer (Cambrosio et al. 1993). The availability of many co-occurrences with a keywords or phrases indicates to a central point which has many connections with other words in a corpus that may resemble a research theme.

The study analyses the concerns of the field of Scientometrics and Digital Library research's trend, during the period of 2001-2010. The concepts that have been researched and studied in the presented analysis are- the vital issues and subjects that have been addressed and discussed, the peoples who have presented their ideas, the resources that have been used in order to express their concerns effectively, and the contributions of institutions and countries that have been made, in both subjects during the studied period.

1.1 Source Journals

The sources of articles which have been considered for the study are the journal *Scientometrics* and *D-Lib Magazine*. Brief introductions of source journals are as follows:

1) **Scientometrics**

   Scientometrics is an international journal for all quantitative aspects of the science of science, communication in science and science policy. It was launched in 1978. Tibor Baurn is the founder and Honorary Editor-in-Chief of the international journal *Scientometrics*. It is a peer-reviewed academic journal in the field of Scientometrics. It is published by Akadémiai Kiadó, Budapest (not an "academy" in the sense of

learned society, but an editing house) and Springer Science+Business Media, Dordrecht.

Scientometrics is concerned with the quantitative features and characteristics of science and scientific research. It emphasises on the investigations in which the development and mechanism of science are studied by statistical and mathematical methods. The aim of the *Scientometrics* journal is to bring the results of such investigations together in one place.

The journal publishes original studies, short communications, preliminary reports, review papers, letters to the editor, and book reviews on Scientometrics. Due to its fully interdisciplinary nature, the journal is indispensable to research scholars, and research administrators. It provides valuable assistance to librarians and documentalists in central scientific agencies, ministries, research institutes, and laboratories.

2) D-Lib Magazine

D-Lib Magazine (D-Lib), one of the very first manifestations of the "born digital" generation of journals was launched in July 1995. *D-Lib Magazine* is an open access, electronic only scholarly journal, and it publishes articles in fields related to digital library research and development (Catherine Rey, Managing Editor *D-Lib Magazine*, personal communication, Aug 17, 2016).

In its inaugural issue, Editor Amy Friedlander characterized the audience of *D-Lib* Magazine as researchers, developers, and the intellectually curious interested in digital library (DL) issues. It aims digital library research and development, including emerging technologies, applications, and contextual social and economic issues. The primary goal of the journal is to deliver efficient information to the digital library community, to help digital libraries and develop this phenomenon as a broad interdisciplinary field.

1.2 Significance and Scope of the Study

The study has been conceived to study the content and bibliometric aspects of articles published in the selected journals. The analysis of literature on scientific study and digitization of library are the important areas of Library and Information Science. The

journal *Scientometrics* cover the all aspect of methods, techniques, models of the study of scientific literature while *D-Lib Magazine* deals with the development of digital technology and digital communication of information resources in the field of the library. The journal *Scientometrics* is dedicated to Scientometrics research, which covers subject areas like Scientometrics, Bibliometrics and Webometrics whereas *D-Lib Magazine* focuses on Digital library and its different aspects.

The aforesaid journals have been selected on the basis of indexing of journals in LISA[1], accessibility through online form Mizoram University, nature of journal and SJR[2] ranking. There were 414 journals that were indexed in LISA database (LISA, 2011). Out of them only nine journals were accessible through UGC-Infonet[3] from Mizoram University. Under UGC-Infonet only *Scientometrics* was subject specific journal in the field of library and Information science and rest of eight journals (American Journal of Information Science and Technology, Journal of Documentation, ASLIB Proceeding, Journal of Librarianship and Information Science, Journal of Information Science, Library Review, The Serials, and College & Research library) covers general aspect of LIS. The SJR of this journal was 1.257 which was relatively high with the peer group subject-specific journals in the field of Library and Information Science. *D-Lib Magazine* is also indexed in LISA and focuses on a specific subject Digital library. As it is an open access journal and can also be accessed from Mizoram University. The SJR of *D-Lib Magazine* was 0.463 which was enough good among SJR of other subject-specific journals indexed in LISA.

This study investigated the subject structure (intellectual structure) and publication trends of the journals for a decade. It also inspected authorship pattern, collaborative trend, appended references at end of the articles and institutions productivity over the study period. It examines whether any subject-specific article is regularly published over the year and identifies the institutions whether they have any impact on the subjects or not.

The Study also emphasis on co-word analysis as a tool for content analysis and uses this technique to identify the subject structure (intellectual structure). Thus, with the help of co-word and bibliometric techniques, this study uncovered the subject development, a

community of scholars and their associated institution, and citation trend of the journals (*Scientometrics* and *D-Lib Magazine*) during the framed time period. This work explores well-established topics, emerging idea, obsolete idea, peoples indulged in this activity, and the types of supporting literature to perform research for both journals. This study developed a technique for co-word analysis, using open source software 'R'. This research may have a greater impact on a scholar community to provide effective direction for further research in the domain.

The time constraint and goal of errorless findings and conclusion have confined the researcher to study only two journals. This study deals with articles of the journals published during the period 2001-2010 only. Over the mentioned year, a total of 1644 articles from both journals have been considered for the study. The full texts articles of the journals have been accessed online in PDF and HTML format from concerned journal's website via UGC-Infonet (E-SodhSindhu) from Mizoram University.

1.3 Research Design

The overall research strategy for this study has been explained under following points:

1.3.1 Statement of the Problem

Research in any field creates a new idea, technique, and solution to a problem. The researcher needs sources of information to perform research. Here, sources of information refer to journals, books and other documents related to their study area in print or electronic form and some more. Among all the information resources, journals are the best resource of updated information. Journal has been considered as primary resource of Information and used by majority of the research scholars. It means journals are the good carrier of original of information and give reliable information either in print form or electronic form and support the research by providing recent innovations, methodology, and analysis.

The growth and development of the resources and supporting literatures, supporting scholar's community and institutions should be tracked and presented in the right perspective. Therefore, it is necessary to study the idea and concept brought out by journals and supported sources, scholar community, and institution over year. The central concern of this study is to provide researchers, teachers, professionals, students and other interested parties with an updated view of the main spheres of research published in *Scientometrics* and

D-Lib Magazine. The reviewed literature (Chapter 2 of this Thesis) shows that this type of studies has not been undertaken with special reference to *Scientometrics* and *D-Lib Magazine* in India that determines research front or intellectual structure of the discipline.

1.3.2 Objectives of the Study

The objectives of the study are to identify:

1) Intellectual structure (Subject structure) existing in the journals,

2) Citation pattern existing in the journals,

3) Authorship pattern and the collaborative trend among the authors,

4) Institution wise distribution of the publications and institutional affiliation to authors,

5) Coverage pattern of research and non-research articles.

1.3.3 Hypotheses

A hypothesis is a supposition or proposed explanation made on the basis of limited evidence that is not proven but leads to further study or discussion. There are following hypothesis that has been drawn out for the study:

H_0. There is no significant variation in pattern of level of collaboration among the authors over the time segments of the study period.

H_0. There is no significant differences in the frequency of keywords occurred during 2001-2005 and 2006-2010.

1.3.4 Data Set and Research Methodology

The set of document used for the study consists of 1644 full-text journals' articles, published in the year 2001 to 2010 in *Scientometrics* and *D-Lib Magazine*. A journal article has been defined as an article appearing in journals, with exception of editorials, letter to editor, comments on letter to editor, reminiscences, feature report, news items, columns, Historical notes, book reviews, book list, bibliographies, short communication, world flash, opinion, conference report, correction and obituaries etc. (Enger et al., 1989). Distribution of selected articles and appended references in these articles of both journals are presented in Table 1.1. The data for the study have been collected from the different part of the articles (title, abstract, keywords, content, references, authors name and affiliated institution and country). In this study, 'R' software (R Core Team, 2012) has been used. It is open source statistics

analysis software, freely available on the internet. Methodologies for this study by objective have been given as follows:

Table 1.1: Selected journals for the study

Journals	No. of Articles	No. of References
Scientometrics	1241	16627
D-Lib Magazine	403	5442
Total	1644	22069

Source: Primary data

1.3.4.1 Methodology for Objective One *(To identify intellectual structure existing in the journals)*

Co-word analysis a tool of content analysis that has been used by many researchers to explore conceptual network in different discipline (Mohammadi, 2012; Ravikumar, Agrahari & Singh, 2014). Co-word analysis helps us to structure the data at various levels of analysis: as networks of links and nodes; as distributions of interacting networks and as a transformation of networks over time periods (Ding et al., 2001). It uses patterns of co-occurrences of words and phrases in a corpus or in a text. Figure 1.1 shows the steps that have been followed for co-word analysis under this study.

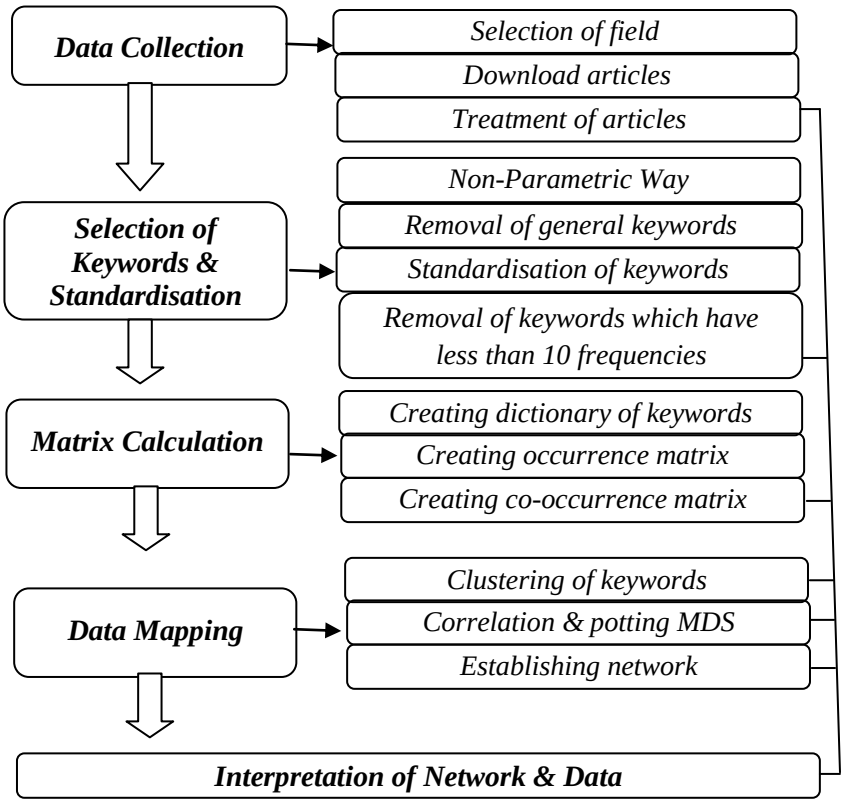

Figure 1.1: Steps of co-word analysis used for the study

Source: Primary source

1.3.4.1.1 Data Collection

Articles of *Scientometrics and D-Lib Magazine* for the period 2010-2010 have been downloaded through the internet from the concerned websites. These articles have been processed to eliminate the abstract, Keywords, Author's name and address, Acknowledgement, Notes, References and Running headings from the articles. It has excluded all those papers which are not fit for the parameters lay down for the selection of articles that has been depicted in section 1.3.4 (see p.6).

1.3.4.1.2 Selection of Keywords

Keyword plays a crucial role in the co-word analysis. There are two ways to extract keywords from the targeted sample (Journals' articles, Conference papers, Chapters of book etc.): Non-parametric and Parametric. Non-parametric deals with manual efforts of collecting keywords given by the author, journal database, abstract database and citation database; While parametric way uses an algorithm for extraction of keywords.

Keywords can be extracted from abstract and title of the document as both items represent core content of the articles. Coulter et al. (1998) used keywords for their study which were added by the indexer, and some keywords selected form the articles and then keywords are standardised to remove the different variants forms of the keywords. Courtial (1994) used keywords given by authors. Coulter et al. (1998) chose descriptor provided by the database as a keyword. Looze and Lemarie (1997) used keywords suggested by an expert on the subject. Nyams and Van Ram (1998) conducted a study using co-occurrence of classification code.

The parametric method uses software to extract keywords from the text such as NP tools, Ti.exe, GenEx. These softwares use an algorithm or text rank to select keywords which represent core topics of the specific subject. Mihalcea and Tarau (2004) examine different algorithm and developed a text rank- graph based on a ranking model for keyword extraction from full text. This method of keywords extraction eliminates the biases of an indexer.

The non-parametric method of keyword extraction has been used for the study. Scholar has accepted not only all keywords added by the author/s of an article but also collected keywords provided by LISA to the same articles and some keywords extracted non-parametrically from the articles' title and abstract.

1.3.4.1.3 Data Standardisation

The collected keywords should be standardised by vocabulary tool (Ding et al. 2001; Yue 2012) as some related concept is presented by different words. The process of keywords standardisation remove all synonyms, ambiguity, general term (a term which occurs mostly in all papers), and different variants form of a word. All collected keywords are standardised with help of the SLSH[4], LCSH[5] and Dictionary of Bibliometrics[6], in order to remove the variants form of keywords such as singular/plural and synonyms words. Keywords representing the same concept have been clubbed into a standardised form. Words having low frequency are merged into a broader term. The word which does not has broader or similar term or which are not specific to the subject or the words which are very common such as analysis, author, article etc, have been ignored (Ding et al. 2001). Using above said selection and standardised procedure, different variants forms of keywords have been eliminated. After multiple corrections, keywords are selected as a research sample for co-word analysis; and the keyword only which has minimum ten frequencies has been considered for the study.

1.3.4.1.4 Matrix Calculation

After selection and standarisation of keywords, a document term matrix (DTM) has been calculated using 'TM' package of 'R' software. The calculation of document term metrics is based on the occurrence of keywords in a corpus (collection of articles). With the help of a program that is compatible to 'R' software and has been developed by the scholar for the study (see Appendix A), the document term matrix transformed into co-occurrence matrix (symmetrical matrix) of keywords and the diagonal value of the matrix is treated as missing data.

1.3.4.1.5 Data Mapping

There are many tools to perform content analysis; Many scholar used software: LEXIMAPPE (Law and Whittaker, 1992; Cambrosio et al., 1993; Courtial, 1994; Looze and Lemarie, 1997); CAIR: Content Analysis and Information Retrieval, (Coulter et al., 1998); BibTechMon (Bibliometric Technology Monitoring) (Kopcsa and Schiebel, 1998); Kohnen's neural network algorthim (Polanco et al., 1998) and Multidimensional scaling and Clustering techniques has been applied by Ding and others (2001) using SPSS

software. This study used hierarchical clustering, multidimensional scaling, and social networking technique to visualize the co-word structures of journals.

In order to understand the co-word structure of both journals, co-occurrences of keywords have been analysed for the period 2001-2010. Further, the period (2001-2010) has been divided into year 2001-2005 and 2006-2010, the reason behind it is to observe the dynamic changes of the subject during the period 2001-2010.

1) Clustering

Clustering is a method of grouping objects into a set on the basis of similarity and dissimilarity. Single linkage is a widely used clustering technique but this technique limiting one cluster to 10 co-words only (Lee and Jeong, 2008). Leydesdorff and Zaal (1988) make a study and suggested that 'Ward' mode of analysis is better suited for symmetrical matrix than single linkage clustering because of the large number of zero hits which may lead to 'Chaining' in the first cluster and isolates. This dissertation has used 'Complete Linkage' method as it measures maximum dissimilarity between two clusters. In this study, all keyword have been grouped into five clusters for analysis.

2) Correlation and MDS

Following steps have been followed in order to plot two dimensional MDS map for each cluster:

i) Pearson's r calculated on the basis of co-occurrence matrix of keywords.

ii) With the help of 'R' statistical software, MDS has been applied to all keywords of each cluster.

iii) Five MDS map has been generated for each segment of the period,

iv) Generated map displays relationship among the keywords of a cluster.

The relation between two words (Pearson correlation coefficient) is calculated on the basis of all co-occurrence frequency that two words have in the cluster and the calculated correlation has been used for plotting MDS. Pearson's r (Pearson correlation coefficient) is used to identify the relationship among the keywords (Leydesdorff and Zaal, 1988; An and Wu, 2011). Pearson's coefficient calculates a value which indicates relation in a pair of keywords. Pearson's value lies between +1

and -1. A positive value indicates similarity between the keywords, whereas negative value shows dissimilarity.

Dissimilarity causes a problem during measurement of the proximity among the keywords, this problem has been resolved by linear transformation of (r+ 1)/2 (where r is Pearson's coefficient value of keywords). The linear transformation would transform the value between 0 and 1 (Leydesdorff and Vaughan, 2006) and better analysis can be done. The words with high Pearson correlation coefficient are located together in the MDS map, and those words located together in the map have high similarity in terms of co-occurrence profile within the matrix.

3) **Network of Keywords**

Thin lines over MDS map between keywords form a network which corresponds to a social network. The linkage between keywords presents the co-occurrence strength. Co-occurrence strength takes a value of Salton index. Salton value can be calculated using following formula (Yue, 2012):

$$Salton\ value = C_{ij} / \sqrt{N_i\ N_j}$$

Where, C_{ij} is a number of co-occurrence frequency of i and j keywords; N_i is a number of frequency of 'i' keyword; N_j is a number of frequency of 'j' keyword. Slaton value of two keywords lies between 0 and 1.

This study has considered two Salton values: **a)** >0.35 for defining a link between clusters, and **b)** >0.2 for defining a link between keywords within a cluster.

1.3.4.1.5 Interpretation of Network and Data

For interpreting and comparing the different cluster and existing network among its keywords, following characteristics of a network have been used:

1) ***Outer link*** refers to the number of links of a cluster which established a network with other clusters (sub-domain).
2) ***Inner link*** refers to the number of link which exists between keywords of a cluster. If A and B connected with an arch, it means A and B each have one link.
3) ***Total link*** refers to the sum of inner and outer links.
4) $\textbf{\textit{Inner Link \%}} = \frac{\textbf{\textit{Inner Link}}}{\textbf{\textit{Total link}}} * 100$

5) ***Outer Link %*** = $\frac{\boldsymbol{Outer\ link}}{\boldsymbol{Total\ link}} * 100$

6) ***Inner Link Key*** refers to the number of keywords which has a link within a cluster.

7) ***Outer Link Key*** refers to the number of keywords which has a link from other clusters.

8) ***Total Key*** refers to the number of keywords within a cluster.

9) ***Inner link key %*** = $\frac{\boldsymbol{Inner\ Link\ key}}{\boldsymbol{Total\ key}} * 100$

10) ***Outer Link Key%*** = $\frac{\boldsymbol{Outer\ link\ key}}{\boldsymbol{Total\ Key}} * 100$

11) ***Average link per key***= $\frac{\boldsymbol{Total\ link}}{\boldsymbol{Total\ key}}$

12) ***Centrality*** is defined as a mean of outer links (sum of Salton index of outer links/outer link). It measures the intensity of links for a given cluster with other clusters. (Ding et al. 2001)

$$Centrality = \frac{\boldsymbol{\Sigma X}}{\boldsymbol{Outer\ Links}}$$

Here, X= values of Salton index of outer link.

The higher centrality of a cluster suggests the strategic position of keywords of the cluster. It shows the importance of keywords for a scientific and scholarly community.

13) ***Density*** is defined as a mean of inner links (sum of Salton index of inner links/inner link). It measures the strength of the links that tie the words making up the cluster together (Ding et al., 2001).

$$Density = \frac{\boldsymbol{\Sigma Z}}{\boldsymbol{Inner\ Links}}$$

Here, ***Z***= values of Salton index of inner link.

The higher density of a network denotes that the topics of the cluster have good representation in the universe of knowledge. It suggests that a good number of studies have been done on the topics and have a potentiality to maintain and develop itself over the period.

Scholar has used above mentioned methodology in a research article entitled '*Mapping the Intellectual structure of Scientometrics: a co-word analysis of journal Scientometrics (2001-2010)*' which published in *Scientometrics* in 2014.

1.3.4.2 Methodology for Objective Two *(To identify Citation pattern existing in the serials)*

References appended in the articles of journal *Scientometrics* and *D-Lib Magazine* have been analysed to fulfill the objectives. The selected articles of *Scientometrics* contain more than thirty-three thousand references; the study of such a huge quantity may prone to error in recording and analysis of data. Therefore the scholar restricted to study of top 50% highly cited articles of each year. To determine highly cited article scholar used four years citation time window for articles. Web of Science[7] has been used to collect the citation data during the first week of March, 2015. All citations received by each article are counted for four years and articles are arranged year wise in decreasing order with articles. Thus, a total of 621 articles were determined highly cited articles which included 16627 references were considered for study and data were collected.

In contrary to *Scientometrics*, The selected articles from *D-Lib Magazine* have appended only 5442 references that have been considered for the study. The above mentioned strategy of sampling applied to *Scientometrics* can't be applied to *D-Lib Magazine* as this sampling strategy will produce less than two thousand references.

Data were collected from references appended in selected research article for this objective. Using Open Office, a database was set up to record selected item of each reference: Author(s), article's title, language of article, type of publication, country of publication, volume, issue and date of publication, Subject of article. Each citation had given an unique identification number. A second database had been created containing information about the source articles that were used for crosschecking. Again, a unique identification number was given that linked the source article to the citation. The references considered for the study have been divided into following ten broad categories:

1)	Journal	–	Print journals, and e-journal
2)	Books	–	General, and Subject specific books
3)	Proceedings	–	Proceedings of conferences, symposium, workshops etc.

4) Dissertations & Thesis	–	Prepared project by MLIS students and Ph.D. Scholars
5) Reports	–	Research reports/annual reports, technical bulletins and other reports issued by government or private agencies
6) Reference Books	–	Encyclopedias, yearbooks etc.
7) Magazines	–	All news papers and magazines
8) Web-resource	–	Web pages and e-resources.
9) Others	–	It includes all items other than above mentioned items such as a database, software, white paper, and bibliography etc.

All references have been assigned subject using Web of science subject category (WC). If a title did not find in the Web of Science then the PubMed[8], LISA and LISTA[9] were searched and subject category of the same had been used. In case of more than one subject of an item, the first subject was taken as a subject of the item. Some title was not found in above mention tools were googled and a subject was assigned after studying the description of googled item. Further, the assigned subject was standardised using above mentioned tools' subject category. Some of the references which had inaccurate and missing information were supplied with correct information using Web of Science, PubMed, and Google Scholar. Google translate was used to translate abstract and content of item available in other than English language. Descriptive statistics are used to quantify and in the analysis of the data.

1.3.4.3 Methodology for Objective Three *(To identify authorship pattern and the collaborative trend among the authors)*

The required data for the objective three has been collected from the journal's articles studied in objective one. Information about each author and collaboration of the articles have been collected and recorded into a spreadsheet. The collected data has been analysed with 'R' and presented in the form of tables. The number of author/s of each article was counted and then all the articles were grouped into five categories of collaboration on the basis of author's institutional affiliations and distinguished as Local Collaboration (all authors of an article belong to only one institution), Domestic Collaboration (if each author of an article

belongs to more than one institutions of a country), International Collaboration (if the authors' institutions of an article belong to more than one nation), and No Collaboration (it holds only one authored articles). Further, the following Scientometrics tools have been used to analyse the data and calculate the collaboration in numerical value.

1) **Collaboration Index (CI)**

   It is a mean number of authors per jointly authored paper. This was suggested by Lawani (1986) and expresses the mean number of authors per article for a total sample of publication. For this analysis, we have omitted the single-authored articles which are equal to 1 always. To determine the mean number of authors per jointly authored article, the following formula has been used:

$$Collboration\ Index\ (CI) = \frac{Total\ number\ of\ authors\ in\ jointy\ authored\ papers}{Total\ number\ of\ jointy\ authored\ papers}$$

2) **Collaboration Co-Efficient (CC)**

   It is used to measure the strength of collaboration between the authors who contributed articles to the journals. The following formula suggested by Ajiferuke (1988) to calculate CC that has been used for the study:

$$Collaboration\ Co-cofficient\ (CC) = 1 - \sum_{j=1}^{k} (1/j)\ Fj/N$$

   Where, *Fj* is the number of j authored journal's articles; *N* is the total number of Journal's articles and; *k* is the greatest number of authors per paper.

   The value of Collaboration Coefficient lies between 0 and 1. The CC bigger than 0.5 indicates strong collaboration rate among the authors; While, 0 or near to 0, indicates no or weak collaboration.

1.3.4.4 Methodology for Objective Four.*(To identify Institution-wise distribution of the publications and institutional affiliation to authors)*

The data used in objective four has been collected from a set of articles examined in objective three. Information about the articles and author's affiliation (title of article, affiliated institution, institution's country) has been tabulated in a spreadsheet and the numbers of institutions have been counted of each paper. In the case of more than one

affiliation of an author, the first affiliation of the author has been considered for the study of institutional affiliations of authors. Here, all institutions are classified into three border categories on the basis of following functional definition framed for the study:

1) **Research Institution**

   A research institution is an institution which is established to perform research in the specific area and doesn't have a system to impart education similar to a university, college, and school.

2) **Academic Institution**

   An Academic institution is the institution belongs to university, college or any other educational system.

3) **Non-academic Institution**

   The institution that doesn't fall under the above mention categories is classified under Non-academic institution.

1.3.4.5 Methodology for Objective Five *(To identify coverage pattern of Research and non-research articles)*

In the perspective of this objective, all selected articles published in *Scientometrics* and *D-Lib Magazine* during the period of the year 2001-2010 are the unit of analysis and each of them were examined to categories into research and non-research articles (Walia and Kaur, 2012; Dilevko, 2007; Koufogiannakis et. al., 2004). The functional definitions of research and non-research article are given bellows which have been considered for the study:

1) **Research Article**

   Research article is an article that deals with primary data and carried out by systematic investigation and contribute either to conceptual framework or provide new primary data or new technique/model, and it includes introduction, background of study or literature review, objectives, hypothesis, Methodology, tools for analysis, result or data analysis and findings, discussion, recommendations and references or bibliography as body of articles.

2) **Non- Research Article**

   The journal article which does not come under the label of the research article contains the knowledge already existing in public domain and does not report any

original idea and technique has been considered as Non-research Article such as review article, Informative article, evaluative article, project report etc.

In the light of Objective five, subject coverage of research and non-research articles are studied. Scholar has assigned subject to each article on the basis of abstract, keywords and content, in a non-parametric way. Each article was assigned only one subject on the basis of emphasis or perceives intent of the article. For conducting the study, the content of each article or paper was scanned and the relevant information (title of article, type of article, Subject of the article, year of publication, name of journal, volume and issue no.) have been recorded in a spreadsheet and examined.

1.4 Overview of Chapters

The study has been divided into five chapters. In text citations, and References of chapters follow 6th edition of 'Publication Manual of the American Psychological Association'. The chapter one is 'Introduction' of the study and deals with discussion of importance of journals in scholar communication. It discusses the research strategy under the heading 'Research Design' which includes Statement of the problem, Objectives of the study, Scope of the study, Data set and methodology.

The chapter two is 'Literature Review' which provides extensive literature review over the relevant topics for the study that are: Content analysis in LIS domain, Co-word analysis, Citation pattern, Authorship and Collaboration, and Coverage analysis.

The chapter three is 'Overview of Library and Information Science Journals'. It discuss the different aspect of journals, types of journal, importance of journals and provide a statistics, and brief details of reputed journals in the field of library and information science of the world.

The chapter four is entitled 'Content Analysis' that throws light over the history and different aspect of content analysis. It evaluates the uses of this method in field of library and information science and introduce with different software available for content analysis. It also describe co-ward as tool of content analysis.

The chapter five is 'Data Analysis and Interpretation' and it provides analysis of collected data to fulfill the objectives of the study. Scholar employed quantitative method and

quantitative data were collected for journals' articles using different computer programs and techniques. Further, data were summarised using different statistical formula and organised in table and presented in diagrams and graph.

The last chapter of the thesis is 'Findings, Conclusion and Suggestions' which includes findings, discussion, and conclusion of the research work and provides some suggestion that is valuable and can be considered by academician and scholar of library and information science.

Thus, the description of this chapter establishes the foundation for this study and lay down a strategy for this study. It reveals the importance of journals in scholarly communication and discuses Co-word analysis and Bibliometric analysis as an important tool for analysing these communications to know the development trend, growth, and dimension of a discipline.

Notes

[1]Library and Information Science Abstracts (LISA) is an international abstracting and indexing tool designed for library professionals and other information specialists produced by ProQuest LLC (United State).

[2]SCImago Journal Rank is a Measure of influence of communication, maintained by SCImago Institution Ranking on the basis of number of received citation and prestige of source of citation

[3]The UGC-INFONET was a Digital Library Consortium monitored by INFLBINET, Hyderabad. Now, it has been merged in e-ShodhSindu: Consortium for Higher Education Electronic Resources.

[4]The Sears List of Subject Headings is a thesaurus-which serves a core list of headings, to help a cataloger in creating further headings as needed, since the first edition in 1923.

[5]The Library of Congress Subject Headings (LCSH) is a thesaurus (a tool to controlled vocabulary) of subject headings, maintained by the United States Library of Congress, for use in bibliographic records.

[6]Dictionary of Bibliomertics is collection of bibliometric term complied by Virgil P Diodato in 1994.

[7]Web of Science (WOS) is an online subscription-based scientific citation indexing service originally produced by the Institute for Scientific Information (ISI), now maintained by Thomson Reuters (United State).

[8]PubMed is a free search engine accessing primarily the MEDLINE database of references and abstracts on life sciences and biomedical topics. The United States National Library of Medicine (NLM) at the National Institutes of Health maintains the database.

[9]Library, Information Science & Technology Abstracts (LISTA) is an indexing and abstracting tool in the field of library and information science. It is maintained by EBESCO Information Services (United State).

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Chapter 2

Literature Review

A literature review introduces the problem, develops the background providing a history of scholarly work on the subject, and ends with the purpose and the rationale for the study (Wysocki, 2008). It constitutes an integral part of any research, its main goals are to situate the current study within the body of literature and to provide context for the research. Literatures review is an essential part of any research in an academic area. The undertaken research area is very new in the domain of Library and information science, hence only a few studies have been taken place in this area. The available research and non-research studies which are found relevant for this study have been thoroughly reviewed along with their findings.

2.1 Content Analysis in LIS Domain

Content analysis provides insight into the development of a profession as it indicates the subject trends and major issues that occupy the profession within a given period of time (Blessinger and Frasier, 2007). Content analysis is a method of analysing written, verbal or visual communication messages (Cole, 1988). It was first used as a method for analysing hymns, newspaper and magazine, articles, advertisements and political speeches in the 19th century (Harwood & Garry, 2003). Content analysis has a long history of use in Mass Communication, Journalism, Sociology, Psychology and Business, and during the last few decades, its use has shown steady growth (Neundorf, 2002). Content analysis as a research method in a systematic and objective means of describing and quantifying phenomena (Krippendorff, 1980; Downe-Wamboldt, 1992; Sandelowski, 1995).

Content analysis, in Library and information science research, has been the central topic of various studies. Several studies used content analysis to identify the focused subjects and themes of journals articles and other information resources in LIS field. Some important studies related to content analysis have been reviewed as follows:

Chu (2015) analysed quantitatively and qualitatively 1162 research articles, published from 2001 to 2010 in three major journals of library and information science, to identify some recurring themes about research method selection and application in the scholarly domain.

This study showed that replacing the dominant positions that questionnaire survey and historical method previously held, content analysis, experiment, and theoretical approach have become the top choices of research methods in the field. This study also examines two recurring themes regarding research methods namely, use of multiple methods in one study and adoption of the qualitative approach, but finds no conclusive evidence of increased implementation of either practice.

Walia and Kaur (2012) conducted a content analysis of 165 research papers published in the six LIS journals published from UK and USA in the year 2008. He found that 93 (56.36%) of the articles out of the total 165 were research articles. The variation is found with regard to coverage of core subject areas published from UK and USA. The study also found that the area of information storage and retrieval is the most popular area of research followed by Bibliometrics, Scientometrics, Infometrics and Webometrics and Information seeking behavior, whereas in case of non-research articles the area digital library & digitization is the most popular followed by librarianship in studied journals.

Aharony (2012) analysed journals' research articles of the top 10 Library and Information Science journals published during the year 2007 to 2008. He used a statistical descriptive analysis of bibliographic components. Furthermore, conducted a content analysis of keywords and abstracts extracted from the journals' articles the studied period (2007-2008), using Zins' (2007) classification scheme of Information Science. The study revealed the tendency of authors towards collaboration in authorship; North American and European authors, from the core discipline of Librarianship and Information Science, can be considered as leaders in the top 10 LIS journals. Furthermore, there are three major cores of research in these journals: Information technology, Methodology, and Social information science.

Zhao and Zhang, (2011) conducted a content analysis to identify the research paradigms on digital libraries in China and compared with that of international digital libraries research. The study used Co-word network in documents and their co-occurrence relationships to analyse knowledge domains, which represents the cognitive and intellectual structure of science. A total of 6068 and 1250 papers published between 1994 and 2010 were, respectively retrieved from the China National Knowledge Infrastructure (CNKI) and ScienceDirect databases with a topic search of digital libraries or digital library in abstracts of papers. This paper used methods of co-word analysis, social network analysis, and

mapping knowledge domains as theory basis, using software UCINET and Netdraw, the result showed that Chinese digital libraries studies are much more diversified in comparison to international digital libraries research. Studies of Contents and Technologies, Right issues, Basic theories, and Services were major paradigms of Chinese digital libraries studies while user-center ideas were international digital library studies.

Hider and Pymm (2008) conducted a content analysis aimed at identifying the distribution of empirical research strategies and techniques reported in twenty high-profile LIS journals' literature published in the year 2005. The researchers found that the survey approach remains the predominant research strategy in both Library Science and Information Science. A marked increase, however, was noted in experimentation and a modest increase found in the use of qualitative approaches, except for historical research, which showed a marked decline.

Davarpanah and Aslekia (2008) presented a quantitative study of author productivity, characteristics, subject areas and various aspects of global publication in the field of LIS. A total of 894 journals articles published in 56 LIS journals indexed in SSCI during the year 2000-2004 were analysed. They found that the majority of author (89.93%) contributed only one paper during the period and the average author per paper was 1.52. Most of the authors (70%) were belong to US and UK.

Blessinger and Frasier (2007) analysed publication and citation trends of 10 LIS journals indexed in Journal Citation Reports (JCR) of a decade (1994–2004). A total of 2220 articles were studied and they revealed the areas of concentration within the research, frequently published subjects through the years, and the characteristics of the top-cited authors and resources during this time. They concluded that librarians are still writing about practical issues that faced by the profession, and about new technology in LIS, most notably the Internet that had a tremendous impact on the LIS community.

Julien et al. (2005) carried out a content analysis of 717 articles published in top five journals on LIS System between 1999 and 2003 to discover whether the LIS systems-oriented literature reflects any serious interest in affective issues such as emotion or confidence, as these have an effect on information behavior. This study shows that most LIS systems work, at least that which is being published in the field's most influential journals, continues to ignore affective issues. The research front in systems work outside of the discipline is

moving in fascinating new directions in a number of areas, offering intriguing, but yet unfulfilled, potential for similar work in LIS.

Koufogiannakis, Slater, and Crumley (2004) conducted a content analysis of library and Information Science literature published in 2001 and test the domains developed by Crumley and Koufogiannakis. A total of 807 research articles were analysed that published in 91 journals. They found the domain Information Access and Retrieval had the highest number of research articles (314/807), followed by Collections (193/807), Management (135/807), Education (95/807) and Reference (77/807) and identified two new domains: Library History and Professional Issues. This study suggested that there were enough evidence to add the domain Professional Issues to Crumley and Koufogiannakis' taxonomy.

Rochester and Vakkari (2003) reviewed national and international trends in Library and information science research based on research articles in a core collection of journals. In studies, comparing distribution of topics, subtopics, approaches and methods in Australia, China, Finland, Spain, Turkey and the United Kingdom in 1965, 1975, 1985, and 1995. The study found a remarkable variation of emphases and trends in research in the countries examined. Each has its own research profile, which does not follow very closely the international trends. Despite the differences, there are similarities. A strong interest in LIS services was typical of the research in Australia, Turkey, and UK. Research trends in Finland, and UK reflected most closely the research profile in international core journals. Conceptual method and surveys are universally popular, and, to a lesser extent, historical method.

Pu, Chuang, and Yang (2002) conducted content analysis of Web query terms to understand Web searching interests. Web documents were used to extract co-occurring terms and to create a feature set. An effective ranking function has also been developed to find the most appropriate categories. The experimental results demonstrated that the approach was efficient in dealing with large numbers of queries and adaptable to the dynamic Web environment. Through a good integration of human and machine efforts, the frequency distributions of subject categories in response to changes in users' search interests can be systematically observed in real time. The approach has also shown potential for use in various information retrieval applications and provides a basis for further Web searching studies.

Park (2001) conducted a investigation and explored three areas to assess research methods in Korean library and information science (LIS) graduate programs: (1) comparison of research methods' courses across Korean LIS graduate programs; (2) content analysis of the trend of research methods education; (3) comparison of research methods' courses between the U.S. and Korean library and information science graduate programs.

Nielsen (2001) conducted an empirical study and used a mixed set of methods (group interviews, recollection of information needs and word association tests to collect data; content analysis and discourse analysis to analyse data) to evaluate whether these methods collected the data needed for work domain oriented thesaurus design. The findings showed that the study methods together provided the domain knowledge needed to define the role of the thesaurus and design its content and structure. It also reflected the information environment and made it possible to develop a thesaurus according to the characteristics of the work domain. It seemed more difficult to capture the needs of the individual user and adapt the thesaurus to individual characteristics.

Mbambo and Cronje (2001) made an investigation to examine the usability of the internet as an information resource in developing countries with special reference to Botswana and other developing countries. The researcher examines Internet use at two levels: macro level of issues of Internet connectivity and the second level is the micro level of the usability of the World Wide Web (WWW) for information management. Content analysis and case study were used for this study. The study found that Website is easy to use for entrepreneurs, but while there is, a need for macro policy to create national and global environments for using the Internet sustainable connection should not be universal, but should rather be based on the information management needs of a target population. Inherent infrastructural and socio-technical challenges should then be tackled as part of the effort to create a sustainable Internet usage.

Lynch and Smith (2001) made an investigation using content analysis of 220 job advertisements that appeared in *College & Research* Libraries News between 1973 and 1998. The study concluded that by 1998, all academic library jobs routinely included computer technologies, that instruction had become an integral part of reference work, and that behavioral skills, especially oral and written communication skills, had emerged as new

job requirements. The master's degree from a program accredited by the ALA continues to be widely accepted as the appropriate professional degree for academic librarians**.**

Cole (2001) analysed the content of a newspaper to identify the coverage of European Union stories in British daily newspapers. Three months of newspapers were scanned on a daily basis and their pro and anti stance monitored. It included a content analysis of online newspaper and its print equivalents. The results show that for both hardcopy of newspapers and their online equivalents the anti-European press is passionate in its beliefs, whereas the pro-European presses were largely solid but unexciting in theirs. It also found with the view that in political and newspaper speak Europe is just not a 'heart' issue.

Järvelin and Vakkari (1993) reported a content analysis of LIS research from 1965 to 1985, the study samples consist of 142, 359, and 449 full-length research articles published in 1965, 1975, and 1985, respectively, in core LIS journals. He found that the most frequent subjects were Library and information service activities, and Information storage and retrieval; and noticed the most remarkable changes in these years was the lack of interest in methodology and analysis of LIS and the shift of interest from classification and indexing to information storage and retrieval.

Kumpulainen (1991) made a content analysis of 632 articles which appeared in 30 core journal of library and information science. He classified all articles according to 10 variables covering the subject, method, and approaches. The study found that 56.80% were classified as research article and the rest 43.20% as non-research articles. Information storage and Information retrieval was the most frequent subject that was the central point the scholars. The most frequent research method was survey and verbal argumentation. The use of quantitative method was rare.

Järvelin and Vakkari (1990) examined more than 833 articles published during 1985 in 37 core journals in LIS. Complete articles of the journals were divided LIS literature into research articles and professional articles and analysed according to 11 variables covering their topic, approach, and method. Fifty-four percent of the articles were classified as research articles and 46% as professional articles (e.g. reviews, discussions, bibliographies, etc.) They claimed that in these two groups of articles focused on practical and daily operations topics of libraries such as library services, information storage and retrieval etc.

Atkins (1988) reviewed a decade of literature from 1975 to 1985. He used a quantitative approach of content analysis and analysed 2705 articles of nine scholarly journals in fields of library and information science. He classified all articles into 58 subjects and revealed out the subject trends in the field of library and information science, and found a heavy concentration on automation-related subjects such as Information retrieval, Databases, Cataloguing, Library automation, Technology, and Research methods.

2.2 Co-word Analysis

Co-word analysis is one of the important methods that used to identify themes and relationship among these. It is related to co-citation analysis (Small 1973; Small and Griffith 1974). It deals directly with a set of terms shared by documents instead of shared citations. It counts and analyses the co-occurrences of keywords in the publication on a subject. In addition, it has potential to describe interactions, which exist between different phases of an innovation process and to show whether basic research or applied research is the moving force (Callon et al. 1991). Some important studies that used co-word analysis have been reviewed as followed:

Ravikumar, Agrahari and Singh (2014) conducted a co-word analysis to trace out the trends and patterns of Scientometrics research by measuring the association strength between selected keywords that represent the presented concept and idea in *Scientometrics* journal. A Total of 915 articles published in *Scientometrics* journal during the year 2005-2010 were processed to collect data using 240 standardized keywords. With the objective of delineating dynamic changes of the field of Scientometrics, the period 2005–2010 was studied, and further divided into two consecutive periods- 2005–2007 and 2008–2010. The results show that publication has some well-established topics such as Citation analysis, Author productivity, Bibliometrics, and it identified some marginal, emerging, and obsolete topics.

Zong et al. (2013) conducted a Co-word analysis, including cluster analysis, strategic diagram and social network analysis, and studied the internal and external structure and relationship of research fields in doctoral dissertations of Library and Information Science in China. Data were collected, during the period of 1994-2011, from six public dissertation databases and ten degree databases. The study found that Wuhan University is the most important institution of doctoral education in LIS in China. The main topics were Information resource, Ontology, Semantic web, Semantic search, Electronic government,

Information resource management, Knowledge management, Knowledge innovation, Knowledge sharing, Knowledge organization, Network, Information service, Information need, and Digital library. The research fields of LIS doctoral dissertations in China are varied. Many of these research fields are still immature; accordingly, the well-developed and core research fields are fewer.

Hu et al. (2013) conducted a study to analyse the Intellectual structure of Library and Information Science (LIS) in China during the period 2008–2012 utilizing co-word analysis. He analysed 21,593 articles of 18 core journals of China with 181 keywords using multivariate statistical analysis and find out Information service, Knowledge management, Knowledge service, Information resource, Digital reference service, Digital library, Library management, Social network, Information literacy, and Intellectual property are the core concept of Chinese of the library and information science during the studied period.

Holmberg, Tsou, and Sugimoto (2013) examined the intellectual landscape of iSchools conducting a co-word analysis of all iSchool faculty members' research interests. The relations between the current research profiles of the iSchools were compared by calculating the cosine similarity between co-word profiles and visualized in network graphs. The results showed how the current research landscape of the iSchools and the shared research interests were built by many topics that still reflect dominant information science topics (e. g., Bibliometrics, Information retrieval, and Information seeking behaviour), but there are also some growing areas that reflect the iSchools' interdisciplinary composition.

Mohammadi (2012) investigated the multidisciplinary patterns of Iranian research on Nanoscience and Technology based on 1,120 research article indexed in ISI which published during 1974 to 2007. Ninety-six unique key terms were identified for the study. Then the scientific structure of the Iranian Nanoscience and Technology was mapped through multidimensional scaling. The results showed that the Nanoscience and technology had a multidisciplinary structure which is composed of different fields, such as Pure Physics, Analytical Chemistry, Chemistry Physics, Material science and Engineering, Polymer science, Biochemistry and new emerging topics.

Zhao and Zhang (2011) conducted a study to identify the research paradigms on digital libraries in China and compared with that of international digital libraries research using co-word analysis.. A total of 6068 and 1250 papers published between 1994 and 2010 were, respectively retrieved from the China National Knowledge Infrastructure (CNKI) and

ScienceDirect databases with a topic search of digital libraries or digital library in abstracts of papers. This paper used methods of co-word analysis, social network analysis, and analyse knowledge domains, with assistance of software UCINET and Netdraw. The result showed that Chinese digital libraries studies are much more diversified in comparison to international digital libraries research. Studies of content and technologies, Right issues, Basic theories and Services were major paradigms of Chinese digital libraries studies while user-center ideas were international digital library studies.

Milojevic et al. (2011) conducted a co-word analysis to reveal the cognitive structure of Library and Information Science. The study was based on 10,344 articles published between 1988 and 2007 in 16 LIS journals. Analysis revealed out that library and information science consists of three main branches: the traditionally recognized Library-related, Information-related branches, and equally distinct Bibliometrics/Scientometrics branch. The three branches focused on Libraries, Information, and Science, respectively. In addition, this study identified 'Information seeking behavior' as a new branch and substructures within each branch. Furthermore, the study found a cognitive concept in LIS evolves continuously. The most rapid development occurred between 1998 and 2001, influenced by the increased focus on the Internet. The change in the cognitive landscape is found to be driven by the emergence of new information technologies, and the retirement of old ones.

An and Wu (2011) used co-word analysis to analyse the evolvement in stem cell field. Articles in the stem cell journals are downloaded from PubMed for analysis. Terms selection is, one of the most important steps in co-word analysis, so the useless and the general subject headings were removed firstly, and then the major subject headings and minor subject headings are weighted respectively. Then, improved information entropy was exploited to select the subject headings with the experts consulting. Hierarchical cluster analysis has been used to cluster the subject headings and the strategic diagram was formed to analyse the evolutionary trends in the stem cell field.

Jeong and Kim (2010) analysed the intellectual structure of biomedical informatics reflected in scholarly events. The data were collected from the titles and abstracts of 12,536 papers presented at five Medical Informatics (MI) events and six bioinformatics (BI) global scale scholarly event series during the years 1999-2008. Then, n-gram terms (MI = 6,958; BI = 5,436) from the paper corpus were extracted and the term co-occurrence network was analysed. The result identified major topics of both medical Informatics and Bioinformatics

and they found that shared methodology-related topics were used in different contexts. The study found some newly emerging topics in biomedical informatics, which can allow for a better understanding of the forefront biomedical informatics.

Lee and Jeong (2008) delineated the area of robot technology with application of co-word method using cosine similarity between two vectors (diagonal value of matrix assumed zero) was used as a similarity-coefficient, and Ward's method was used for clustering. They analysed metadata of national projects of Korean of the field in the year of 2001. Additionally the subject experts of the field verified each clusters in the maps. They draw a strategic diagram for the robot technology from Korea national R&D Project metadata in 2001 and generate an evolutionary trend of robot technology.

Yang, Bhikshu, and Tsaih (2006) conducted a study to map the structure of the field Hospice care with co-word method. They used growing hierarchical self-organizing map, a text-mining neural Networks, to depict the pattern of the area. Result of this study showed that the analysed topics indicate that of health care science and service as two subject areas had vital role in palliative care related research.

Janssens et al. (2006) analysed five journals of the field of Library and Information Science. Almost 1000 articles and notes published in the period 2002-2004 have been selected for the study. The optimum solution for clustering LIS is found for six clusters. The combination of different mapping techniques, applied to the full text of scientific publications, results in a characteristic tripod pattern. Besides two clusters in Bibliometrics, one cluster in information retrieval and one containing general issues, Webometrics and patent studies are identified as small but emerging clusters within LIS. The study was concluded with the analysis of cluster representations by the selected journals.

Uzun (2002) examined a sample of 102 articles of 21 core journals in the field of library and information science from 1996-1999 using 'Co-word analysis' based on the key words and thematic noun phrases in the titles and abstracts. Articles had either principal or co-authors from developing countries (DCs) and Eastern European countries (EECs). The result indicated that Bibliometrics is the most frequent topic in LIS research in major DCs and EECs. Information retrieval, information need and information use is among the topics of relatively high interest for the researchers working in DCs in Asia and Africa.

Ding, Chowdhury and Foo (2001) conducted co-word analysis to reveal out the trend and pattern of Information retrieval research and used Pearson correlation coefficient and Ward's method for clustering of selected keywords. Data were collected from Science Citation Index (SCI) and Social Science Citation Index (SSCI) for the period of 1987-1997.The results showed that the IR field has some established research themes such as library education, user theory, information storage and retrieval and it changed rapidly to embrace new themes.

He (1999) reviewed the development of co-word analysis, summarizes the advantages and disadvantages of this method, and discusses several research issues and concluded that co-word analysis has been improved in many aspects in the last twenty years. The main progress can be distributed in two fields:

1) **Source of words**

   The early tests used the keywords assigned by indexers. Later, words in the title, summary, and abstract are used. Currently, the technical developments in full-text indexing make it possible to use words in full-text to do a co-word analysis. This will reduce the indexer effects greatly.

2) **Measurements**

   The measurements used in co-word analysis have improved. The early co-word analysis used the inclusion and proximity indexes. A more general index, e-coefficient, was proposed later. Density and centrality are two other important measures that enable us to draw a strategic diagram.

Noyons and Raan (1998) conducted a research to optimize the methods of co-occurrence analysis. They tried to create a map more understandable with application of graphical user interfaces. Users could obtain more detailed information of the mapped research areas based on their needs through the user interfaces and found that this interface enables the users of the maps to focus onto their specific areas of interest and to determine the position of actors in the field.

Coulter, Monarch and Konda (1998) conducted an empirical research that demonstrates the effectiveness of Content analysis using co-word tool to analyse the research literature of the software engineering discipline. The results suggested that certain research themes in software engineering have remained constant, but with changing thrusts. Other themes have arisen, matured, and then faded as major research topics, while still others seem transient or

immature. They found Co-word analysis as a specific technique that identifies associations among publication descriptors (indexing terms) from the ACM Computing Classification System and produces networks of descriptors that reveal these underlying patterns.

Bhattacharya and Basu (1998) investigated the use of co-word analysis method to understand the micro structure of a research specialty. This study was done in the area of Condensed Matter Physics (CMP) taking two time-periods, 1990 and 1995. A co-word pairs were constructed Using words extracted from the titles of research articles of twenty two concurrent journals set. These words and co-word pairs were explored further to understand their linkages with each other through network analysis methods. Dynamics, within the CMP across 1990 and 1995, are investigated through the comparison of the words, co-word pairs and structurally equivalent blocks and he found co-word analysis is a good to uncover the new research area.

Cambrosio et al. (1993) used a co-word analysis to examine biological safety literature of over 70 years. The database used in this project is the Songer Safety Bibliography (SSB) which lists around 17 000 references. The results showed biological safety to be a very fragmented field, characterized by the existence of several relatively independent foci of interest, none of which has been able to structure the field into a tight network. Early periods of activity were marked by the construction of the basic tools of biological safety practices. Those tools became a "robust package' which, in more recent periods, was used routinely. While the safety problems related to recombinant DNA (Deoxyribo Nucleic Acid) research have received much attention in the general press, they do not seem to occupy a prominent place within the biological safety literature.

Callon, Courtial and Laville (1991) made a study to show how co-word analysis techniques can be used to study interactions between academic and technological research. It is based upon a systematic content analysis of publications in the polymer science field over a period of 15 years. The results related to: a.) The evolution of research in different subject areas and the patterns of their interaction; b.) A description of subject area “life cycles”; c.) An analysis of “research trajectories” given factors of stability and change in a research network; d.) The need to use both science push and technology pull theories to explain the interaction dynamics of a research field. The study developed a co-word technique to build a bridge between research in Scientometrics and work underway to better understand the economics of innovation.

Whittaker, Courtial and Law (1989) conducted a study to identify the adequacy of the co-word method for mapping the structure of scientific inquiry is explored. Co-word analysis of both the keywords and the titles of a set of papers in 'acidification research' were undertaken and the results were found to be comparable, though the keyword-derived results provide greater detail. This strongly suggested that keyword indexing could not distort co- word findings. It also pointd to differences between titles (which often emphasize the supposed originality of an article) and keywords (which tend to show the relationship between the paper and other publications). The paper also explored important differences between the methodological assumptions that underlie the Paris/Keele co-word clustering algorithms and the factor analysis method for creating clusters.

Leydesdorff and Zaal (1988) conducted a study and criticise the different method of clustering and suggested that 'ward' method of clustering is better suited for symmetrical metrics than single linkage clustering because of the large number of zero hits which may lead to 'chaining' in the first cluster and isolates.

2.3 Citation Pattern

Exchange of information is crucial for any walk of life. It plays a very important role in the multidimensional progress of a discipline. In, formal communication, references or citations are evidence of exchange of information. A reference appended to a publication indicates citation to other publication. A work's reference made in its footnotes or endnotes are outgoing mail that it sends to older work (Price, 1970). Citation studies have been used to determine the impact of the literature on a field of a study or to analyse research activity or to analyse the available resources or to analyse interdisciplinary nature of a discipline. There are a number of studies on citation pattern of journals articles that have been reviewed as mention below:

Misra and Dutta (2014) analysed the citation pattern of *Annals of Library and Information Studies* of three years (2010-2012). A total of 2318 citations collected from 106 research articles. The study found that majority of the papers (57.7% papers) were written by single author. There were 2061 cited authors and nearly 350 cited journals. The citation age of majority of documents was not more than twenty years ago. The Bradford's law and Lotka's law was verified for the cited journals and authors respectively. It has been observed that the respective distribution patterns fairly in consonance with these two bibliometric laws.

Garg and Bebi (2014) carried out an analysis of 371 (143+228) articles published in *Annals of Library and Information Studies* (ALIS) and *DESIDOC Journal of Library and Information Technology* (DJLIT) during 2010-2013. The findings revealed that DJLIT published more papers than ALIS and also received more citations. However, citation per paper for both the journals is almost equal. DJLIT have a better immediacy index than ALIS. The impact factor of both the journals was less than one in 2012; however, it increased in 2013 and was more than one in 2013.

Das (2013) critically analysed 239 scholarly communications published in the first five volumes of *Journal of Informetrics* (JOI) during the period 2007-2011. Findings revealed that publication output doubles over the study period as article publications increase considerably; though single-authored contributions were significant (30%), the majority of contributions were collaborated by two-authors (36%), while average authorship accounts for 2.28 per communications. The Degree of Collaboration (DC) was impressive (0.699). Ranking of prolific contributors has shown Prof. Egghe on the top followed by L Bornmann; R Rousseau and L Leydesdoff. Result also showed an upward trend of keyword usage of H-index, Citation analysis, Bibliometrics, G-index, etc, expectedly predominates. The study also showed that the journal takes an average of about four months to publish a manuscript.

Singh, Sharma, and Kaur (2011) conducted citation analysis and examined 15587 citations appended to 487 articles published in the *Journal of Documentation* from the year 1996 to 2010. The study found the highest average number of citation per article i.e. 45.9 in the year 2009; Single authored citations are dominant than others and it is 201 (49%). This study also revealed that *Journal of Documentation* is the most preferred journal used by authors in their citation. The paper concludes that only 10 core periodicals can cover more than 2951 (16 %) references.

Deshmukh (2011) examined citation pattern of published articles in Annals of Library and Information Studies during the period 1997-2010. A total of 4141 citations appended to total 326 published articles. The result showed that the source journal is the most cited and there was a dominance of single-authored paper. The half-life of LIS literature was found to be 9 years for journals and 14 years for books respectively. The average citation per articles was 12.70 citations and the most cited journals were *Annals of library and information studies*, *Scientometrics*, and *Journal of American Society of Information science*.

Sudhier (2009) carried out a study based on Journals cited by the Physicist at University of Kerala to examine the applicability of Bradford's law of scattering on a sample of 2660 journals containing 3796 citation collected form 12 doctoral these during the period 2004-08 and found that scattering patterns of journals not fit to Bradford's law of Journal scattering pattern.

Odell and Gabbard (2008) brought out a citation analysis to identify measure of interdisciplinary nature of Library and information science. He collected citation data from Journal Citation Reports (JCR) 1996–2004. The findings of the study replicated Meyer and Spencer's analysis of other-field citations to Library and Information Science (LIS) journals from 1972 to 1994. After 1994, the study also found that JCR added LIS journals emphasizing empirical, information science research and simultaneously dropped journals addressing the profession of librarianship. The newly added journals attract a broader interdisciplinary readership— a readership reflected in a 14 percent increase in other-fields' citations in the LIS journals.

De Groote (2008) conducted an analysis to assess the impact of online journals on citation patterns by examining whether researchers were more likely to limit the resources they cited to those journals which were available online rather than those only in print. He found that citation of print-only journals by researchers with access to a library with a large print and electronic collection appeared to continue, despite the availability of potential alternatives in the online collection. Journals available in electronic format were cited more frequently in publications from the campus whose library had a small print collection, and the citation of journals available in both print and electronic formats generally increased over the years studied.

Singh, Mittal, and Ahmad (2007) undertook a bibliometric study of 1,000 articles related to Digital library for the period 1998-2004 was collected from LISA Plus. The study revealed that the most of the articles (61%) were single-authored. The author productivity was not in agreement with Lotka's Law, except in one case where number of articles was three. The maximum number of articles were published in 2003, English was found the most productive language in the phenomena; a large proportion of articles were published in the journal *D-Lib Magazine*; distribution of articles nearly follows Bradford's Law; and the USA ranked first for maximum number of journals.

Haridasan and Kulshrestha (2007) conducted citation analysis of articles published in the *Journal Knowledge Organization* during the period 1993-2001. The data included 2462 citation appended in 115 articles. The study revealed that the average number of citations is around 21 per articles. The major source of information is books and documents published during the latter half of the century (1982-91). Authors from the USA, UK and Germany are the major contributors to the journal. India was ranked seventh in terms of contributions.

Asha (2007) analysed 675 articles and 9036 appended citations of the *Journal Demography India* from its establishment year 1972 to 2001. The study found that books had a higher proportion than journals. The Journal had 4.3 percent journal self-citation rate. The four journals, which came before the Journal Demography India were foreign journals, in the order of highly cited journal. The rate of citation per article was 11 and the average age of cited documents was 9 years.

Shokeen and Kaushik (2004) carried out a study on authorship pattern and citation pattern of the article that appeared in Indian Journal of Plant Physiology during the period 2002. Overall, 1149 citations featuring 2770 authors were analysed. The study found that 39% articles published (citing articles) in these issues are three-authored. However, it was found that two authored citations (cited articles) are more common. The journal articles are predominant with 81 % of total citations. The results also highlight that 398 citations are below 10 years old, whereas 358 citations are below 20 years but more than 10 years old. It is clear that a majority of documents cited in these issues were published not more than twenty years ago.

Koley and Sen (2003) presented a study that covered 457 citations appended to 26 research articles published in *Indian Journal of Physiology and Allied Sciences* during the period 2001. He found that the solo research in physiology is quite substantial (about 24%). About 77% of the work was the result of team research; the team size was ranging from 2 to 5. Of the citations, 76.81 per cent citation relate to journal articles and 18.59 to monographs. The ratio of Indian to foreign citations was found to be almost 1:6. Author self citations were found 4.59 percent and 2.84 percent citation were journal self citations. No collaboration was noticed in the case of 23 citing articles. The other three articles were the results of two-institution collaboration.

Al-Qallaf (2003) investigated the citation patterns of a journal Medical Principles and Practice of 12 years (1989-200). The data set includes 4740 references from 221 original

research articles. The study addressed (1) bibliometric patterns of cited works in terms of publication format, subject scatter, authorship characteristics, the age of citations, geographic distribution, and language distribution; (2) productivity of journal titles; (3) the role of self-citation; and (4) how selected bibliometric indicators apply. The study revealed that journal articles were most frequently cited; English language publications dominate the literature; there was a trend of multiple authorship, and the pattern of aging was below the norm for medical literature.

2.4 Authorship and Collaboration

As a member of a research community, scientists or social scientist work jointly to understand the mysteries of nature and to lay a theoretical foundation upon which a structure of technology may be built. In word of Patel (1973), scientific collaboration can be defined as a process of functional interdependence between scholars in their attempt to coordinate skills, tools, and rewards. Beaver and Rosen (1979) also define Collaboration is a key element in the advancement of knowledge and in the productivity of research in any field. Research collaboration bridges the different pieces of knowledge and integration allows for the creation of new knowledge, therefore collaboration is greatly emphasised and encouraged. Multiple authorships are an indication of collaborative work. Some key research work on authorship and collaboration reviewed here:

Aswathy and Gopikuttan (2013) analyses the publication pattern of faculty member of three universities in Kerala. Authorship pattern, collaboration, the appropriateness of Lotka's inverse Square Law and year wise and Designation wise distributions had been studied. The study found that multi- authorship dominates among university teacher and there was no statistical significant difference between experience and productivity. Designation-wise Degree of Collaboration showed that Professors had high Degree of Collaboration which indicates that increase in the age and experience results in more collaborative papers. The Lotka's inverse square law was rejected for the studied data set.

Ram (2011) analysed PubMed database for the period of 1996-2010 to study the growth of research on Artemisia that is used worldwide for Malaria treatment, including research distribution by country, type of publications, journal authorship patterns, and Indian publication activity on Artemisia. The study found that only 9% paper contributed by two authorship and rest most of the paper (90%) were written be more than two authors.

Pradhan, Panda, and Chandrakar (2011) examined trends in authorship pattern and author's collaborative research in Indian chemistry literature with a sample of 53,977 articles downloaded from SCI-Expanded database during the period 2000-2009. The study showed the average number of authors per article was 3.55 and the mean value of degree of collaboration over 10 years was 0.97. Thus, the study found that the researchers in chemistry are keen towards team research or group research rather than solo research.

Jain and Kumar (2011) made a measurement of research productivity of Indian scientists contributing to world soybean research between the years 1989 to 2008. The activity index of India decreased gradually. The growth rate was also decreased gradually and correspondingly doubling time has been increased. The paper revealed a high degree of collaboration with 93.10% contributions of joint authorship. The average collaboration coefficient was found 0.931 and average collaboration index value was found 3.115. Lotka's Law was applicable to the study, and Most of the authors attained the low dominance factor value.

Arya and Sharma (2011) analysed data collected from 'CABI abstracts" for the period of 2006-2010 to highlight the collaboration in research and authorship trend in the area of veterinary sciences all over the world with special reference to India. The findings of the study revealed that collaborative research has been preferred by the scientists over that of solitary research. Average degree of collaboration was found 0.84, which also indicates dominance of collaborative research over solo research. Subject analysis showed a good research in the area of animal nutrition and veterinary physiology.

Ardanuy (2011) studied the level of co-authorship of Spanish research in Library and Information Science (LIS) until 2009, the data were collected form Web of Knowledge. The chronological development that took place, and the level of local, domestic and international cooperation. The results showed a significant increase in all co-authorship, including publications in English and those involving international collaboration. As with the increase in Spanish participation in social science (WoK), this growth, coupled with the significant increase in Spanish scientific production in the area of LIS is the evident that the discipline in Spain had entered a more mature phase.

Park (2010) made a bibliometric analysis of *D-Lib Magazine*. Data was collected by examining issues from the Magazine's launch date, July 1995 to the issue dated May/June

2008. The impact of *D-Lib Magazine* was investigated by utilizing Web of Sciences (WoS) databases and its analyzing tools. The study found that 77% of authors made a single contribution to *D-Lib Magazine*. About 2% of all authors contributed five or more times over the period. *D-Lib Magazine* appears closer to a scientific co-authorship pattern than other information science journals. There was a dominance of male author (74%). A high proportion of authors are affiliated with the US institutions (70%), and the US leads digital library research and development. The proportion of international authorship in *D-Lib Magazine* seems to be about average compared to other journals in the LIS field.

Zafrunnisha and Pulla (2009) carried out a study of authorship pattern and collaborative research in the field of Psychology. The data were collected from 141 Ph. D theses during the period 1963 – 2003. A total 14374 journal citations came out and were investigated. The study found dominance of multi-authored papers over single authored papers. The degree of collaboration in Psychology was 0.53. USA defenses first by producing 42.28% of cited journals. Majority of the cited journals of Psychology (94.54%) were in English language.

Akakandelwa (2009) contributed an informetric analysis of 220 paper published by academic faculty at the university of Zambia form 2002 to 2007, the data were downloaded from the Thomson Reuters Database and analysed authorship patterns and collaboration. It was found that the degree of collaboration varied form one discipline to another and collaboration was more intensified in the applied science. Further, the result confirms that the patterns of collaboration between UNZA researchers and foreign researchers fit the Lotka Law distribution.

Sevukan and Sharma (2008) made a bibliometric study of publication of biotechnology faculties in central universities of India from 1997-2006. The data used for the study were retrieved from two database sources, namely, PubMed, NCBI (National Centre for Biotechnology Information); and ISI Web of Science database—Science Citation Index Expanded (SCIE). The result showed that two-authored publications predominate amongst the pattern of authorship and collaboration co-efficient was 0.65; applicability of Lotka's law was validated from the values n = 2.12, C = 0.669, and D = 0.027 obtained using least square method. However, the application of Bradford's law does not fit to the literature analysed.

Willet (2007) carried out a study to identify the authorship pattern of the articles contributed in the *Journal of Molecular Graphics and Modeling* published in the volumes 2-24 during

the period 1984-2006. The study found that the author productivity was followed the Lotka's original distribution.

Ramakrishnan and Babu (2007) analysed the literature output in the field of hepatitis from three bibliographic databases, namely MEDLINE, CINAHL and IPA, and found that One-third of the citations indexed had more than five authors. 85.17% of the total contributions are tending to be collaborative research with different degrees of collaborations ranging from 0.82 to 0.86.

Pillai (2007) analysed the trends of authorship pattern, and collaborative research in physics with a sample of 11,412 journals citations and 1,328 book citations collected from the doctoral dissertations of IISc (Indian Institute of Science, Bangalore) during the period 1999-2003. The study found that 'Team research' is preferred in the field of physics rather than 'Solo research'. The average value of degree of collaboration in journals was 0.80 and 0.44 for books. The authorship collaboration is more in journal articles than in books.

Harirchi, Melin, and Etemad (2007) investigated factors behind co-authorships between scientists in the field of Physics, Chemistry and Biology in Iran and elsewhere. The study also compares the Iranian pattern of collaboration with other countries. Questionnaires were used as a tool for the study of collaboration of Iranian scientist who had internationally collaborated paper. The collaborative motives behind the co-authorships were identified as sharing laboratory devices, accessing knowledge, and increased efficiency of the study at hand. The study found that emigrated Iranian scientists play an important role as collaborators and probably also as links to the international scientific community as a whole. Cultural factors mix with scientific and work related ones. Although the proportion of international co-authorships is lower than in most other countries, the collaborative pattern seems rather similar.

Mittal, Sharma, and Singh (2006) analysed 536 published on Library and Information Science education during the period 1995 to 2004. The productivity of authors and core periodicals were determined and Lotka's and Bradford's law were tested. The study found the sample of data did not fit to Lotka's and Bradford's law that most of the papers (72.8%) were contributed by single authors, followed by two authors (20.69%).

Wagner and Leydesdorff (2005) studied the nature of collaboration in Science; the data were drawn from the Science Citation Index (SCI) CD-Rom version 2000 of the Institute for

Scientific Information (ISI) for six fields of science. The study found that researcher decides on his or her research partners, rather than institutional or official arrangements being made in forming a research team. Using network analysis, preferential attachment explained how international networks of co-authors are formed. How researchers themselves independently select and organize research partnerships, coupled with the dynamic intertwining of co-operation and competition among researchers, are complicated processes to understand.

Cronin, Shaw, and Berre (2003) examined the 100 volume of *Psychological Review*, and *Mind.* The observation revealed that the co-authorship and sub-authorship collaboration in the scholarly journal literature of Psychology (*Psychological Review*) and Philosophy (*Mind*). The study revealed the nature and extent of sub-authorship and co-authorship collaboration. It highlighted the rates of co-authorship and importance of collaboration and increasing division of labor in contemporary research and scholarship.

He and Spink (2002) examined the geographical location of foreign authors of 50-year publication of the year 1950–1999 of the *Journal of American Society for Information Science & Technology* (JASIST) and *Journal of Documentation* (JDoc). The distribution of foreign authors by geography locations was analysed for the overall trends in JASIST and JDoc. The study found, UK and Canadian authors were the most frequent foreign authors in JASIST. Authors from the United States and Canada are the most frequent foreign authors in JDoc. The top 10 geographical locations with the highest number of foreign authors and the top 10 most productive foreign authors were identified, and compared their characteristics and trends.

Farahat (2002) examined the patterns of authorship in articles of nineteen Egyptian journals in the field of Agricultural science of the year 1960, 1970, 1980, and 1990. The study showed that multiple-authorship was predominant and the most common form of multiple authorship involved three authors only. Considerable variation was found among sub-fields, and co-authorship was found to be most common in social-science related agricultural disciplines. The study concluded that there were no significant differences in patterns of collaboration in the agricultural sciences in Egypt over the year.

O'Neill (1998) examined the authorship pattern of two theory-based journals; one is from *American Journal Educational Theory* (1955-1994) and another from *Canadian Journal of Educational Thought* (1970-1974). He found that majority of authorships were single in both

the journals regardless of the date of publication against de Solla Price's prediction that co-authorship would eventually increase and single-author paper will be extinct.

Drenth (1998) conducted a study about the authorship of article that published in *British Medical Journal* over 20 years (1975-1995). The study revealed an increase in the number of original articles and productivity of senior scientists. The designation wise analysis indicates that the professors and department chairpersons contribute more publication than other categories.

Melin and Persson (1996) examined co-authorship of articles. The data were collected form Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI) and discuss how co-authorship data can be retrieved, standardized, and analysed for the questions associated with co-authorship. The study also discussed the relationship between collaboration and co-authorship, the nature of bibliometric data, and exemplified how they can be refined and used to analyse various aspects of collaboration.

2.5 Coverage Analysis

Buttler (1991) described a study that analysed 16 library periodicals with respect to Subject coverage and various characteristics. Subject coverage was analysed by computing the percentage of pages devoted to a total of 130 subjects. Because of the diversity in the extent of articles, it was decided that measuring subject coverage by the number of pages devoted to each subject would be a more accurate assessment of how much is written about a topic. The five most popular identified subjects are cataloging, automation, management, and library and information science education and comparative librarianship.

2.6 Research Gap

The literature review on content analysis studies in LIS domain revealed out that most of the studies analysed subjects, themes, geographic location, and research methodology of published articles in LIS journals. The present literature review explored that there is lacuna of significant study that undertook on leading LIS journals *Scientometrics* and *D-Lib Magazine* by 2012 and therefore a need has been considered for conducting a study to analyse content, supporting literature, author group and collaboration trend in journal *Scientometrics* and *D-Lib Magaz*ine to fill the research gap.

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Chapter 3

An Overview of Library and Information Science Journals

Foundation of any subject based on available literature on the subject. Literature represents a record of achievements by the human races in a particular direction. It may be diverse, complex, and multilingual in nature. It has been growing at a fast pace. It is estimated that literature in Science and Technology doubles itself within 5 to 7 years, while in Social Sciences and Humanities it doubles itself within 10 to 12 years (Kishore, 1987, p.131). It is an established fact that literature in any field start growing when the particular field attains a phase of rapid growth in scientific study, and its prestige and potentiality draws a large number of scholars towards the research area of the field. Since last five decades, library and Information Science has been attracting numerous scholars from various disciplines. The increasing numbers of periodicals (Journals, Bulletins, Transaction, Proceedings works etc.) are the evident of the growth. Journal is one of the most important medium of communication for scholars. This chapter covers different aspects of Journals and its availability in LIS field.

3.2 Meaning and Definitions of Journal

The term 'Journal' has been derived from French word 'Jour' and Latin word 'Diurnalis' which means 'Day' and 'of the day' respectively. It has several related meaning as a daily recorded event, a newspaper or literature publishes each day. However, here 'Journal' refers to an academic journal, scholarly journals, and trade journals etc. Journal publications record original research and development or description of a new application or new interpretation of an old theme or idea. It includes original articles and present unfiltered original idea. Journals are a primary source of information which makes available new established ideas and latest information to a learned community. Generally, the term 'Periodical' is the designation most broadly applicable to this part of literature and is used synonymously for the term 'Journal'. Periodical is a broader concept which includes Journals, bulletins, proceedings or similar works, which appear regularly and continuously in numbered

sequence. Journal appears regularly and continuously in unbroken sequence. It can be defined as follows:

1) Huff (1967 as cited by Rai, 1991, p.9), journal is "a publication issued at regular or irregular intervals each issue being numbered consecutively distinguished from other serials is that the process of publication is continued with predetermines termination."

2) ALA Glossary of Library and Information Science (2014, p.144), Journal is "a periodical, especially one containing scholarly articles and/or disseminating current information on research and development in a particular subject field."

3) International Encyclopedia of Information and Library Science (2003, p.340), Journal is "a periodical publication, particularly one issued by society or institution containing , proceeding , transaction, report, substantial articles and review of publication in a particular scholarly or scientific field and the term learned journal is often used."

4) Singh (2013, p.8), "A journal is a collection of articles usually written by scholars who are experts in an academic or professional field."

5) ANE's Encyclopedic Dictionary of library and Information Science (2006, p.142), Journal is "a periodical published by an academic press, learned society, government agency or professional organization intended for scholars, students, professional or experts and featuring articles that disseminate result, critical interpretation or review of scholarly journals or scientific research in a particular subject discipline or professional."

6) Dictionary for Library and Information Science (2004, p.445), Journal is "a periodical devoted to disseminating original research and commentary on current developments in a specific discipline, sub discipline, or field of study (example: Journal of Clinical Epidemiology), usually published in quarterly, bimonthly, or monthly issues sold by subscription. Journal articles are usually written by the person (or persons) who conducted the research."

7) Agrahari et al. (2017), "A journal is a periodical publication which is brought out by learned societies, organizations, and institutions in consecutive issues at regular or

irregular interval, containing different varieties of peer reviewed or non-peer reviewed research communication. These resources are highly reliable for academic and research purposes."

Thus, it can be said from the above explanation that journal is a type of periodical with distinguish title intended to appear in successive number or parts at regular or irregular intervals as rules for an indefinite time. Each journal generally contains research and review articles, letter to the editor, book reviews, editorials etc.

3.3 History of Journal

Journal has a long history, dating back to the seventh century. It lays itself at the heart of scholarly communication system and has stood the test of time. Printing press provides a tool for sharing and communicating thought with others in a form which leads to the birth of periodicals (Sharma, 2000). It was the 5th Jan 1665 when a first scholarly publication takes shape in the world at Paris, France (Das, 2015, p.7). On this historic day, councilor of the French court of the parliament and predecessor of the '*Academic Des Science'* published a scholarly journal entitled *'Journal des Scavans'*. In 1903 it became a publication of learned society and it was taken under auspices of I' Académie des Inscriptions et Belles Letters of the Institute de France. The first issue of it contains 20 pages including 10 articles, some letters and notes.

In the Indian history, '*Asiatic Researches'* was the first journal of India. It was earliest scholarly journal which started its publication in Asia. Its first issue published in the year 1788 by Asiatic Society, India (Sen, 2002). It was established for enquiring into the History, Antiquities, the Arts, Science, and literature of the Asia. Since 1832, it has been publishing as *Journal of Asiatic society*.

The traditional journals are being gradually replaced by electronic journals with the benefits for the libraries as well users in many ways. Historical evaluation of e-journals has been traced to 1960 when a UNESCO report published and advocated the use of computer technology to help solve the problems of printed journal publication (Sasse & Winkler, 1993). In 1980, a journal 'Mental workload' dealing with human-machine interactions in complex system has been identified as the first fully-fledged electronic journal (Nisonger, 1998, p. 26). It was published by New Jersey Institute of Technology, and funded by the

National Science Foundation. During the early 1990, several seminar and conference devoted to electronic journal were organised to discuss the different issue of the e-journal.

A significant trend has been identified during the last half of the 1990s, it was the creation of web based electronic journal, and a number of scholarly, peer reviewed journal also issued. Sassé and Winkler (1993) estimated that there were more than thirty scholarly journal published in 1992. In a study, Harfer and Kim (1996) identified 77 scholarly peer reviewed journal started their e-version.

In the field of library and information science, the first known electronic journal is 'News Letter on Serials Pricing Issue' edited by Marcia Tuttle has been published on 26 February 1989 in traditional and electronic format both. During the early 1990s, many projects started in different countries. Some of them are cited here: Project QUARTET (United kingdom, 1980), Chemistry Online Retrieval Experiment (USA, 1993); TULIP (USA, 1991); Super Journal Project (UK, 1993); JASTOR (USA, 1997) etc.

3.4 Forms of Journal

There are two forms of journal that have been explained below:

3.4.1 Print Journal

Print journal is also known as traditional journal. China's invention of the printing machine and paper both has been a boon for the human. It offers a medium to share their information in written or printed form. In the 16th century, it started to take a shape of sharing knowledge in the form of printed journal. It was distribute to its subscriber by post. It has some benefit over e-journal. It is very comfortable medium to study and no need any additional devices to read it. This format is also useful in archiving information resources. Many research reveals that the printed form of information resources still a useful medium in the era of digital information. Time log is main hurdles for traditional publication. Print Journal losing it popularity but still dominate in academic publications. The fast and rapidly changing technological environment contains inherent future risks for the print version of journals. The print journal can be defined as:

'A journal which is available in the form of printed document and its size and binding style is different to books. Its distribution and access is possible through physical form only.'

3.4.1.1 Characteristics of Print Journal

The nucleus purpose of a library is to provide services to the needs not only of today's users but also of the potential future. It follows that library must have an adequate collection of traditional journals that is accessible and meaningful to both current and future scholars. For many reasons, physical formats will remain in operation and use for many years to come. It is generally said that any new invention cannot annul the former good ones.

The world had seen the era of post office for sending letter from one person to other. Later on, the invention and introduction of different new medium of writing/ typing communication cannot terminate the former traditional medium. Hence, print media is a time-tested format that endows to satisfy the quest of aspirants that technology cannot yet cope-up. The significance and utility of print mode communication are likely to sustain for all times to come without any doubt.

1) **Stability**

   In the internet era, no one knows which information at what time will be eradicated. Almost all the sites, public domain provide fee-based support to the addition and elimination of information; they do not seek the approval of its users. Whereas such freedom is necessary to keep the updated information, it also provides the unannounced deletion of valuable documents. However, when the print journals are published, the content, which they carry, has a greater promise of stability.

2) **Permanence and Completeness**

   The traditional journals cannot be wiped out completely by the publishers, suppliers as in the case of online journals, to keep the database up to date some old publication which is out dated can be removed by its publishers desirably which cannot be recovered in future. However, printed journals has quality of permanence and completeness, any libraries can subscribe them immediately or later through inter library loan (ILL). On the other hand, as the journals are published electronically, publishers' wish to provide only the most recent information may require it to overwrite the draft documents. However, only a very few publishers, knowingly and actively preserve electronic records of deliberations and drafts. Print journals are complete in all respect as compared to the equivalent online version where the information is available in fragments.

3.4.1.2 Advantage and Disadvantages of Print Journal

Print journals are an authentic source of scholarly communication but today it is not as much popular as earlier. No timely access to information through this format makes it down but we cannot avoid its various advantages like.

3.4.1.2.1 Advantages

1) Print journals can be preserved easily without any extra expenses and retrieved by users whenever it required.

2) Portability and handy format bound user to consult print journals. It can be carried out at home, labs, departments etc wherever it needed. Many journals can be consulted at the same time.

3) It does not have any technological/ mechanical hurdles like loss of data.

4) It does not need any technical device and support to read; even a layman can read it easily.

5) Print Journals provide the most dependable facets of research.

6) Its format very suitable for eye and can read for long time

7) Information can be disseminated to a widely scattered group of readers ;

8) Details information such, as descriptions of methods, tables, diagrams, result etc. can easily be given.

9) It does not need network access or electricity

Mukherjee (2010, p.4) pointed out following advantages of printed Channels of communication:

1) Information can be disseminated to a widely scattered group of readers,

2) Detailed information, such as descriptions of methods, tables, diagrams, results etc. can easily be given,

3) Printed documents contain information which can be critically examined and verified,

4) The document can be easily to referred to as and when required, and

5) Published documents provide a means for establishing 'priority' of academic work and there by contribute to establishing academic merit for authors.

3.4.1.2.2 Disadvantages

There are following disadvantages of printed journals as given below:

1) Delay publication and time lag are its big drawback,
2) It cannot be accessed anywhere whenever user needed,
3) It is very costly and cannot be transferred easily,
4) Physical nature of print journals create problem in portability,
5) It can be lost, stolen or otherwise misplaced, or damaged or destroyed,
6) Information cannot be searched very easily in this format, and
7) It is very difficult to analyze its content for research purpose.

3.4.2 E-journal

Electronic journals are very speedy medium of scholarly communication and well known by the name 'e-journal'. This mode of scholarly communication is the trend of latter part of 20th century and came into the wake of advances of information and communication technology. An e-journal might be available only in electronic format, or it may be an electronic replica of a journal that is available in print form. Initially, these were available on CD-ROM but today in the age of internet, these are accessible via the web, email, or other means of internet approach. Some web-based journal (e-journal) is graphically modeled on the print version. There are various variant terms of 'e-journals'.

a) Online journals,
b) e-journals,
c) Electronic Journals,
d) e- Serials,
e) Electronic periodicals,
f) e- Periodicals,
g) Zines , e- zines or webzines.

Many scholars have defined e-journal as given bellow:

1) Lancaster (1995), "Journal created for the electronic medium and available only in this medium."

2) Harrod's Librarians' Glossary and Reference Book (2009, p.243), "A journal which is available in electronic format, a physical, printed version may also be available."

3) Dictionary of Library and Information Science (2004, p.243), "A digital version of a print journal, or a journal-like electronic publication with no print counterpart, made available via the Web, e-mail, or other means of Internet access."

4) Jose and Pacios (2005, p.189), "Electronic Journals are journals whose full text is available on the web, including both those that began in paper print form but later incorporated the electronic version and those which were in electronic format from the beginning."

5) Curits (2005), in simplest term, "electronic journals meets the bibliographical definition of serials; is accessible through computer; and has feature of a journals, magazine or news letter."

It is clear from above scholarly explanation that e-journals are digitized form of journals that are produced, published, and distributed electronically and their print counterparts may or may not be available. Digital conversion (scan copy) of print journal is also included in e-journal.

3.4.2.1 Characteristics of E- journals

Electronic journal still shake down period. Each new medium begins by imitating its predecessor, so despite the dramatic difference between the printing press and electronic of online journal of the present transported to a computer screen. Following features have been identified in e-journals:

1) **Accessibility**

   Accessibility of e-journals through web have liberated user from confine of time and space and made it available 24*7 hrs remote access is the access or local accesses is the strangest points which attracts to its user. The thorniest situation the web has created for both libraries and publishers (on behalf of Authors, shareholders and readers) is process of restricting the use of e-journals to those who are authorized to use them through license agreement and payments.

2) Web Presentation

As the pre publication process of journals is now largely electronic, so publishers of print journals find it more economical to scan the printed page than convert from one electronic format (suitable for print publication) to another (suitable for web format). There are two types of technology for web publication Born digital and Converted digital. Today journal publishers are using both technologies making their article published on web. Mostly online journal provides their article in PDF and Markup Language (HTML, XML, and SGML) to take better advantage of the web environments. Some Scientific journals provide their article in some special file format, such as Latex (to optimize the expression of scientific notations), Postscript, and Math ML etc.

3) Multimedia Objects, Data Files, and Other Supplementary Materials

The internet provides excellent opportunity to extend on online journal for beyond the limitations of ink paper. As internet bandwidth increase and the cost server space decreases, these opportunities become more attractive and practical. The cast of using color and pages is restrictive in print but no problem on the web. The size limitation of print journal determines the length and number of articles and incorporation of supplementary items (like data file, image, video, voice) into the printed text is a big problem but in web and electronic environment, to link supplementary materials into the published content become very easy. Now, it becomes very easy in the electronic environment to:

a) Share 3D models and graph

b) Manipulate image and laboratory data

c) Share programming code concerned to the article

d) Share animation audio, video files.

A link inside an article provides access to a reader into referred or specialised database. E-version of print now started to take advantage of web capabilities at this point. A study of five publisher's e-journal (Kichuk, 2003) found 52 types of file

formats in the publication of e-journal and these file formats are supported by twenty-two types of plug-ins.

4) Immediacy

It is another feature of web-based publication. Mostly, all publishers of print version are behind the scheduled time of an issue. The print version and online version both process of publication passing through selection, review, editing, and revision to have a sufficient number of articles for an issue of predetermined size. After the mentioned process, with some technical support, online version of publication become ready to spread over the world but the print version requires some more time for printing, compilation and further more time in reaching to the library or other subscriber.

A recent improvement to several publishers' sites is the availability of articles that are ready for publication before compilations of an issue. For example, Springer-Verlag offers an 'Online First' in this section articles become available before an issue is compiled. In this fashion, Blackwell Journal offer 'Online Early', Wiley Interscience offer 'Early View' and ScienceDirect has an 'Article in Press' section on the content page of many journals and each unpublished accepted article are also available online labeled either 'In Press-uncorrected Proof' or 'In Press-corrected Proof'. A corrected proof is in final form of publication that does not has pagination and issue number.

5) Searchability

Searchability is a unique feature and advantage of electronic journals over their print counterparts. Once an article on monitor its text is usually searchable (except in case of a scanned copy of print journal). Today mostly all publisher or host site provides a facility for simple search and advance search. With the help of theses both option a database can be searched with author name, subject, keywords, year etc.

6) Linking Facility

E-journals are intertwined through the linking system. Today, it becomes very easy to link a table, graph, and citation to a text within an article. Sometimes, publishers

provide a facility of cross-reference to link a source article to cited article within a database and sometimes out of database also.

7) **Interactivity**

Articles in the printed and digitalised form of journal frequently include authors' address and their e-mail address. In case of electronic journals, readers are allowed to initiate an e-mail message with a click. In this way, it provides direct contact between author and reader. On other hand, readers of the printed journal cannot be facilitated with this type of services.

8) **24*7 hrs Availability**

Another major strength of electronic journals is their availability at any times and any place where the internet can be accessed. If you have download an article and stored in any system it can be ported anywhere easily without any additional weight and space.

3.4.2.2 Advantages and Disadvantages of E-Journal

Electronic journal bring many benefits to users, libraries and publishers. Simultaneously it has some great drawbacks as given below:

3.4.2.2.1 Advantages

1) Electronic- journals provide benefit to users and publishers in the way that they are available to authorized users on anytime and at anywhere,

2) One can interact with other related electronic resources with a click,

3) It saves users time through desktop or other electronic gadgets access wherever they want,

4) It provide enhancement support and searchability that is unavailable in the print environment,

5) E- journal become available on the web and can be spread out over the world much earlier than they are available in print,

6) It can be read by more than one person at a time on different monitor,

7) It is generally suitable for adoptive technology for visual impairment,

8) These materials do not be stolen and or vandalised,

9) This form of resources are superior resource for delivering for distance education,

10) It improves the service to homebound user,

11) It reduces shelving and processing cost,

12) It reduces staffing for claims or replacement of misplaced or missing issue

13) It reduces compilation, binding, and distribution cost,

14) It increases accessibility of resources by people to more research information.

3.4.2.2.2 Disadvantages

1) The coverage of content is not always as complete as in the print version,

2) The long term preservation of e-resources is not assured,

3) Some e-journal is less suitable than its print version in lacuna of adoption of new technologies,

4) The technical difficulties sometimes render them temporarily unavailable,

5) Managing of e-journals always requires relocation resources,

6) The stability of the market become upset and sometimes libraries suffer as in demise of the vendor.

3.5 Generation of E-journals

Duranceau and others. (1996).identifies two generation of e-journals, which are pointed out below:

3.5.1 First Generation

Characteristics of First generation e-journals are:

1) Based on ASCII text files and used a simple file structure,

2) Published by individuals or groups of scholars rather than commercial or university presses,

3) Disseminated through e-mail; thus making check-in easy,

4) Copyright restrictions waived by publishers,

5) Because of 'small file sizes, ASCII text format, and lack of access restrictions', local library storages cost relatively little in file space and staff time,

6) Uncertainty about server and archive stability.

3.5.2 Second Generation

In contrast to the first generation, second generations of electronic journals are more likely to:

1) Be based on HTML or 'specially formatted files' for distributions on the www rather than on ASCII text,
2) Have more complex file structures (specially for multimedia),
3) Require more storage space,
4) Be fee-based rather than free and thus concerned with copyright,
5) Determine delivery of information resources to a person without e-mail address,
6) Be difficult to check-in due to links to other sources on the internet, and
7) Be published by university presses or commercial publishers rather than individuals or groups of scholars.

3.6 Types of Journals

Literary content and sponsoring bodies of a journal make it distinguishable to other publication. Many scholars have categorised journal as given below.

Grable (1937, p.19) as cited by Mittal (2007, p.392) categorised periodicals (journals) on the basis of literary content:

1) Those intended to foster the interest of knowledge
2) Those intended to foster the interest of trade, Profession or society.
3) Money-making venture. (Intended for popular appeal).

Grenfell, D. (1953, p.1) classified periodicals (journals) on the basis of Sponsoring bodies are:

1) The publication of Societies and other Organization,
2) House journals, it is a publication of firms and similar bodies,
3) An independent periodical.

Publication of Societies and other Organisations used to publish memoirs, proceedings, and transaction of various societies such as ASLIB Proceeding, IASLIC Bulletin etc. These publications are the result of the conferences, seminars and various events of societies and organisations.

House journals include those articles which are issued by various firms and bodies and are meant generally to distributed free of charge amongst a limited circle of clients and members such as Information Bulletin, ASLIB information.

Independent Journal includes the whole of the universe of knowledge such as The Caravan, Nature etc.

Singh (2013, p.8) also categorized journals (periodicals) into following three types:

1) **Non-commercial journal**

   Publication is one of the major activities of learned societies, academic institution, and other organisations. A significant number of journals are published by them. The main purpose of these journals is to furnish an opportunity for the researchers to publish the result of their investigation. Societies encourage their scientist and researchers to undertake research work and publish the result of their investigation.

2) **Commercial Journal**

   Majority of the journals in the field of Science and Technology are produced by commercial publishers. Most of them are available in print as well as in digital form. The journals published by commercial publishers are increasing day by day.

3) **House journal**

   It is a journal produced periodically by industrial organizations, business houses, etc. It is published generally for the benefit of staff for updating information in related technology and about the organization not to gain any profit. There are two types of house journals:

   a) **External Houses Journal:** It is circulated outside the company publishing it, among clients.

   b) **Internal House Journal:** It is circulated to the personnel working in the company only.

House journal is used to disseminate information about the function, activities, products, and services of the parent body which issue them.

Keeping above description in mind, journals can be classified in following categories:

1) **Academic Journal**

Academic journal is also known as scholarly journal and it is intended to a particular research community. It is usually peer reviewed publication which published at a stated interval or irregularly. It carries original knowledge to a particular academic discipline. It is a primary information resource for introduction and presentation for scrutiny of new research and critique of existing body of knowledge. It includes articles explaining original research, review articles and book review.

2) **Peer review Journal**

Peer review means referring. It is a process to scrutinize an author's scholarly work research by experts in the same field. The work may be accepted, considered acceptable with revision or rejected. Peer review requires a panel of experts in a given field who are qualified and able to perform a reasonably unbiased review. Reviewers check article's authenticity and originality arising quarry related to article's content to concerned scholar. On the basis of expert's view, it may be accepted or rejected. It takes several week and months. The number of peer reviewers or experts varies according to journal's editorial practice, typically no fewer than two. Peer review journal generally concentrates on two types of articles:

a) **Research Article**

A research article is a primary resource of scholarly communication; it reports the methods and results of an original study performed by the author. There may be different types of study (it could have been an experiment, survey, interview, etc.), but in all cases, raw data have been collected and analysed by the authors, and conclusions should be drawn from the results of the analysis.

b) **Review Article**

Review articles also called reviews of progress. It analyses or discusses previously published research works rather than reporting new research result. Review articles has significance, as they draw findings upon the articles that they review to suggest new research gap or directions, to strengthen a support for existing theories and/or identify patterns among

existing research studies. There are two types of review article- systematic review and literature review:

I) ***Systematic review*** determines an objectives list of criteria and finds all previously published original experimental paper that meets the criteria and then compares the result presented in the articles.

II) ***Literature review*** provides a summary of authors believes, and most relevant prior publication on a specific topic. some literature review article is presented to be peer-reviewed and some may not, it varies according to journal's editorial board policy

3) Trade Journal

A trade journal is a periodical, which brought articles for professionals who work in particular discipline, trade or industry. It represents news and trends in a field, but not original research, its main goal is to keep members of the industry abreast of new development. It provides reviews on products or services, Job listing, and advertisement.

3.7 Importance of Journals

Journals are vehicles for the current research output of knowledge. Its role in catering researcher's thrust, creation, and dissemination of information cannot be underestimated. Journal is the best resource to update ones knowledge in a library for the scientist and scholar of higher education. In the word of Crane (1957, p. 64) stated that a book is out of date but a live journal can and keep up with the onward march of scientific discovery. These words show the importance and value of periodicals literature. Regular scanning of journals makes a scholar able to keep abreast of the current development in a knowledge body and advancement in a technology on their track, and give a right direction to their research and draw substance for their research work.

Journals provide a grand platform for communication of ideas and transmission of current development, exchange of experiences in social sciences and science and technology. Many studies show that journals growth in number is rising with a fast speed (Mabe and Amin, 2001; Mabe, 2003; Larsen and Von, 2009). Regular publication of journals ensures that it conveys more update knowledge in a suitable format in a discipline. Journals provide full

scope far catering ideas which are not capable themselves to develop to a suitable length for publication. It is a matter of honor to be published a publication in a reputed referred journal. Journal's literature has special format for knowledge presentation and play a role as a formal communication device among scientist.

It is fact that nascent ideas, discoveries, and novel presentation of experiences first appeared as journal's article. Therefore, a large number of research articles come from research lab, thesis, and project do not attract any other form of publication and looks a place in a journal. Journals are primary documents that include only that articles/information that has not been abstracted, and indexed anywhere. They are the first and after publication in a journal, the concept and ideas, and discovery and experiment become records of original research, development and a new account of science and technology only. It is important for an information center and library to subscribe and archives all issues of these sources for catering needs and demands of their users.

The information contained in journals is almost invariably more up-to-date than that appears in books. Journals usually report the result of recent investigations more quickly than a book. Information on new process and discoveries can appear in journals within weeks of their formulation, the same might take two to three years before the same can appear in a book.

Today subscription of journals has become more important and crucial than books because of their users. This fact becomes evident of various studies, which concludes the use of journal is more than books (Bhat, 2014; Singh & Agrahari, 2014). Among the literary wealth in a library and information science filed, academic journals hold the first place harvesting 409 publications and forming 51.31% of the total publications (Wani et al, 2008).

The quality of journals can be accessed calculating impact factor (Saha, Saint, and Christakis, 2003) which reflect average citation rates for articles (Garfield, 1999); a high impact factor shows that a journal is important in generating a new idea, concept, and research in the field in its field. Schaffner (1994) identified five distinct roles of a journal are: building a collective knowledge base; communicating information; validating the quality of research; distributing rewards; building scientific communities. Curiosity-driven research leads to specialisations, which increase depth of a subject focusing a micro area of Library

and information science. It is a journal, which carries scholarly information scholar to scholar over the world.

3.8 Growth and Development of LIS Journals

It is well known fact that that the field of Library and Information Science (LIS) is relatively new in modern world. The first library school in the world, known as the Columbia school of library economy was set up by the Melvil Dewey in 1876 at New York, United state. He was also the first editor of the library journal. 'Library journal' exist in 1876 in the glorious history of Library and information science. This journal was published by R. R. Bowker, New York and is still being published on regular basis.

In India, Library and information science education stroke its century in 2011. It has long history in India. The genesis of LIS journal in India is mere the one centenary old. The first library journal 'library miscellany' was published in 1912. Although library Miscellany ceased publication in 1919, it was the pioneering journal and thereafter a number of library and information science journals have been published in India not only in English, but also in several regional languages. Between 1912 and 1987, 87 periodical were emerged, out of them only 40 are surviving (Mohamed and Davis, 1994, p. 88). Some of the Indian LIS journals have been in existence for over 50 years now. A couple of journals have been established by Dr. S. R. Ranganathan, the Father of Library Science in India. Despite the long history of Indian LIS journals, none of them has been indexed in Thomson ISI's citation databases (Web of Science) so far. Giving an overview of the LIS periodicals in South Asia, Sharma (2000) stated that lack of timeliness, poor language, lack of planning in starting a journal resulting in the premature death of the journals, and so on are some of the problems afflicting the LIS journals from the region.

The oldest and active journal that has been published since 1849 from London under the title *Notes & Query: a medium of intercommunication for literary men, artists, antiquaries, genealogists, etc.* Now, it is being published under the title *Notes & Query: for readers and writers, collectors and librarians.*

3.8.1 Geographical Distribution of LIS Journals

Geographical distribution of journals in the field of Library and information science over world can be observed, from Table 3.1 and Figure 3.1. The table shows that 27.86 percent of

total journals are published from the USA followed by 14.38 percent from the UK, 5.39 percent from China, 4.04 percent from India, 3.82 percent from Canada, 3.82 Percent from Germany. Altogether 55.05 percent of world's journal publications in LIS field is coming from above mention six countries and the rest 45.95 percent journals are added by the other 75 countries listed in Table 3.1. Ijari and Kannappnavar (1990) found that India has 3rd rank in contributing periodicals to the world in the field of LIS. In LIS journal publication India had 5th rank during 1980-1990 and 4th in the first decade of 21st century (Agrahari, Chaudhary, and Sing, 2017).

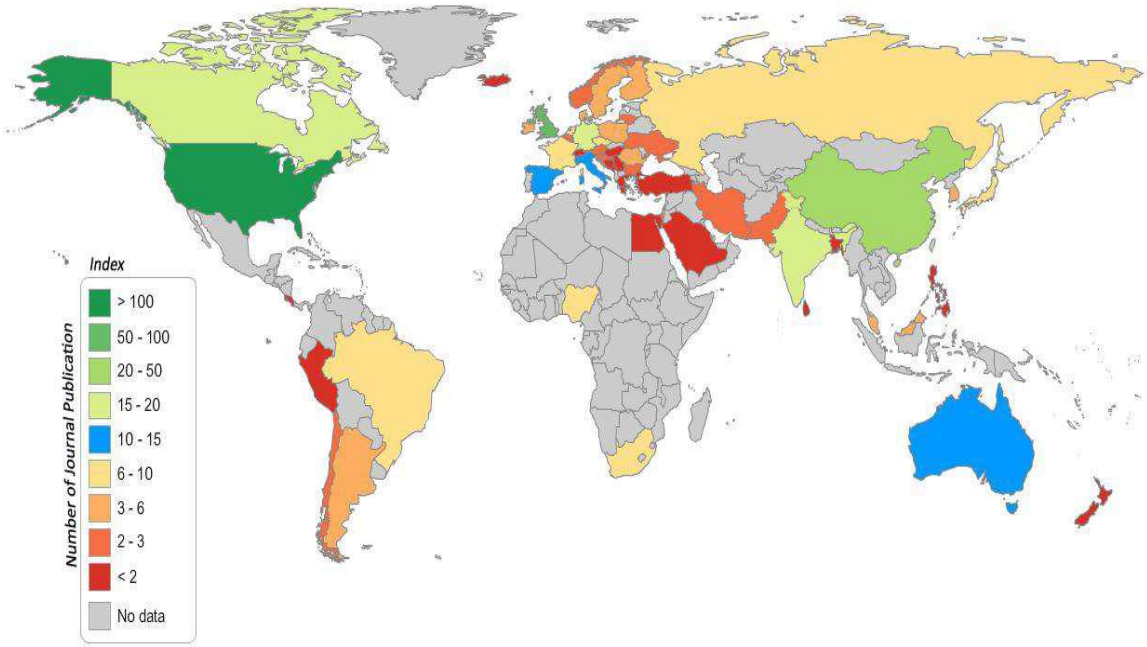

Figure 3.1: Geographical distribution of LIS journals by country

Data Source**:** *Ulrich Periodical Directory 49th edition, 2011(only those entry has been collected that has complete information about journal such as Title, Year, Language, Publication)*

Source of Map: *Stat Map*

3.8.1.1 Growth of LIS journals in American Continent

The *'Library Journal'* which published in 1876 (Golden Year of Library and Information science) is very first journal publication in the field as an official publication of American library association. It covers the burning issue and problem of a library. Intensive research activity in Library and information science and its interdisciplinary nature has born new subject area which result in new journals in shape. The rich and favorable condition for libraries in America boost up the research works in the field of library and information science.

The USA is a world's advanced country in this sphere and has the first position in research work (see Table 3.1). Its first journal *'Library Journal'* appeared in 1876 by Melvil Dewey (Founder of Library and Information in America) and there is no evidence of another journal in the 19th century. In the 20th century, many journals sprout out, some of them are: *Law Library Journal* (1908) an official publication of American Law Library and Association, *Harvard Library Bulletin* (1920), *LIBRA* (1933) a publication of the University of Virginia, *American Archivist* (1938) by the Society of American Archivist, it cover the different aspect of Archival Science, *College & Research Libraries* (1939) which is available online free since 2011, *American Society for Information Science and Technology Journal* (1948), *Library Resource & Technical services* (1957), *Journal of Information Ethics* (1962), *Information Technology & Libraries* (1968), *Information Research with International* (1974), *Collection Management* (1975), *Library & Archival Security* (1975), *Behavioural & Social Science Librarian* (1979), *Cataloging & Classification Quarterly* (1980), *Journal of Library Administration* (1980), *Resource Sharing & Information Network* (1981), *Association of college & Research Libraries* (1983), *Information Systems Management* (1983), *Journal of Classification* (1984), *Journal of Electronic Resources in Librarianship* (1989), *Progressive Librarian* (1990), Issues in Science & Technology Librarianship (1991), *Informing Science* (1997), *LITA-l* (Library and Information Technology Association-1) (1997), *Library Philosophy and Practice* (1998).

Some Important Journals which started its publication from the USA in 21st century are: *Journal Hospital Librarianship* (2001), *Portal* (2001), *Journal of Archival Organization* (2002), *Journal of Electronic Resources in Medical* (2004), *Journal of Information Science and Technology* (2004), *Journal of Library and Information Services in Distance Learning* (2004), *Critics* (online) (2005), *Journal of Information, Information Technology and Organization* (2006), *Communication in Information Literacy* (2007), *In the Library with Lead Pipe* (2008), *Collaborative Librarianship* (2009), *B Sides* (2010), *International Journal of Information Retrieval Research* (2010), *International Journal of Digital Library System* (2010), *Journal of Library Innovation* (2010).

In American continent, Canada, Brazil, and Argentina are very active in research publication and have 6th, 15th, and 26th position in the field of library and information science research (see Table 3.1). In Canada, *PNLA Quarterly* (1939) is a first journal in field of LIS is a

publication of Pacific Northwest Library Association; *Documentation et Bibliothèque* (1955), *Archives Journal* (1965), *ACA Bulletin* (1975), *Canadian Journal of Information and Library science* (1976), CURSUS (1995), *School Librarian in Canada online* (1999) are Important journals which were established in the 19th century. *The Electronic Journal of Academic and Special Librarianship* (2001), *SIMILE* (Studies in Media an Information Literacy Education) (2001), *Preservation* (2003), *Canadian Health Library Association Journal* (2004), *Reseau Canadian De' information Sur Le Patrimoine* (2005), *New Knowledge Environment* (2009) are the journals taken place in first decade of the 21st century.

In Brazil, *Perspectivas em Ciência da Informação* (1972), *Informacao & Informacao* (1996), *Revista Digital de Biblioteconomia e Ciência da Informação* (2003); in Argentina, *Archivo General de la Nacion* (1971), *Archivo General de la Nacion* (1999), *Info Diversidad* (1999), *Informacion, Cultura Y Sociedad* (2002) are important journals which are indexed in Ulrich Periodical Directory.

3.8.1.2 Growth of LIS journals in Europe Continent

The UK (United Kingdom) placed itself in the second position in the race of research publication in the field of LIS. One of the earliest magazines in LIS field, *New Library World* is being published since 1898 from London and the first journal of the country in this field *Assistant librarian* started its publication in the year 1898 and ceased its publication in 1999. The journal *Library Association Record* was brought out in 1899. Other important journal which started its publication in the 20th century and they are still providing their services are: *School Librarian* (1937), *Library Review* (1987), *Journal of Documentation* (1947), *Society of Archivists Journal* (1947), *ASLIB Proceeding* (1949), *Information Processing & Management* (1963), *Program* (1966), *Journal of Librarianship and information science* (1969), *Legal Information Management* (1970), *VINE: The Journal of Information and Knowledge Management Systems* (1971), *IFLA Journal* (1975), *Serials Review* (1975), *Library Management* (1976), *Online Information Review* (1977), *Public Library Journal* (1977), *Collection Building* (1978), *Journal of Information Science* (1979), *Information Technology & People* (1982), *Library Hi-tech* (1983), *Health Information & Libraries Journal* (1984), *Information Development* (1985), *Journal of Information Technology* (1986), *Government Libraries Journal* (1991), *New Library World* (1998). Some

other Journals which are born in 21st century are: *Information Measurement and Metrics* (2000), Journal of eLiteracy (2004), *International Journal of Digital Curation* (2006), *Journal of Information in Literacy* (2006), *Library and Information Research* (2007).

In addition to the UK, Germany, Italy, Spain, Netherlands, France, and the Czech Republic are the active country of Europe continent in Library and information science research activity and have 5th, 7th, 8th, 14th, 15th, and 18th palace respectively in the world.

Some major publications from Germany are: *BuB: Forum Bibliothek und Information* (1948), *LIBRI* (1951), *Microform & Digitization Review* (1972), *Knowledge Organization* (1974), *LIBREAS* (2005). Some important journals publication in Spain are: *BiD: Textos Universitaris de Biblioteconomia i Documentació* (1944), *LLIGALL* (1988), *Anales de documentación* (1998), *Archival Science* (2000), *European Journal of e-Practice* (2007). Some important publications of Neatherlands are: *Education for information* (1983), *Information Polity* (1991), *LIBER Quarterly*: *The Journal of European Research Libraries* (1991), *Ethics & Information Technology* (1999), *Open Information Research Science Journal* (2008).

In the year 1964, Italy saw publication of '*Biliotime*' an official publication of Italian Library Association; it was the first journal in field of LIS in Italian language. National Associtation of Italian Archival started its official publication '*Archivi E Cultura*' in english language in 1967. The other important journals in the field in the 20th century are *Informatica E Diritto* (1975) by Istituto per la Documentazione Giuridica; *AIDAinformazioni* (1983), it was founded as the official magazine of the 'Italian Association for Advanced Documentation; *Nuovi annali della Scuola speciale per Archivisti e Bibliotecari* (1987); *ABI NOTIZIE* (1989), *Reference reviews Europe* (1995), *Scrineum Rivista* (1999). *JLIS.it - Italian Journal of Library and Information Science* (2010), *Biblioteheca* (2002), *Bibliologia* (2004) are appeared in 21st century.

3.8.1.3 Growth of LIS Journals in Asian Continent

In Asia, India, China, Japan, and Taiwan are very prominent country in field of library and information science. They have a long history of excellent libraries dating back to the fourth century BC.

Republic of Chain is the largest country in the Asia and also known as inventor of paper but it was behind in publication of LIS journals. At present, it has 3rd rank (see Table 3.1) in the

field of LIS research. China saw its first journal in Library and Information Science *Tushuguan Jianshe* in 1976, the language of publication is Chinese. It was a publication of Heilongjiang Sheng Tushuguan, Heilongjiang. Zhongguo Renmin Daxue Shubao Zilio Zhongxin started second journal *Dang'anxue* (Archives Science) in 1978. *Tushuguanxue, Xinxi Kexue, Ziliao Gongzuo* (Library science, Information, and data collection) was also launched in 1978 from Beijing. Sichuan Library society started *Sichuan Tushuguan Xuebao* (Journal of the library science of Sichuan) in 1979 and *Tushuguan Gongzuo Yu Yanjiu* (Library work and Study), and *Zhongguo Tushuguan Xuebao* (Journal of the library science in China) appeared in the same year from Tianjin and Beijing respectively.

China had 21st rank in research publication in field of library and information science in last decade of 19th century (Ijari and Kannappanavar, 1990). During the 1980s many journals started its publication in China. In turn, China proliferated a number of journals and placed itself on the second rank in the world (see Table 3.1). Some major publications of the 19th century are: *Shandong Thsuguan Xuekan* (1981) was an official publication of Shandong Sheng Thsuguan Xuehei from Ji'ana; *Tushuguan Luntan* (1981) from Guangzhou; *Daxue Tushu Qingbao Xuekn* (Journal of Academic library and information science), 1983; *Daxue tushuguan xuebao* (Journal of academic libraries, 1983) is an organ of Peking University, Steering Committee of Academic Libraries of China; *Beijing Dang'an* (Beijing Archives, 1984); *Shanghai Dang'an* (Shaanxi Archives, 1984); Guji Zhengli Yanjiu Xuekan (journal of ancient books collection and studies, 1985); *Shanghai Dang'an* (Shanghai Archives,1985); *Shanghai Dang'an Gongzuo* (Shanghai Archive Work, 1985); *Qingbao Tansuo* (Infromation Research) 1987; Nongye Tushu Qingbao Xuekan (Journal of Library and Information Science in Agriculture, 1989) from Beijing; *Zhoonghua Yixue Tushu Qingbao Zahi* (Chinese Journal of Medical library and Information Science, 1991); *Guojia Zhengli Yanjiu Xuekan* (National Library of China, 1992) was brought by National Library of China, Beijing, and *Dang'an Tiandi* (Archives World, 1993) from Hebei. In the 21st century, China maintains itself at the same position in the world ignoring India. However, China Contributed only one journal *Chinese Journal of library and information science* from Beijing, in the first decade of the 21st century, which is index in Ulrich Periodical Directory, is being published by Chinese Academic of Science, National Library of Science.

India has a great advantage over other Asian countries in publishing library journals, its most of the publications are published in English language and has 4th rank (see Table 3.1) in the world. In this field, *Library Miscellany* was the first LIS journal of India. It started publication in the year 1912 from Baroda and it discontinued its publication after seven years in 1999. India is a leader of Asia in publishing journals in the LIS field but only a handful of journals are known and available outside India (Sarma, 2000). The earliest Indian journal in the field of library and information science is *Pustkalya* (1925) which is index in Ulrich Periodical Directory is a publication of Gujrat Pustakalaya Sahayak Sahakari Mandal. Bengal Library Association started a journal *Granthga*r in Bengali language from the year 1937.

NISCAIR (National Institute of Communication and Information Retrieval, before 30 September 2002, it was known as INSDOC) brought *Annals of Library Science and Documentation* from New Delhi in the year 1954, in the year 2001, it has been renamed as *Annals of Library and Information studies*. In 1962, *Herald of Library and Information* was started its publication from Rajasthan. Uttar Pradesh Library association (Lucknow Branch) brought *Lucknow Librarian* in 1962. In addition to these, *SRELS Journal of Information Management* (1964) a publication of Sarada Raganathan Endowment for Library Science Bangalore, *Journal of library and information science* (1976), *Library Progress* (1981), *International Information Education* (1982), *Granthana: Indian Journal of Libraries studies* (1990), *Information Technology* (1991), and *Information Studies* (1990) are started in the 20th Century. In early 21st century, India meet some more important journals are: *Trends in Information Management* (2005); *Indian Journal of Library and Information Science* (2007); *World digital Libraries: an international journal* (2009).

Japan saw first noteworthy journal in LIS field was *Toshokan Zasshi* (Library journal) in the year 1907, which was published in Japanese language. *Igaku Toshokan* (Japan Medical Library Association Journal) started publication as an organ of Japan Medical Library Association in 1954. Japan Society of Library and Information science brought *Nippon Toshokan Joho Gakkai-Shi* in the year 1999 from Ibaraki. *Library and Information Science* took place in the year 1963 as a publication of Mita society of Library and information science in two languages English, and Japanese. Some important journals of Japan during

19th century are: *Sanko Shoshi kenkyu* (Reference Service and Bibliography, 1970), Daijaku Toshokan Mondai Cenkyuukaishi (1971) a publication of Japan Academic Librarians' Association, *Karento Aweanesu* (Current Awareness, 1979), and *Kochi University Faculty of Science Memoirs Series Information Science* (1980).

Russia is a country of Asian-European country and has 11th rank in world and 4th rank in Asia in LIS journal publication. In Russia, *Bibliotekovedenie* of Russian State Library started publication in the year 1952 from Moscow as the first remarkable Journal in the field. Federal'naya Arkhivnaya Sluzhba Rossii, Moscow started publication of *Otechestvennye Archivy* in 1959. *Referativnyi Zhurnal* (Informatika: Otdel'nyi Vypusk) appeared as an official publication of VINITI (Vserossiiskii Institut Nauchnoi I Tekhnicheskoi), Moscow in 1963. Other noteworthy journals are: *Nauchno-tekhnicheskaya informasiya* (1961), *Mezhdunarodnyi Forum Po Informatsii* (1975), *Vestnik Arkhivista* (1991), *Bibliotechnaya Assambleya Evrazii Vestnik* (1993). In first decade of the 21st century, *Mediateka I Mir* (2006) started publication from Moscow.

Taiwan has 16th rank in world and 5th rank in Asia in LIS journal publication. In 1970, Taiwan saw first remarkable journal *Jiaoyu Ziliao Yu Tushuguanxue* (Journal of Educational media and library sciences) and its publication was started from Taipei. Besides these, *Journal of library and information science* (1975), *Journal of Information, Communication and Library Science* (1994), *Tushu zixum Xueran* (Journal of Library and Information Studies, 1999), *Zixun Guanli Yanjiu* (2001), and *Zinxun Guaanli Yanjiu* (2001) are the journals which are indexed in Ulrich Periodical Directory.

Some other country of Asia such as Taiwan, Malaysia, Korea, Turkey, Pakistan and ISRAEL are active and have 16th, 23rd, 24th, 27th, 30th, and 34th rank (see Table 3.1) in the LIS field.

3.8.1.4 Growth of LIS Journals in Australia and Oceania Continent

This region is subdivided in 14 countries. Among these, only Australia and New Zealand are active in LIS Journal publication. Australia became a part of journal publication in the field of LIS Research from the 1950s. The first journal which got popularity at international level and indexed in Ulrich Periodical Directory was *The Australians Library Journal* an organ of Australian Library and Information Association started publication in 1951 from Kingston.

The journal *Australian School Librarian* started publication in 1964 from Vermont now it is being published under title *Access*. The State Library of Victoria Foundation starts a notable publication *The La Trobe Journal* from Melbourne in 1968. *Australian Academic and Research Libraries* started its publication in the year 1970 from South Bank. Some other notable Journals of the 20th century are: *SCAN* (1970), *Australian Law Librarian* (1973), *ARLIS/ ALS News* (1977), *Australian Public Libraries and Information Service* (1988), Archives *and Manuscripts* (1995). In 21st century a noteworthy journal appeared in the year 2003 is *Provence and Synergy* from Victoria.

Table 3.1: Geographical distribution of LIS journals by country

Rank	Country	No. of Journals	Cum. no. of Journals	Percentage (%)	Cum. %
1	USA	124	124	27.87	27.87
2	UK	64	188	14.38	42.25
3	China	24	212	5.39	47.64
4	India	18	230	4.04	51.69
5	Germany	17	247	3.82	55.51
6	Canada	17	264	3.82	59.33
7	Italy	14	278	3.15	62.47
8	Spain	12	290	2.70	65.17
9	Australia	11	301	2.47	67.64
10	Japan	9	310	2.02	69.66
11	Russia	8	318	1.80	71.46
12	Netherlands	7	325	1.57	73.03
13	South Africa	8	333	1.80	74.83
14	France	7	340	1.57	76.40
15	Brazil	8	348	1.80	78.20
16	Taiwan	6	354	1.35	79.55
17	Nigeria	6	360	1.35	80.90
18	Sweden	5	365	1.12	82.02
19	Romania	5	370	1.12	83.15
20	Denmark	5	375	1.12	84.27
21	Czech republic	6	381	1.35	85.62
22	Poland	3	384	0.67	86.29
23	Malaysia	3	387	0.67	86.97
24	Korea	3	390	0.67	87.64
25	Ireland	3	393	0.67	88.31
26	Argentina	3	396	0.67	88.99
27	Turkey	2	398	0.45	89.44
28	Slovenia	2	400	0.45	89.89
29	Puerto Rico	2	402	0.45	90.34
30	Pakistan	2	404	0.45	90.79
31	Norway	2	406	0.45	91.24
32	Mexico	2	408	0.45	91.69
33	Lithuania	2	410	0.45	92.13
34	Israel	2	412	0.45	92.58
35	Iran	2	414	0.45	93.03
36	Finland	3	417	0.67	93.71

37	Chile	2	419	0.45	94.16
38	Bulgaria	2	421	0.45	94.61
39	Belgium	2	423	0.45	95.06
40	Austria	2	425	0.45	95.51
41	Singapore	1	426	0.22	95.73
42	Tanzania	1	427	0.22	95.96
43	Sri Lanka	1	428	0.22	96.18
44	Serbia	1	429	0.22	96.40
45	Saudi Arabia	1	430	0.22	96.63
46	Philippines	1	431	0.22	96.85
47	Peru	1	432	0.22	97.08
48	New Zealand	1	433	0.22	97.30
49	Iceland	1	434	0.22	97.53
50	Hungry	1	435	0.22	97.75
51	Croatia	2	437	0.45	98.20
52	Costa Rica	1	438	0.22	98.43
53	Bosnia Herzegovina	1	439	0.22	98.65
54	Bangladesh	1	440	0.22	98.88
55	Ukraine	1	441	0.22	99.10
56	Switzerland	1	442	0.22	99.33
57	Greece	1	443	0.22	99.55
58	Egypt	1	444	0.22	99.78
59	Montenegro	1	445	0.22	100.00
	Total	445			

***Data Source**- Ulrich Periodical Directory 49th edition, 2011 (only the entry has been considered from the directory, which has complete information about journal such as Title, Year, Language, Publication)*

In New Zealand, the premier journal of LIS field is *New Zealand Library and Information Management* was published in 1937, is an organ of Library and Information science association of New Zealand from Aotearoa (New Zeland), except it, there is no other journals in the field of library and information science, which are indexed in Ulrich Periodical Directory.

3.8.1.5 Growth of LIS Journals in Africa Continent

There are 53 countries in Africa continent. Only three country of Africa: South Africa, Nigeria, and Ghana are playing important role in LIS journal publication and have rank 13th, 17th, and 42nd in the world respectively.

South Africa found a remarkable journal in the year 1933, which started publication under title '*South African Journal of Library and Information Science*' as an organ of South African Bureau for Scientific Publications from Hatfield. National Archive of South Africa began *Argiefjaarboek vir suid-Afrikaanse Geskindenis* (Archives Yearbook South Africa History) in 1948. *Mousaion: Library Science Contribution* (1955) started its publication from Pretoria. Other important journals are: *Free State Libraries* (1958), *SUID-Afrikaanse*

Argiefblad (South African Archives Journal, 1959), *ESARBICA Journal* (Journal of the Eastern and Southern Africa Regional Branch of the International Council on Archives, 1959), *INDILANGA: African Journal of Indigenous Knowledge System* (2002).

Nigeria saw a journal in LIS field in the 1970s. The first worth mentioning journal *Nsukka Libraries Notes* started publication as an official publication of University of Nigeria Library that came in the year 1975 from Enugu. Nigerian Library association started its official publication *Nigerian Library and information Science Review* in the year1983 from Oyo. The other important journals in the field are *African Journal of Academic Librarianship* (1983), *African journal of library archives and information science* (1991), *Journal of Librarianship and information science in Africa* (2001), *Lagos journal of library and information science* (2005).

3.8.2 Chronological Distribution of LIS Journals

It can be observed from Table 3.2 that there were only two journals in LIS field by the year 1989 in the world. *The Library journal* is the first journal, and it is continuing their service in the field of library and information has been started in the year 1876, from California of

Table 3.2: Chronological growth of journals in the LIS field by country

Rank	Years / Country	1875-1900	1900-1910	1910-1920	1920-1930	1930-1940	1940-1950	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2011	Total
1	USA	1	2		4	6	3	8	11	17	20	20	32	124
2	UK	1		1	1	2	4	3	9	18	14	6	5	64
3	China									6	14	3	1	24
4	India				1	1		1	2	3	2	4	4	18
5	Germany						1	2	2	6	2	3	1	17
6	Canada					1		1	1	3	2	3	6	17
7	Italy								2	1	4	2	5	14
8	Spain						1				2	6	3	12
9	Australia							1	2	4	1	1	2	11
10	Japan		1					2	1	3	1	1		9
11	Russia							2	2	1		2	1	8
12	Netherlands										1	4	2	7
13	South Africa					1	1	4		1			1	8
14	France								2			2	3	7
15	Brazil									1		5	2	8
16	Taiwan									2		2	2	6
17	Nigeria									1	2	1	2	6

18	Sweden			2			1	1			1			5
19	Romania							1	1			3		5
20	Denmark							1		2		1	1	5
21	Czech republic							2				3	1	6
22	Poland				1			1	1					3
23	Malaysia									2		1		3
24	Korea								1	2				3
25	Ireland									3				3
26	Argentina											1	2	3
27	Turkey							1					1	2
28	Slovenia									2				2
29	Puerto Rico											1	1	2
30	Pakistan								1			1		2
31	Norway		1										1	2
32	Mexico										1	1		2
33	Lithuania								1				1	2
34	Israel						1					1		2
35	Iran								1				1	2
36	Finland		1									2		3
37	Chile											1	1	2
38	Bulgaria							1					1	2
39	Belgium				1					1				2
40	Austria							1		1				2
41	Singapore												1	1
42	Tanzania										1			1
43	Sri Lanka								1					1
44	Serbia						1							1
45	Saudi Arabia										1			1
46	Philippines										1			1
47	Peru											1		1
48	New Zealand					1								1
49	Iceland									1				1
50	Hungry							1						1
51	Croatia							2						2
52	Costa Rica										1			1
53	Bosnia Herzegovina							1						1
54	Bangladesh								1					1
55	Ukraine												1	1
56	Switzerland												1	1
57	Greece												1	1
58	Egypt												1	1
	Total journal	2	5	3	8	12	13	37	43	81	71	82	88	445
	Cum. no.	2	7	10	18	30	43	80	123	204	275	357	445	
	Cum. %	0.45	1.57	2.24	4.03	6.71	9.62	17.9	28	46.1	62	80.3	100	
	Growth	0	3	-2	5	16	1	24	6	38	10	11	6	

Data Source- *Ulrich Periodical Directory 49th edition, 2011 (only the entry has been considered from the directory, which has complete information about periodical such as Title, Year, Language, Publication)*

the USA. The number of journals increased to 10 in the year 1920, 30 in the year 1939, 80 in the year 1959, 204 in the year 1979, 357 in the year 1959, and in the year 2010, the number of journals reaches to 445. The Figure 3.2 shows that highest growth has taken place during the decade of the 1970s. Almost 82% of journals started their publication in the last five-decade (1960-2010). There are 10 journals for which date of first publication could not be ascertained. Some countries such as Singapore, Ukraine, Switzerland, Greece, and Egypt started their firs publication in the LIS field the first decade of the 21st century.

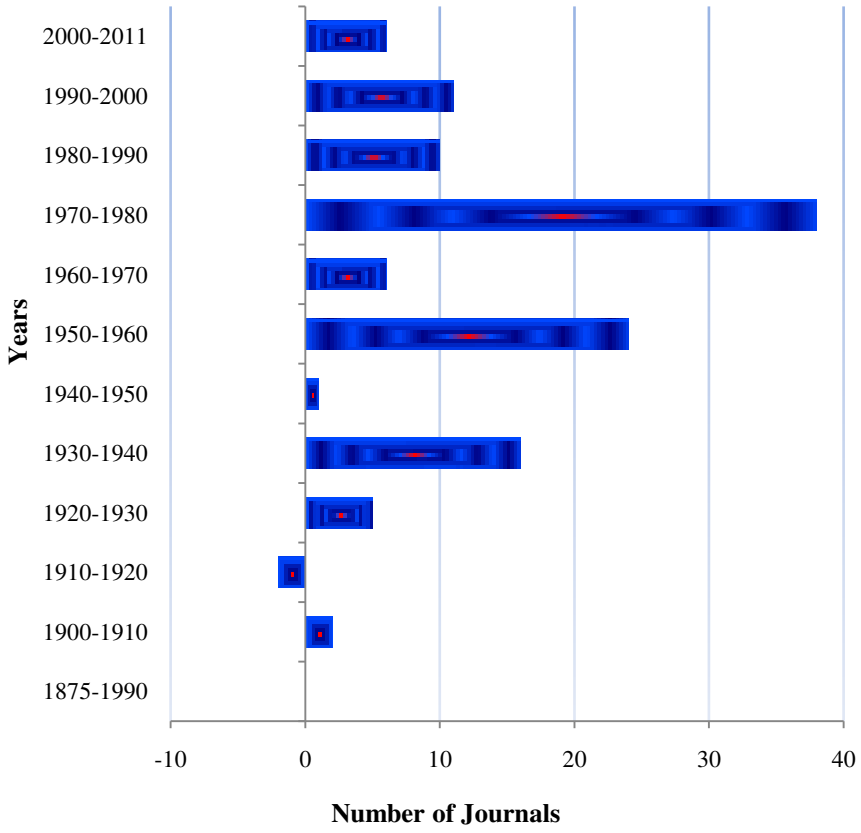

Figure 3.2: Chronological growth of LIS journals

Data Source- *Ulrich Periodical Directory (only that entry has been considered from the directory, which has complete information about periodical such as Title, Year, Language, Publication)*

3.8.3 Languages of LIS Journals

English language is a good medium to communicate idea all over world. In field of LIS journal publication, it can be observed from Table 3.3 that, the English language is predominant with 60.67 percent of the total research output, followed by Chinese (6.29%), French (4.71%), Spanish (4.26%), German (3.14) and Italian (2.47%). Rest 0.13% journals published in 29 languages. Out of the total journal publication, 4.94% are in bilingual and

2.25% in multilingual (more than two languages). Mostly, one language of the bilingual and multilingual journals is English.

Table 3.3: Language wise distribution of LIS journals

Rank	Language	No. of Journals	Percentage (%)
1	English	270	60.67
2	Chinese	28	6.29
3	French	21	4.72
4	Spanish	19	4.27
5	German	14	3.15
6	Italian	11	2.47
7	Portuguese	10	2.25
8	Russian	9	2.02
9	Japanese	6	1.35
10	Danish	5	1.12
11	Czech	4	0.90
12	Polish	4	0.90
13	Romanian	4	0.90
14	African	3	0.67
15	Catalina	3	0.67
16	Finish	3	0.67
17	Korean	3	0.67
18	Serbo-Croatian	3	0.67
19	Bulgarian	2	0.45
20	Croatian	2	0.45
21	Hindi	2	0.45
22	Lithuanian	2	0.45
23	Slovenian	2	0.45
24	Swedish	2	0.45
25	Arabic	1	0.22
26	Other	11	2.47
27	Bilingual	22	4.94
28	Multilingual	10	2.25

Data Source- *Ulrich Periodical Directory 49th edition, 2011 (only the entry has been considered from the directory, which has complete information about journal such as Title, Year, Language, Publication)*

Thus, it is clear from the above made discussion that journals are the vehicles for the research and its history go back to seventh century. Journals are available broadly in two forms i.e. print and electronic form. Both of them has own advantage and disadvantage. During the last few decades, different studies shows that use of e-journals increased in proliferated way due to its speedy and omnipresence nature. The growth of library and information science journals is at a good pace. Developed countries like America, UK, and

Germany etc. are contributing a large chunk of research literatures through various types of journals. Developing countries like India and China have also made laudable contributions to library and information science research. The chronological representation of journals indicates that research activities in library and information have been expanding its hand. The maturity of the scientific aspect of the library science discipline has helped in increasing the research publication in the field of library and information science. Furthermore, the countries with a well established tradition in the field of LIS are showing an explosive growth in the LIS literature.

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Chapter 4

Content Analysis

Content analysis has been a widely used research method by social scientists to study the content of a communication. Now, it has also become an important research technique in the field of Library and Information Studies (LIS). This method can be performed in two ways: Quantitative, and Qualitative. The quantitative technique involves counting of occurrences of words and phrases. Whereas, qualitative analysis technique is used to analyse information resources to identify ideas behind a word. Co-word analysis is a hybrid approach to content analysis technique that uses co-occurrence of words or phrases to find out a relationship among ideas. This chapter summarizes the development, advantages, and disadvantages and discusses several practical issues related to content analysis.

4.1 Meaning and Definition

Content analysis refers to a research technique. It consists of two words viz. 'Content' and 'Analysis'. The term 'Content' means a text which can be expressed, communicated and comprehended and the process, logic or a systematic way by which theme, ideas, and purpose of the content can be analysed by quantitative and qualitative manner, and be explained is its 'Analysis'. Thus, content analysis is a systematic process for a qualitative and quantitative description of content. Content analysts do not collect their data from physical event as many researchers do but collect data from text which are recorded for their purpose and analyzed with such in the mind.

Here, text may be printed matter, articles, letters, communicated material, handwritten material, recorded speech, news, videos etc. These texts are recorded form of human interaction and medium of communication. To study this interaction content analysis is a good research technique which uses some inferences from content in context to some research purpose. This technique is used to identify a concept, word and phrases within the content. This tool is very useful to quantify and analyse the presence of meaning of words phrases, idea and concepts and identify relationship among them. In simple words, content analysis is a systematic way to provide a quantitative, numerical and qualitative description of written, spoken and visual communication.

Content analysis has seen different stages of in which it is defined indifferently by scholars over time its development; it was defined indifferently by scholars at various stage times. All these efforts have certainly revealed various dimension of content analysis. Some prevalent definitions of content analysis are given below:

1) Berelson (1952, p.18), "Content analysis is research technique for the objective, systematic and quantitative description of the manifest content of communication."

2) Holsti (1969, p.14), "Content analysis is a technique for making influence by objectively and systematically identifying specified characteristic of message."

3) Weber (1990, p.9), "Content analysis is a research method that uses a set of procedure to make a valid inference."

4) Riffe, Lacy and Fico (1998, p.20), "Qualitative content analysis is a systematic and replicable examination of communication which has been assigned numerical value according to valid measurement rules and the analysis of relationship involving those value using statistical method in order to describe the communication, draw inferences about its meaning or infer from the communication to its context, both of production and consumption."

5) Kaplan (1943, p.230), "Content analysis attempts to characterized the meaning in given body discourse in a systematic and quantitative fashion."

6) Krippendroff (2004, p.18), "Content analysis is a research technique for making replicable and valid inferences from data to their context."

7) Sinha (1980, p.10), "Content analysis does not study behavior itself; rather it process on artifacts produced by behavior that is recorded speech in writing. Content analysts infer the orientation concerns of the speaker, sub-culture or culture from the record of what is said."

Thus, the above explanation enables us to understand the concept of content analysis. In brief, content analysis is a technique which involves a procedure to describe previously recorded or reported phenomenon and objectively and systematically breaking up it into

more manageable units that are related to the topic under the study, so that it can be analyzed qualitatively and quantitatively making valid and replicable inferences.

4.2 History of Content Analysis

The term content analysis appeared in 1948 as a research methodology in a mimeographed text titled 'The analysis of communication content' authored by Berelson and Lazars Field, which was later published as 'Content analysis in communication research' by Berelson in 1952. Earlier, it was not acknowledged as a research method in which form it is established today. 'Content analysis' is about 55 year old terminology. The tirst time, it was listed by Webster's Dictionary of English in 1961. However, its root goes far back in history, to the beginning of man's conscious use of symbol and language.

The systematic analysis of text can be traced back to the inquisitorial pursuits by the Church, in the 17th century. After the advent of printing press, the Church become worried about the spread of nonreligious printing matter, and so it dealt with newspaper content in moralizing term (Groth, 1948, p. 26 as cited by Krippendorff, 2004). Probably the first well accepted case of quantitative analysis of printed item appeared in 18th century in Sweden (Kripendorff, 2004, p.4) when 'Songs of Zion' (a collection of 90 hymns) of unknown authorship had been analyzed to identify whether the songs have some dangerous idea, if so, how. Now such kind of analysis becomes a part of content analysis. In the year 1910, at a meeting of German Sociological Society, Max Weber proposed a large-scale analysis of press, but for a variety of reasons the research never got off ground. Later, in the year 1930, content analysis found important stimulus through the work of Harold B. Lasswell and his associates (Sinha, R., 1980, p.11)

During the Second World War, content analysis was employed by several governments in the field of mass communication to analyse the content of newspapers. This method is also applied to the commercial circle for advertisement and publicity purposes. In 1940, content analysis has been used in the US, and UK for the study of literature. In India, Raghuvir Sinha has recently made an elaborated study of sociology of Hindi literature based on thematic approach of content analysis in his work 'Social changes in contemporary literature', in the year 1977.

Holsti (1969, p.23) described a series of interrelated and continuing trends on the basis of its history:

1) Increased use of content analysis,
2) Heightened concern for theoretical and methodological issue,
3) Application to broader spectrum of problems, especially those focusing the antecedents and effect of communications,
4) Increased used for testing hypothesis as opposed to purely descriptive research,
5) Greater diversity in the materials studied,
6) Use in conjunction with other technique of social research,
7) Content analysis by means of computer.

4.3 Content Analysis as a Research Methodology

An evaluation of content provides a technique to look into the development of a profession within a given period. As a full phase research methodology 'Content analysis' is developed in the study of mass communication in 1915 (Kripendorff, 2004. p.8). It was based on basic communication model (Aristotle's communication model), which includes sender, message, receiver as components. Initially, researchers emphasized drawing inferences based on quantified analysis of recurring, easily identifiable aspect of text content and some time it is referred as a manifestation of content. From the beginning of the 20th century, researchers of different disciplines including anthropology, psychology, social psychiatry, sociology, political science, management and library and information science utilize content analysis. In the course of study, information scientist followed content analysis to answer his/her researcher question identifies a new branch of research technique and approaches. Mertem (as cited by Titscher, Meyer, Wadak, Vetter, 2000 and White and Marsh, 2006) notes that the range of procedure in content analysis, each enormous in terms of both analytical goals and the means are the process developed to pursue them. There are many variants of content analysis such as conversation analysis, discourse analysis, ethnographic analysis, and narrative analysis etc.

Content analysis explores the intellectual structure and direction of communication (for, against, neutral), cognitive and historical significance. During the 1950s, information

scientists started working on the contained concept of content. Earlier this technique was applied in Library and Information Science as an information retrieval technique. Now, it is used to study different sphere of Library and Information Science, and becomes one of the prominent research technique the discipline. In a study, Heting Chu (2015) found that 57% research in the field of Library and Information science have done using content analysis technique. It is a highly flexible research technique that has been widely used in 'Library and Information Science' research with various goals and objectives (White and Marsh, 2006). During the first decade of the 21st century, some prominent research (on the basis of received citation) articles appeared that uses different approach of content analysis fulfilling various purposes are listed in Table 4.1.

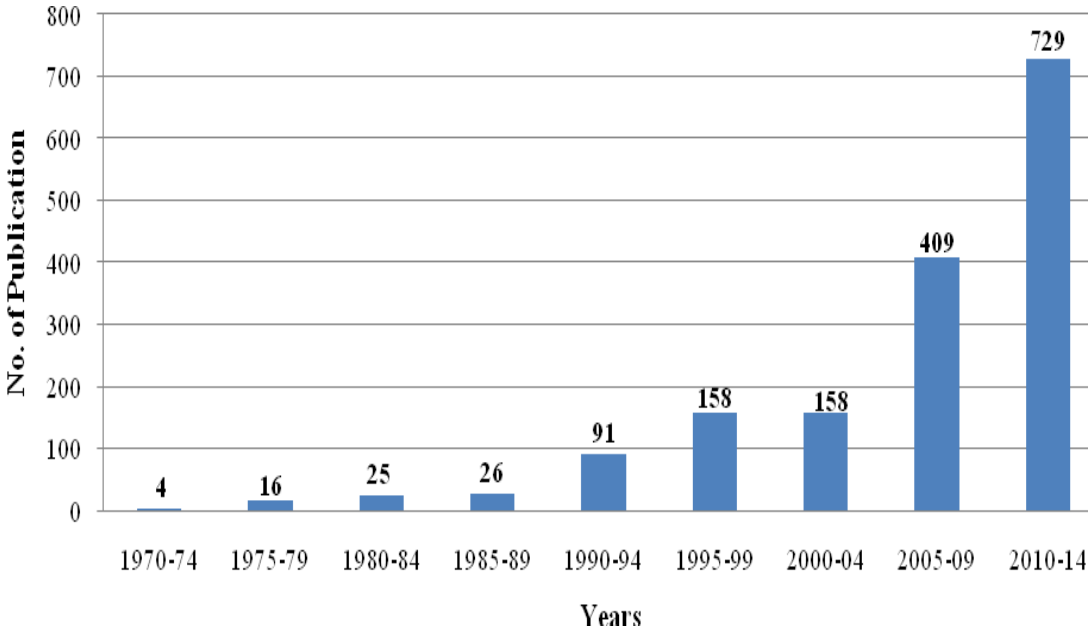

Figure 4.1: Content analysis in Library and Information Science research

Data Source: *LISA Database*

Most of the listed articles' methodology in Table 4.1 does not have a purist approach to content analysis, and some of the articles use a hybrid approach to content analysis. The content analysis fulfills the premises of Library and Information Science research that enables practical or theoretical changes to improve the library and information services. Figure 4.1 shows that the number of scholars in LIS domain is increasing who uses content analysis to solve their research problem, over the consecutive period. Analysis of communicated material particularly documentary form, in context to its meaning, distinguishes content analysis from the other methods of research.

Table 4.1: Content analysis in Library and Information Science research

Article (Author's Name & Year)	Purpose	Data Sources	Type of content analysis
Heisig, 2009	• To identify difference and correspondence among different Knowledge management models	Research publication & conference proceeding's paper on KM	Quantitative & Qualitative
Hall & Davison, 2007	• To identify the use of blog technology	Students' blog comment	Qualitative
Kim & Oh, 2009	• To examines the criteria of questioners use to select the best answers in a social Q&A site (Yahoo! Answers) within the theoretical framework of relevance research	Comments on Yahoo! Answers	Qualitative
Lynch & Smith, 2001	• To identify significant changes in content Advertisement; • To identify technology knowledge in job requirements; • to identify behavioral skills in job advertisement	Advertisements in C&RL News	Quantitative
Al-Debei & Avison, 2010	• To study the BM(business Model)concept framework	Literature on BM (business model)	Quantitative
Kracker & Wang, 2002	• To investigate students' perceptions of research and research paper anxiety	Written paragraph on research experience by students	Qualitative
Koufogiannakis, Slater & Crumley, 2004	• To identify different type of research in LIS	Library and information studies (LIS) literature	Qualitative
Himelboim, Gleave & Smith, 2009	• To identify discussion catalyst on political issue	Message of political Usenet newsgroups	Quantitative & Qualitative
Croneis & Henderson, 2002	• To examine electronic services position	Job advertisement in College & Research Libraries News	Quantitative
Aharony, 2009	• To describe and classify the LIS blogosphere	Library professional blogs	Quantitative
Quiroga & Mostafa, 2002	• To identify empirical research methods	Research papers	Quantitative
Shachaf, 2009	• To examine the quality of answer on Wikipedia reference desk	Answer on Wikipedia reference desk	Qualitative

Mathews & Pardue, 2009	• To identify requirements job analysis	ALA's online Job List	Quantitative
Walter & Mediavilla, 2005	• To evaluate the effectiveness of Tutor.com's Live Homework Help service	100 transcripts of online transactions between teens and the virtual reference librarians in California	Qualitative
Zhang, 2008	• To study undergraduate students' mental models of the Web as on information retrieval system	Data collected from questionnaire, semi structured interview, and participant observation,	Quantitative
Bar-Ilan, 2004	• To understand the characteristics of self linking	Institution web page	Quantitative & qualitative
Kim, Coyle & Gould, 2009	• To examine collectivist and individualist cultural influences on the design of organizational websites originating in South Korea and the U.S.	American and South Korean company-sponsored websites	quantitative
Hara, Shachaf & Stoerger, 2009	• To identify the values that can be assigned to some categories (relevancy of discussion, boundary crossing, and cultural diversity).	E- mail massage of online discussion forums	quantitative
McKechnie & Pettigrew, 2002	• To examine the use of theory in LIS research	Research publication	Quantitative
Aharony, 2009	• To understand the idea of posts that appear in the blogs	Librarians' blogosphere	Quantitative & Qualitative
Genuis, 2006	• To explored the role of the literature in the diffusion of new information	Articles published in medical and consumer publication	Quantitative & Qualitative
Aharony, 2010	• To identify emerging trends in the field of information literacy	Bibliographical data from web of science	Quantitative
Mackenzie, 2005	• To analyze on what basis and by what procedure managers select individuals to serve as information sources	Recorded data from interview	Qualitative
Shachaf, 2005	• To identify the typology of ethics principles proposed by professional associations	Data from English versions of codes of ethics proposed by professional associations	Qualitative & Quantitative
Kim & Jeong, 2006	• To examine the state and characteristics of theoretical research in Library and Information Science	Research publications	Qualitative & Quantitative

Lee & Bates, 2007	• To examine use, perception and extent of weblog technology used by Irish librarians and the factors behind promoting and discouraging the use of weblogs.	Irish library and librarian weblogs	Quantitative & Qualitative
Bar-Ilan, 2007	• To examine the use of blogs by librarians and libraries	Content in blogs	Qualitative & Quantitative
Corrall, Sheila 2007	• To explore and investigate the development of indicators • To evaluate level of engagement of institutions in UK with information literacy.	Public domain documents which were accessible from institutional websites	Qualitative
Jeong & Kim, 2005	• To analyze the knowledge structure of LIS in South Korea	Scholarly research articles	Qualitative & Quantitative
Marchionini & Mu, 2003	• To analyze how people understand electronic tables and to inform development of a web based statistical table browser.	Research publication	Qualitative &Quantitative
Kracker, 2010	• To understand the human understanding of libraries and the implications of this understanding for library use and service.	User study and content analysis of user narratives	Qualitative & Quantitative
Mbambo & Cronje, 2002	• To study that the use of internet reduce the development gap between developing countries and developed ones.	Discussion list	Quantitative & Qualitative
Stansbury, 2002	• To study the role of problem statements in scholarly journals	Problem statements in journal publications	Quantitative & Qualitative
Clyde, 2004	• To study changes in school websites	School websites (1996-2002)	Quantitative
Wang & Gao, 2004	• To identify technical services	Institutional library websites	Quantitative

Data Source: *LISA Database*

4.3.1 Content Analysis as Scientific Technique

As a research technique, content analysis includes some special procedure which can be adopted or rejected by a researcher on the basis of his/her personal experience. Like any other research methods, content analysis confirms six basic principles of a scientific method, they are:

1) **Objectivity:** It means analysis is pursued on the basis of some explicit rules which enables a researcher to reach a conclusion from a content (document, message, etc.).

2) **Systematic:** Content analysis is a rule-based technique. Under this method content is to be analyzed step by step following rules of a procedure, devising content into analytical unit. It has structured forms that allow analyst to extract relevant information more consistently than if they were reading the same documents only casually.

3) **Generalization:** It is very important criteria for a research method to prove itself a scientific technique. Generalization refers to "the degree to which the findings are applicable to other populations or samples" (Ryan and Bernard, 2000, p.786). Thus, it draws on the degree to which a sample data represents a population e.g. after completing a poll of 300 city residents; the researchers obviously hope to generalize their findings to all residents of the city.

4) **Replicability:** The replication of a study is a safeguard against over generalizing the findings of one particular research endeavor. Replication involves repeating a study with different case or in different context, checking to see similar result is obtained each time.

5) **Reliability:** It refers to the extent to which a measuring procedure yields the same result on repeated trials. Without acceptable level of reliability, content analysis measures are meaningless.

6) **Validity:** Validity refers to the extent to which an empirical measure adequately reflects what humans agree on the real meaning of the concept. In content analysis researcher is a boss, making final decisions on what concept to measure and how to measure, there are good guidelines available for improving validity.

Thus the availability of above mentioned principles in content analysis technique make it a scientific tool to analyse text.

4.3.2 Content Analysis as a Quantitative Technique

Initially, only quantitative approach was used for the content analysis. It is known as classical content analysis. It consists of tabulating of occurrence of content units (word, phrases etc.). Content analysis was born as a quantitative technique. In 1952, Berlson described content analysis as a quantitative description of the manifest content of a communication. Counting frequency was the main activity of content analysis in the 1940s. The quantitative technique is widely used in Mass Communication, Library and Information Science as a way to count manifest textual elements. Content analysis, as a typical quantitative approach to study a text, offers a valuable tool for tearing out meaning from text, or any other symbolic material. For example, if one deal with an analysis of 100 of pages of transcripts or symbolic material, this technique certainly helps us reveal a specific pattern of the analysed unit from the data. The quantitative content analysis is deductive in its approach and test hypothesis. The deductive hypothesis flows from what is already known about the problem and the extant research question. This method uses random sampling or other probabilistic approaches in selecting data sources, so as to ensure the validity of statistical inference. It produces a number that can be manipulated with various statistical methods. Its main objective is to make applicable and valid inference form texts (or other meaningful matter) to context of their use (Kripendorff, 2004, p.19). One advantage of the quantitative analysis is that it is very effective to deal large quantities of data without getting worried under the sheer volume of material. Its disadvantage is that it may miss out on subtle nuances in the production of meaning.

Marilyn D. White and Emily E. Marsh (2006) identify following steps for a study using quantitative content analysis

1) Establish hypothesis or hypothesizes,

2) Identify appropriate data (text or other communicative material),

3) Determine sampling method and sampling unit,

4) Draw sample,

5) Establish data collection unit and unit of analysis,

6) Establish coding scheme that allows for testing hypothesis,

7) Code data,

8) Check for reliability of coding and adjust coding process if necessary,

9) Analyze coded data, applying appropriate statistical test, and

10) Write up results.

4.3.2.1 What to Count

There are seven major elements in a written message that can be counted in the content analysis as words, themes, characters, paragraphs, items, concepts, and semantics (Berelson, 1952; Berg, 1983; Merton, 1968; Seltiz et al., 1959 as cited by Bruse L. Berg, 2000).

1) **Words:** The word is the smallest element or unit used in the content analysis. Its use generally results in a frequency distribution of specified words or terms.

2) **Themes:** In its simplest form, a theme is a simple sentence, a string of words with a subject and a predicate. Because themes may be located in a variety of places in most written documents, it becomes necessary to specify (in advance) which places will be searched. For example, researchers might use only the primary theme in a given paragraph location or alternatively might count every theme in a given text under analysis.

3) **Characters**: In some studies, characters (persons) are significant to the analysis. In such cases, you count the number of times a specific person or persons are mentioned rather than the number of words or themes.

4) **Paragraphs**: The paragraph is infrequently used as the basic unit in content analysis chiefly because of the difficulties that have resulted in attempting to code and classify the various and often numerous thoughts stated and implied in a single paragraph.

5) **Items**: An item represents the whole unit of the sender's message—that is, an item may be an entire book, a letter, speech, diary, newspaper, or even an in-depth interview.

6) **Concepts**: Concepts involve words grouped together into conceptual clusters (ideas) that constitute. For instance, a conceptual cluster may form around the idea of deviance.

A word such as crime, delinquency, kiting, and fraud might cluster around the conceptual idea of deviance. To some extent, the use of a concept as the unit of analysis leads toward more latent than manifest content.

7) **Semantics**: Researchers are interested not only in the number and type of words used in a content but also how a word affect the other word(s). In other words, how strong or weak a word (or words) may be in relation to the overall sentiment of the sentence.

4.3.3 Co-word Analysis as a Quantitative Analysis Tool

Co-word analysis is a content analysis technique (He, 1999).It is a quantitative description to analyze the content. This is an effective way to measure the strength of association between keywords in a textual data. Co-word analysis is one of the various approaches that are used for mapping the knowledge structure of scientific and other types of article. Co-word analysis uses patterns of co-occurrence of pairs of words and phrases in a corpus of text to trace out the relationship between ideas within the subject area present in the texts. On the basis of co-occurrences frequency of keywords, inclusion and proximity indexes are build which is used to measure the strength of relationship between keywords. Using the indexes keywords are clustered and exposed into a network map. Inclusion map highlights the central theme in a sphere and proximity map reveal the linkage between minor areas hidden in central one. Some other parameters such as centrality and density are employed to evaluate the shape of each map. It measures the degree to which each area is centrally structured and the extent to which each area is central to the others. By comparing the network maps for different time periods, the dynamic development of a discipline can be detected.

4.3.3.1 Types of Co-occurrences

There are four notions of co-occurrences of a word that have been identified (Saeedeh Momtazi et al. 2010) are given below:

1) **Co-occurrence in a Document**: If two content words $\boldsymbol{w}$ and $\boldsymbol{w}^1$ are seen in the same document, they are usually topically related. In this notion of co-occurrence, how near or

far away from each other they are in the document is irrelevant, as is their order of appearance in the document.

2) **Co-occurrence in a Sentence:** Since topic changes sometimes happen within a single document, and our end task is sentence retrieval, we also investigate the notion of word co-occurrence in a smaller segment of text such as a sentence. In contrast to the document-wise model, sentence-wise co-occurrence does not consider whole documents, and only concerns itself with the number of times that two words occur in the same sentence.

3) **Co-occurrence in a Window of Text**: The window-wise co-occurrence statistic is an even narrower notion of context, considering only terms in a window surrounding w1. Specifically, a window of a fixed size is moved along the text, and f ww1 is set as the number of times both w and w1 appear in the window. Since the window size is a free parameter, different sizes may be applied.

4) **Co-occurrence in a Syntactic Relationship**: Another notion of word similarity derives from having the same syntactic relationship with the context w. This syntax-wise co-occurrence statistic is similar to the sentence-wise co-occurrence, in that co-occurrence is defined at the sentence level. However, in contrast to the sentence-wise model, w and w0 are said to co-occur only if there is a syntactic relation between them in that sentence. E.g., this type of co-occurrence can help cluster nouns that are used as objects of the same verb, such as ‘tea’, ‘water’, and ‘cola’ can be used with the verb ‘drink’.

4.3.4 Content Analysis as Qualitative Technique

The qualitative content analysis is dealt with appearance or non-appearance of attributes in a message. It examines meaning, theme, patterns that may manifest of latent in a particular text. It allows researcher to understand social reality in a subjective but scientific manner. The qualitative content analysis has been developed primarily in Anthropology, Qualitative

Sociology and Psychology, in order to explore the meanings underlying in physical message. A. L. George (1959, p.7), "qualitative analysis of a limited number of crucial communication may often yield better clues to the particular intention of a particular speaker at one moment in time then more standardize".

This method mainly uses inductive approach and research question guiding the gathering data and examination of topic and theme as well inferences drawn on the basis of available and unavailable attributes in text sometimes it attempts to generate theory to relate concept and to suggest hypothesis that can be tested deductively. It uses purposively sampling for selecting items from population which can hit the research question is being investigated and produces description or typologies along with expression form the subject reflecting how they view social world. It pays attention to unique themes that illustrate the range of meaning of the phenomenon rather than statistics significance of the occurrence of a concept.

Yan Zhang and Barbra M. Wildemuth (2009) suggest following steps to conduct qualitative content analysis:

1) Prepare data,

2) Define the unit of analysis,

3) Develop categories and coding scheme,

4) Test your coding scheme on a sample text,

5) Code all the text,

6) Access your coding consistency,

7) Draw conclusion from the coded data, and

8) Reports your methods and findings.

The above mentioned both approach of content analysis are not mutually exclusive and can be used in combination. In word of Smith (1975, p.218) "qualitative analysis deals with the form and antecedent-consequent patterns of form, while quantitative analysis deals with duration and frequency of forms". Weber (1990) also considers content analysis uses quantities operation or qualitative operation and sometimes it uses both qualitative and quantitative operations for a study.

4.3.5 Difference between Quantitative and Qualitative Approach of Content Analysis

White and Marsh (2006) have differentiated quantitative and qualitative approach of content analysis on the basis of following dimension:

Dimension	*Quantitative*	*Qualitative*
1. Research Approach	Deductive; based on previous research, which allows for formulating hypothesis about relationship among variables.	Inductive; research question guide data gathering and analysis but potential themes and other questions may arrive from careful reading data.
2. Research tradition or orientation	Positivist	Naturalist or Humanist; hermeneutics.
3. Objective	To make replicable and valid inferences form text to context of their use.	'To capture the meaning, emphasis and themes of messages and to understand the organization and process of how they are presented' (Altheide, 1996,p.33). 'Search for multiple interpretations by considering diverse voices (readers), alternative perspectives (from different ideological positions), oppositional readings (critiques), or varied uses of the texts examined (by different groups)' (Krippendorff, 2004, p. 88)
4. Data: Nature	Syntactic, semantic, or pragmatic categories; naturally occurring texts or text generated for project.	Syntactic, semantic or pragmatic category; naturally occurring text or text generated for project.

Dimension	*Quantitative*	*Qualitative*
5. Data: Selection	Systematic, preferably random sampling to allow for generalization to broader population; data selection usually complete prior to coding.	Purposive sampling to allow for identifying complete, accurate answer to research question and presenting the big picture ; selection of data may continue throughout the project.
6. Categorization schema	Coding scheme developed a priori in accord with testing hypothesis; if adjustment are made during coding, items already coded must be recorded with the revised scheme; may use coding schemes for other studies.	Coding scheme usually developed in the process of close, iterative reading to identify significant concepts and patterns.
7. Coding	Objective; test for reliability and validity.	Subjective; in some case use, use of memos of documents perceptions and formulations; techniques for increasing credibility, transferability dependability and confirm ability of findings.
8. Argument basis for proof	Frequency, indicating existence, intensity and relative importance; data allow for statistical testing; objective to generalize to broader population and predict; interpretation may be supported by quotation form text.	Deep grounding of data; if numbers are presented, they are usually presented as counts and percentage, description of specific situation or case accurately and thoroughly; may involve triangulation based on multiple data source for some concept; may use technique to develop ground theory to relate concept and to suggest hypothesis that can be tested deductively; interpretation may be supported by quotes for analyzed texts and literature about the contexts of those texts into their conclusions, by

Dimension	*Quantitative*	*Qualitative*
		constructing parallelisms, by engaging in triangulations, and by elaborating on any metaphors they can identify.
9. Research Approach	Deductive; based on previous research, which allows for formulating hypothesis about relationship among variables.	Inductive; research questions guide data gathering and analysis but potential themes and other questions may arise from careful reading of data.
10. Use of computer	For dictionary base content analysis or for developing environments prior too dictionary based content analysis; also for statistical test; representative software for content analysis: VB Pro, Word Stat etc.	As annotation and searching aids representative software- Atlas, Ti and NVivo etc.

4.4 Framework of Content Analysis

Kripendorff (2004) proposed a framework for content analysis using some conceptual components. The framework (see Figure 4.2) make understandable the concept and design of content analysis and different elements of the framework have been described below:

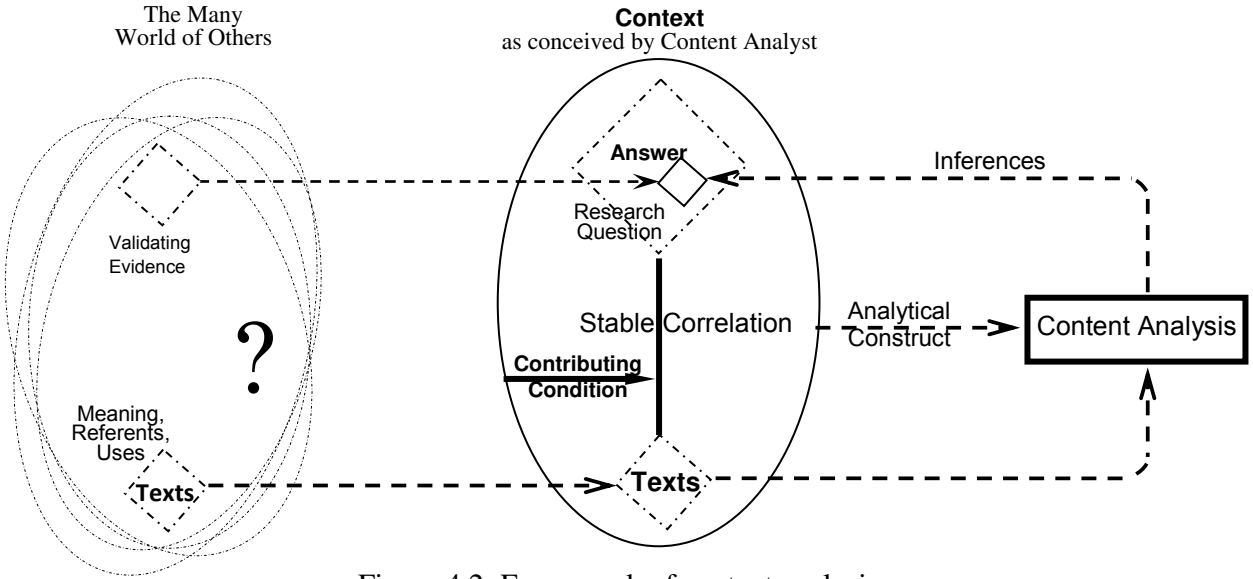

Figure 4.2: Framework of content analysis

Source: *Krippendorff, 2004, p.30*

1) **World of Others, and Texts:** Many dotted ovals indicate concepts, ideas, thinking and environments of some people, in which they are engaged to compose their text for which they are responsible. These texts (dotted diamond leveled 'text') are meant to read, interpreted, understood by the people other than an analyst. Within dotted oval reader may decompose what they read into meaningful units, recognize the compelling structure, and rearticulate their understanding sequentially of holistically. This text may be writings pictorial, image, gesture, webpage, musical composition, behavioural sequence. Figure 4.2 illustrates that text occurs in analyst world but acknowledge their origin in the 'world of others'. The oval with dark circumferences represents the context (world of the content analyst), the context specifying the world in which text can be related to the analyst's research question.

   In the course of content analysis, the context includes all knowledge that content analyst applies to the given text. This knowledge can be categorized into two parts-

   a) ***Stable correlation***- it uses empirical knowledge of the analyst with establishes usual relation between research question and text which is to be analysed for a possible answer. This knowledge, analyst got after reading text keeping the research question in mind.

   b) ***Contributing condition***- it is the knowledge which analyst got from another source not form the text which to be analysed. It consists of all factors that affect the network of stable co-relation in foreseeable ways.

2) **Analytical Construct:** it is idea, concept, and situation, what analyst knows about the context is applied to the content analysis process. In the illustration, it extracts from the known context and enters into context analysis (research process). The purpose of analytical construct is to ensure that texts are processed in reference to what is known about their context of use.

3) **Inferences:** Inference in the content analysis is maintained and explained by the analytical construct that enters into that content analysis box as a representation of conceived context by an analyst. In the content analysis, Kripendorff (2004, p.36) uses

neither deductive nor inductive inferences but abductive inference are use. Abductive inferences proceed from particular of one kind to particular of another kind, for example,

One might date a document form vocabulary used within it.

One might infer a writer's psychology from the image used in her prose.

4) **Validating Evidence:** There is absence of direct observational evidence in content analysis as it analyse recorded material. For example, analysis of domestic violence on women in India form a local newspaper, in this case, validation of the evidence may be difficult or infeasible.

   Validation may be impossible in research question concern past or future happenings, such as inferences from a document two historical facts, inference from a work for deceased author to his/ her intention. Any content analysis should be valid in principle which prevents analyst form pursuing such research question which yields results with no baking (support) expect by the authority of research.

   According to Krippendorff, Klaus (2004), "Content analysis should be valid in principle." Validation in principle restrict to the analyst to answer the research question which does not provide empirical evidence nor provide result without any support for example: a conclusion from an analysis of television serials that women domestic violence is rising in India, those who came to this findings can show that this conclusion is not merely their abstraction from television serials but also have some independently observable reality that can show that arising women domestic violence is manifest something other than television serials.

4.5 Component of Content Analysis

Kripendorrf (2004) stated different components of content analysis which are very help to conceptualize and evaluate content analysis design step by step. Its components have been describe below-

1) Unitizing
2) Sampling
3) Recording/coding

4) Reducing data

5) Inferring

6) Narrating answer

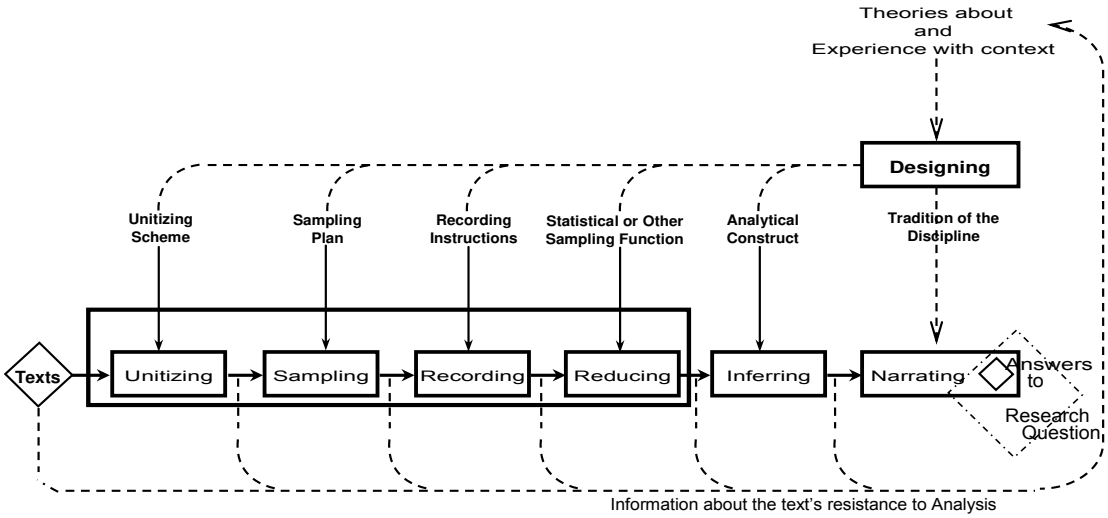

Figure 4.3: Components of content analysis

Source: *Krippendroff, 2004, p.86*

In Figure 4.3, first four components in the rectangles in a dark perimeter are used to extract data from text these four elements called together 'Data making components'. In the illustration, dashed line show a flow of information that is motivated by the analyst resistant to the text. These information enrich the theory about and experience with the context of analyst which is very useful for good content analysis design.

The dashed line which come out form 'designing' box and enter into 'narrating' box is the tradition of analyst's discipline which is inherited pattern of thought or action or system to deal any task or to conduct of analyst.

The unbroken lines that comes out from design box and enters into different components of information, and function which are written in detail by analyst. These information direct to each component and should have enough information so that other tan analyst replicate the design and evaluate critically. The tradition of analyst's discipline does not need any explicitly.

1) **Unitizing:** It is a systematic way to recognize the text (documents, images, voice and other observables) that are of interest to an analyst.

2) **Sampling:** It allows an analyst to reduce the volume of text into a manageable subset of text which economises the time and resource of the analyst. Text must be sampled in view of what mean, what information they contain and what interpretation they narrate. The sample size must be appropriate large so that research question can be answered with sufficient confidence.

3) **Recording/Coding:** Recording takes place when an observer of readers or analyst interprets what they see, read or find and then state their experience. It is performed to translate the unedited text, original image and unstructured sound into analysable representation. After recording any phenomenon one can compare across the time and replicate the analysis of other different researchers, apply different method to them.

4) **Reducing:** Analyst uses many criteria to reduce prepared data for efficient presentation in case large volume of data. For example, in an analysis, frequency of different words have been recorded form text. Tabulation of frequencies of words makes a large chunk of data. Now, one can remove the word that has less than ten frequencies as they don't have good representation in the text. In this way reducing can be performed which can't make any negative effect.

5) **Inference:** Krippendorff (2004) uses abductive inference in content analysis. It proceeds from particular of kind to particular of another kind and motivated by 'Analytical Construct'. It is a knowledge which assumed about the context of the content analyst. But some scholar stated that inductive and deductive approaches are used to conduct content analysis (Kyngas & Vanhanen, 1999; Zhang & Wildemuth, 2009; Mayring, 2000; Berg, 2000; Elo & Kyngas, 2007).

6) **Narrating:** On the basis of established inference, it is trying to answer the research question appropriately which contribute some new explanation and findings to the available literature. This narrating process influenced by the traditional of analyst's discipline.

Thus, the above explanation suggests that content analysis is a process which includes six components through which a text passes to get the appropriate answer. It is repetitive process

until a certain quality is not achieved. This repetition occurs in quantitative content analysis at the development stage of research (White and Marsh, 2006).

4.6 Source of Data for Content Analysis

Originally, content analysis dealt with only recorded materials which are recorded to communicate some idea, information, and social-cultural to their coming generation. These recorded materials are known as a source of data for conducting content analysis. Ram Ahuja (2001) identifies five important sources for collecting data for content analysis. These sources are given below:

1) Newspaper

2) Books and Magazines

3) Filmed Material

4) Archives Documents

5) Records etc.

1) **Newspaper**: It is widely available form of written communication, it does not only report local, state, national, international event but also deals with social political economic and cultural issues. They present the opinions of intellectual people, experts as well as the common people. Thus, newspaper provides a wealth of information

2) **Books and Magazines**: Both items serve as important source for content analysis. Various collections of books, magazines, journals and different types of documents are available in libraries could be used for examining any issue from simple to complex or from old to current.

3) **Archived Documents:** Documents available in archives may be more difficult to obtain and if available at all, require special handling and care. Letters are written to kin, friends, and acquaintances reveal fascinating views of the social situation during the specific period of history are important source.

4) **Films:** Films including videotapes provide another source of data. By analysis of the content of films, one can pick out themes, issue, and beliefs for analysis. For example,

Sex and violence, changing value of youths, rights of women, police corruption and so on.

5) **Records:** Records are obtained by sorting out files from office, archives, college libraries, information centers, etc. For example, correspondence between the viceroy and Congress leasers during struggle for independence period. Radio programs and different types of recorded speech in audio format are very important for content analysis.

Besides, above mention source there are so many sources of data that can be used for content analysis:

1) Periodicals
2) Research articles
3) Books chapter
4) Song Lyrics
5) Government policies
6) Parliamentary speeches or general speeches
7) Transcript of news reporting
8) Editorials
9) Conversations
10) Images
11) Recorded voices
12) Diaries/letters/ e-mails
13) Twits on social network
14) Interviews
15) Web pages
16) Opinion Surveys
17) Censuses
18) Laws
19) Advertisements
20) Radio programs
21) T V Serials and programs, etc.

4.7 Use and Application of Content Analysis

Generally, content analysis is used to understand a wide range of manifested and latent ideas recorded in different communication medium such as social change, cultural symbol, social issue, and social problem and so on. In the field of Library and Information Science, it is used to focus on a particular specialty or subject area, perform conceptual analysis, discover the nature of different discipline, examine the relationship between different subject, identify the used theory in different scholarly publication, analyse the publication trends of scholarly journal articles, examine effect of particular information over different community and so on. It also used for identifying the authorship pattern, subject trend, conducting user behavior studies etc.

A well known scholar in the field of content analysis Berelson made a study in 1952 and enumerates following use\application of content analysis which have been categorized under three broader categories.

a) Use of content analysis on the basis of characteristics of content

b) Use of content analysis on the basis of producers or causes of content

c) Use of content analysis on the basis of audience and consequences of content

4.7.1 Use of Content Analysis on the Basis of Characteristics of Content

1) **To describe a trend in communication:** Content analysis can be of most valuable use in studying trends and changes in communication.

2) **To trace the development of scholarship:** Content analysis of the literature in various scholarly and scientific fields has been used to describe their development.

3) **To disclose international differences in communication content:** Systematic analysis can disclose differences in the focus of audiences of communication available in various countries.

4) **To compare 'media' or 'levels' of communication:** Communication not only attracts different audiences but they also treat the same topics in different ways. Example: A comparative analysis of a book or a comic's serial and its film translation.

5) **To audit communication content against objectives:** Every communication outlet has an objective or set of objectives, whether implicit or explicit. One measure of the quality of content is the extent to which it faithfully expresses such objectives.

6) **To construct and apply communication standards:** Evaluation of content necessarily involves the same standard with which the communication content is compared by means of content analysis. During the past years, there has been considerable debate on the standards of performance of the communication media.

7) **To aid in technical research operations:** In this application, the function of content analysis has been used, for instance, in the coding of qualitative materials secured through sample surveys or experimental methods.

8) **To expose propaganda techniques:** A majority of content studies can be considered propaganda analysis, A propaganda is meant the deliberate attempt to influence attitudes or behavior on controversial issues.

9) **To measure the 'readability' of communication materials:** The main purpose behind this is to identify the communication content, whether it is easy to read and comprehend or difficult. It is helpful to understand, what are the concrete factors that distinguish the easy book from the hard book? What are the elements of the communication content make it easy or hard to read and comprehend?

10) **To discover stylistic features:** The problems of literary and oratorical styles have attracted students since ancient times, and countless volumes have been written about them.

4.7.2 Use of Content Analysis on the Basis of Characteristics of Content

1) **To identify the intentions and other characteristics of the communicators:** It is a major use of content analysis. The basic logic of this application of content analysis is this: The content has such-and-such characteristics; therefore the communicators have such and such intentions.

2) **To determine the psychological state of persons and groups:** This involves the analyses of the social work or the therapeutic interview, or personality tests, or fictional creations, or of letters, diaries, or other personal documents.

3) **To detect the existence of propaganda:** This concerns comparison of content under study with that of other content explicitly identified with a certain propaganda position, or with explicitly formulated standards.

4) **To secure political and military intelligence:** This concerns the questions: What is the foreign policy of a particular nation as articulated in its communication media? How is the enemy reacting to our propaganda?

4.7.3 Use of Content Analysis on the Basis of Audience and Consequences of Content

1) **To reflect attitudes, interests, and values of population groups:** Content analysis is used to identify cultural patterns which are derived from analysis of communication widely distributed in the community, as a kind of consumption habit study. Example: Attitudes toward cities' family life as reflected in a local magazine.

2) **To reveal the focus attention:** Content analysis has been used to describe in a systematic fashion the focus of an attention of various groups of people on different subjects, or the subject matter distribution of what appeared in the selected media of communication.

3) **To describe attitudinal and behavioral responses to communications:** Under certain conditions, content analysis can contribute to the investigation of effects. For examples, Effect of e resources on library user.

4.8 Advantage and Disadvantage of Content Analysis

Content analysis has its strength and its weakness like other research technique has, content analysis is no expectation.

4.8.1 Advantages

Content analysis offers several advantages to researchers which are given below:

1) The most significant advantage of content analysis technique is its unobtrusive nature, i.e. it has no effect on the subject being studied. In other technique such as- interview, observation, experiment etc., researchers are directly involved with their subject which are being studied. Content analysis eliminates the sources of response biases that threaten researchers whenever the respondents are directly questioned and observed as content analysis does not collect data directly from people.

2) This technique allows researchers to apply both approach quantitative and qualitative in his /her research.

3) It can be used as a reliable technique in historical research concerned with a particular period or with trends over time by studying view of some people who are no longer available to answer the questions.

4) The second significant advantage of this technique is that it can handle unstructured data. Structured data like a filled questionnaire and structured interview etc. typically offer to respondents predefine choices that are easily tabulated, coded or processed by computer.

5) Content analysis can be used to test preliminary ideas, hypothesis or theories prior to a complete investigation.

6) People are more candid while writing down their thoughts than when confronted by interviewer or a questionnaire. Therefore, studying society where people are more literate, content analysis proves to be more reliable method of research.

7) This method is more useful where research budget is small and resource is limited.

8) It provides insight into complex models of human thought and language.

9) It can be used to interpret texts for purposes such as the development of expert systems (since knowledge and rules can both be coded in terms of explicit statements about the relationships among concepts).

4.8.2 Disadvantages

Despite all of these benefits, content analysis has some limitations like any other method. The following point can be considered as its disadvantages:

1) Content analysis is a well planned method; it lacks the spontaneity and unplanned qualities of field research.

2) Determining validity is difficult. For example, did the newspaper give the real values and feelings of the workers during the strike? Probably not.

3) Some required documents may not be available to the researcher which may affect the conclusions.

4) It is susceptible to the coder bias.

5) Content analysis is quite expensive and quite extensible operation.

6) This technique often disregards the context that produced the text, as well as the state of things after the text is produced.

7) Content analysis method has no theoretical base in order to draw meaningful inferences about the relationships and impacts implied in a study.

8) This method can be extremely difficult to automate or computerize.

9) Content analysis cannot be used to test the casual relationship between variables.

4.9 Application of Computer in Content Analysis

The widespread use of computers has revolutionized the manipulation of texts in ways that attract to content analysis. Content analysis, done manually is often time-consuming and unreliability is a persistent problem. This technique usually requires skilled and sensitive coders, the very person who soon becomes bored and frustrated by tedious and repetitive nature of the task, cannot deal by hand with big data. Thus, this technique is prone to error if it is manipulated by the human. A significant effort to deal with these problems, some computer programs have been developed to handle a variety of operations involved in the textual analysis. Collectively, software programs performance smoothly with great capacities. Following characteristics of computer make it useful for conducting content analysis whether big or small data.

1) Computer is a sequential electronic machine

2) Computer processes a large chunk of numerical and textual data with great speed.

3) Computer uses logical or mathematical operations to the internal representation of data, and processed it according to the instructions. The data are feed as an input and give output which are available for human inspection.

4) Computer uses instruction that is known as program which made computer software engineer according to need of the user. There are so many software package for a specific for specific task which are sold in market and some freely available on internet.

5) Computer operations are always deterministic and therefore it is reliable .there is no ambiguities and uncertainties within the computer.

Having above mention characteristics computers are playing important role in performing content analysis which are given below.

1) As a research assistant, it make easy to mark up data, divide them into chunks for analysis, write notes, group together multiple instances of the same classification and allow for editing and coding.

2) As manipulator and extractor of data, matching the text against specialized dictionary for coding purpose.

3) As a database, it maintains the electronic and coded version of data, keeps all steps on track in the analysis and it allow for replicate the analysis.

4) As a means of quantitative analysis, such as frequency count, percentage, co-occurrence matrix either within the program itself or exporting data to statistical packages. These statistical packages usually allow inferential statistics.

5) Computer programs facilitate human coding of the electronic data to direct involvement in analysing the document; matching terms to and electronic dictionary which is a coding scheme and coding data.

4.9.1 Software Packages for Content Analysis

There are many sets of programs for dictionary base content analysis e.g. NVivo (2003-2005), QSRN6 (2005), and Atlas.ti, R's TM library etc. Many programs now allow for storing not only textual documents but also image, audio in electronic form dictionary based content analysis programs rely on several basic functions: word, category, co-occurrence counts and frequency analysis, visualization (including clustering) and some time concordance generation. DIMAP-4 (Litkowski & Mc Tavish, 2001), KEDS (Schrodt, 1996) and TABRT (Schrodt, 2000) are examples of developing environments. Word Stat 5.0 (Peladeau, 2005), VBPro (Miller, 2003) and the General Inquire (Stone, 2002) are examples of dictionary-based content analysis program. Most of the researchers do not reveal the used software for content analysis. Afosto

and Hughes-Hassell (2005) mention NVivo; Marsh (2002) uses Atlas.ti; White (2000), and Kracker and Wang (2002) use QSR NUD*IST (latest version known as QSR N6); Scholar has tested R's TM package in a research article (Ravikumar, Agrahari & Singh, 2011) for paving a base for this Ph.D. thesis. Information about different software in brief are given below:

1) **CATPAC**

   Website: http://www.terraresearch.com/catpac.cfm

   Operating Systems: Windows

   License: Commercial $595; Academic $295; Student $49.

   Code base: Proprietary (executable only)

   Languages: English (ASCII only)

2) **Computer Programs for Text Analysis**

   Websites: http://www.dsu.edu/~johnsone/ericpgms.html

   Operating Systems: MS-DOS

   License: Freeware

   Codebase: Proprietary (executable only)

   Languages: English (ASCII only)

3) **CONCORDANCE**

   Websites: http://www.rjcw.freeserve.co.uk

   Operating Systems: Windows

   License: $89 + $10 handling fee. $40 per subsequent license.

   Codebase: Proprietary (executable only)

   Languages: English, Chinese

4) **DICTION**

   Website: http://www.sagepub.com

   Operating Systems: Windows

   License:Commercial $189; Academic $129

   Codebase: Proprietary (executable only)

   Languages: English (ASCII only)

5) **HAMLET**

   Homepage: http://www.apb.cwc.net/homepage.htm

   Operating Systems: MS-DOS

License: Free “for personal use”

Codebase: Proprietary (executable only)

Languages: English (ASCII only)

6) T-LAB

Websites: http://www.tlab.it

Operating Systems: Windows

License: $520 single user license

Codebase: Proprietary (executable only)

Languages: English, Spanish and Italian.

7) WinATA

Website: http://www-users.aston.ac.uk/˜roepj/guide/guide.htm

Operating Systems: Windows

License: Free

Codebase: Proprietary (executable only)

Languages: English (ASCII only)

8) TEXTPACK

Website: http://www.social-science-gesis.de/en/software/textpack/index.htm

Operating Systems: Windows

License: Commercial single user E300; Student E100; Network E1500

Codebase: Proprietary (executable only)

Languages: English (ASCII only)

9) LIWC

Website: http://www.erlbaum.com

Operating Systems: Windows, Mac

License: Single user $99

Codebase: Proprietary (executable only)

Languages: English (ASCII only)

10) MonoConc / ParaConc

Website: http://www.ruf.rice.edu/˜barlow/mono.html

Operating Systems: Windows

License: Free

Codebase: Proprietary (executable only)

Languages: English (ASCII only)

11) LEXA

Website: http://nora.hd.uib.no/lexainf.html

Operating Systems: Windows

License: Free

Codebase: Proprietary (executable only)

Languages: English (ASCII only)

12) SPSS TextSmart

Website: http://www.spss.com/textsmart/

Operating Systems: Windows

License: Unknown

Codebase: Proprietary (executable only)

Languages: English (ASCII only)

13) VBPRO

Homepage: http://excellent.com.utk.edu/˜mmmiller/vbpro.htm

Operating Systems: MS-DOS

License: Free

Codebase: Proprietary (executable only)

Languages: English (ASCII only)

14) WordStat

Website: http://www.simstat.com/wordstat.htm

Operating Systems: Windows

License: $278 ($129 + required Simstat base $149)

Codebase: Proprietary (executable only)

Languages: English, French, Spanish and Dutch

15) DIMAP

Website: http://www.clres.com

Operating Systems: Windows

License: Commercial $330; Academic (See below)

Codebase: Proprietary (except for the Franklin parser)

Languages: English (ASCII only)

16) Visual Text

Homepage: http://www.textanalysis.com

Operating Systems: Windows

License: (Contact Company)

Codebase: Proprietary

Languages: English

17) KEDS / TABARI

Homepage: http://www.ku.edu/~keds/

Operating Systems: MS-DOS, Mac, Unix/Linux

License: Free

Codebase: Open source

Languages: English (ASCII only)

18) Atlas.ti

Website: http://www.atlasti.de

Operating Systems: Windows, MS-DOS

License: $250

Codebase: Proprietary (executable only)

Languages: English only(?)

19) NUDIST

Homepage: http://www.qsr-software.com

Operating Systems: Windows

License: Single user $325; 2-30 licenses $260

Codebase: Proprietary (executable only)

Languages: English only

20) R's TM Package

Website: https://cran.r-project.org/web/packages/tm/index.html

Operating Systems: Windows, Linux

License: free

Codebase: Open source

Languages: English, Latin and other

21) TextQuest

Website: http://www.textquest.de/

Operating Systems: WinXP, Windows Vista, Windows 7, Mac OS-X 10.4 or newer

License: Commercial 800,00 EUR; Academic 600,00 EUR

Codebase: Proprietary (executable only)

Language: English, German, and Spanish.

Thus, content analysis is a research technique which is being used in LIS field to attend various research goal. it uses qualitative, quantitative and some time uses both approach in a study. It employs a wide range of analytical technique to generate findings and put them into context. In the field of Library and information science, content analysis does not always in purist form but occasionally uses a hybrid approach incorporating quantitative and qualitative technique. Co-word analysis is technique to quantify trend and evaluation of subject within the spam of particular journal and characterize a co-word technique as a content analysis tool which analyse the document content in systematic way and briefly descried the involved step in quantitative and qualitative content analysis.

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Chapter 5

Data Analysis and Interpretation

Analysis and interpretation of data lead to the findings of any research work. It depicts a clear picture of a subject and enables researchers to furnish their research work with concluding remark, and suggestions. Based on quantitative data, bibliographical components, and keywords that have been extracted from published articles in ***Scientometrics*** and ***D-Lib Magazin*e** during the year 2001-2010, the chapter examines and interprets bibliometric aspects and content of the journals. However, to fulfill the objectives stated in the Introductions (Chapter one) and. to have a clear understanding of the collected data, the data have been analysed and interpreted under following sub-headings:

1) Intellectual structure (subject structure)
2) Citation pattern
3) Authorship pattern and Collaborative trend
4) Institution wise publication and Author's Affiliations
5) Subject coverage of Research and Non-research articles

The related data for the study has been tabulated and analysed as well as suitable graph and statistical tools have been used to describe them as follows.

5.1 Intellectual Structure (Subject Structure)

Thomas Kuhn's idea of scientific revolutions and the concept of paradigm shift made many researchers curious about the intellectual structure (subject structure) of their academic fields (Kim, 2013). Studies of the intellectual structure of an academic discipline provide ways to examine the discipline's current state as well as to show the changing structure as the field goes through modification in their subfields or subject specialties.

5.1.1 Scientometrics (Journal)

A total of 889 raw keywords were collected from 1241 articles of *Scientometrics* Journals. These keywords were standardised (for standardising process see p.9 section 1.3.4.1.3) and as a result, 243 unique keywords were finally used for co-word analysis.

The average number of occurrences of keywords per article is 15.38. The range of keywords in an article varies from 1 to 51. A total of 52 (4.19%) articles have more than 30 keywords and two articles have 51 keywords. There are 257 (20.71%) articles which have 21 to 30 keywords; 577(46.49%) articles have 11–20 keywords and 355 (28.61%) articles have up to 10 keywords. Thus, 71.39 % articles contain more than 10 keywords.

In order to understand the overall intellectual structure of the journal *Scientometrics*, co-occurrence of 243 keywords were analysed for the period 2001-2010. Further, the period (2001-2010) has been divided into two period segments i.e. year 2001-2005 and 2006-2010, the reason behind it is to observe the dynamic changes of subject during the period 2001-2010. The keywords of each period divided into five clusters using complete linkage cluster method [see p.10, 1) of section 1.3.4.1.5].

5.1.1.1 Intellectual Structure based on Co-word Analysis (2001-2010)

5.1.1.1.1 General Overview Structure

A general overview structure has been generated with the help of MDS to understand the relative position of different clusters of Scientometrics field during the period 2001-2010 (see Figure 5.1.1). Each cluster has been selected as input variables for creating MDS graph.

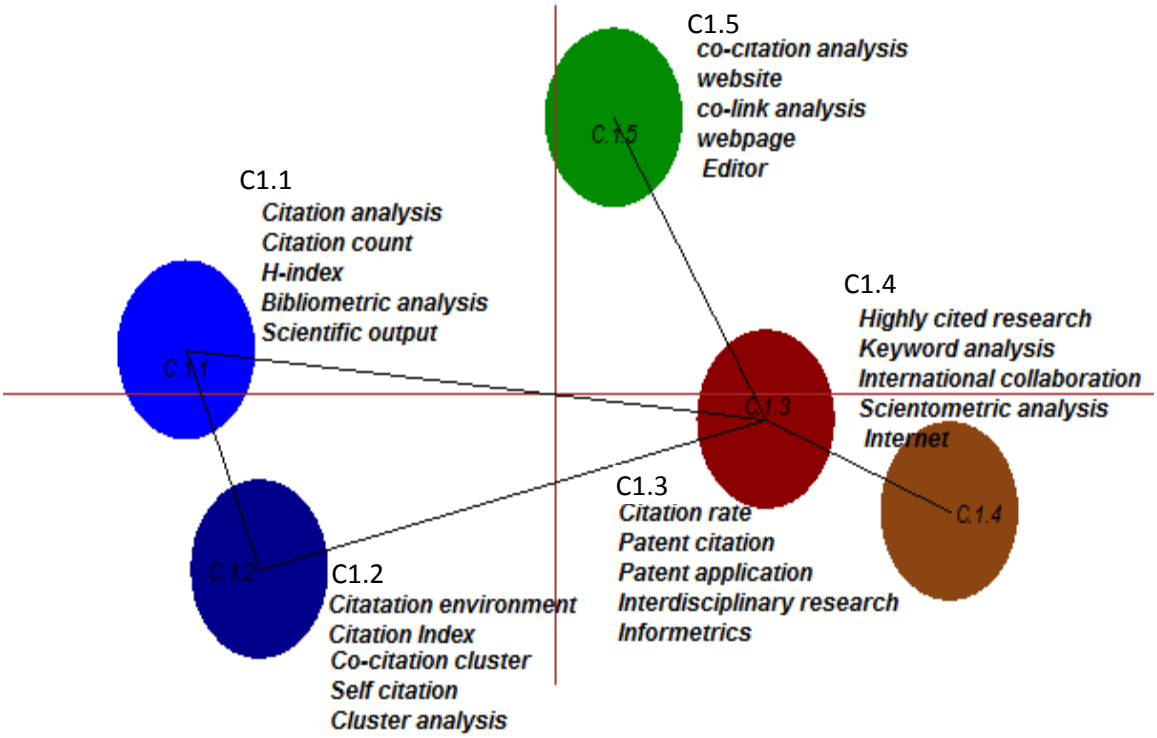

Figure 5.1.1: General overview structure of *Scientometrics* in 2001-2010

Data Source: *Primary Data*

As shown in Figure 5.1.1, each cluster is represented by five keywords which occurred most frequently in the cluster. The position of a cluster (sub-domain) relatively to each other in the graph depicts the relation of its keyword with other clusters' keywords. A link between clusters has been developed by thin lines in the figure, shows a strong relationship that is based on the Slaton index value of the two clusters which is greater than 0.35.

5.1.1.1.2 Co-word Structure of Clusters

In order to plot a detailed co-word structure of each cluster, keywords of the cluster have been used as the input variable to map the sub-domain (see Figure 5.1.1) based on the correlation matrix of 245 keywords. The detail structures of the five clusters (Figure 5.1.2−5.1.6) are plotted to visualise specific characteristics of each sub-domain (clusters) in the Scientometrics field. In the graph, thin lines represent the link between two keywords with the Salton Index value >0.2. The keyword with crass mark represents outer link keyword (the keyword which has a link with other clusters' keywords) in the co-word structure map.

The cluster C1.1 includes 46 keywords with a higher frequency such as Citation analysis, Scientific output, University ranking and Case study. Cluster C1.2 has 45 keywords like Cluster analysis, Self-citation, Publication output, citation pattern, Search strategy, Statistical analysis. Cluster C1.3 includes 54 keywords as Scientometrics analysis, Keyword analysis, Collaboration, Authorship, Bibliometric law, etc. Cluster C1.4 includes 52 keywords related to Interdisciplinary research, Power law, Centrality, Informetrics, and Patent citation and so on. Cluster C1.5 includes 47 topics related to Website, URL, Co-link analysis, Gini-index, web-citation, co-word analysis, and collaboration pattern.

It can be observed from plotted network (see Figure 5.1.2−5.1.6) that connection strength of each keyword is not equal. University ranking , Bibliometric analysis , Citation analysis in cluster C1.1; Citation pattern, publication output ,Citation index, and Citation impact in C1.2; Patent analysis, Network analysis, Co-authorship network, Scientific collaboration, International collaboration, Centrality, and Lotka law in C1.3; National patent, University patent, Bibliometric map, Patent citation and Citation performance in C1.4; Co-citation analysis, Author co-citation analysis, Co-citation count, Multidimensional scale, Website, Co-link analysis, Webometrics in C1.5 are active keywords which occupy more links relatively.

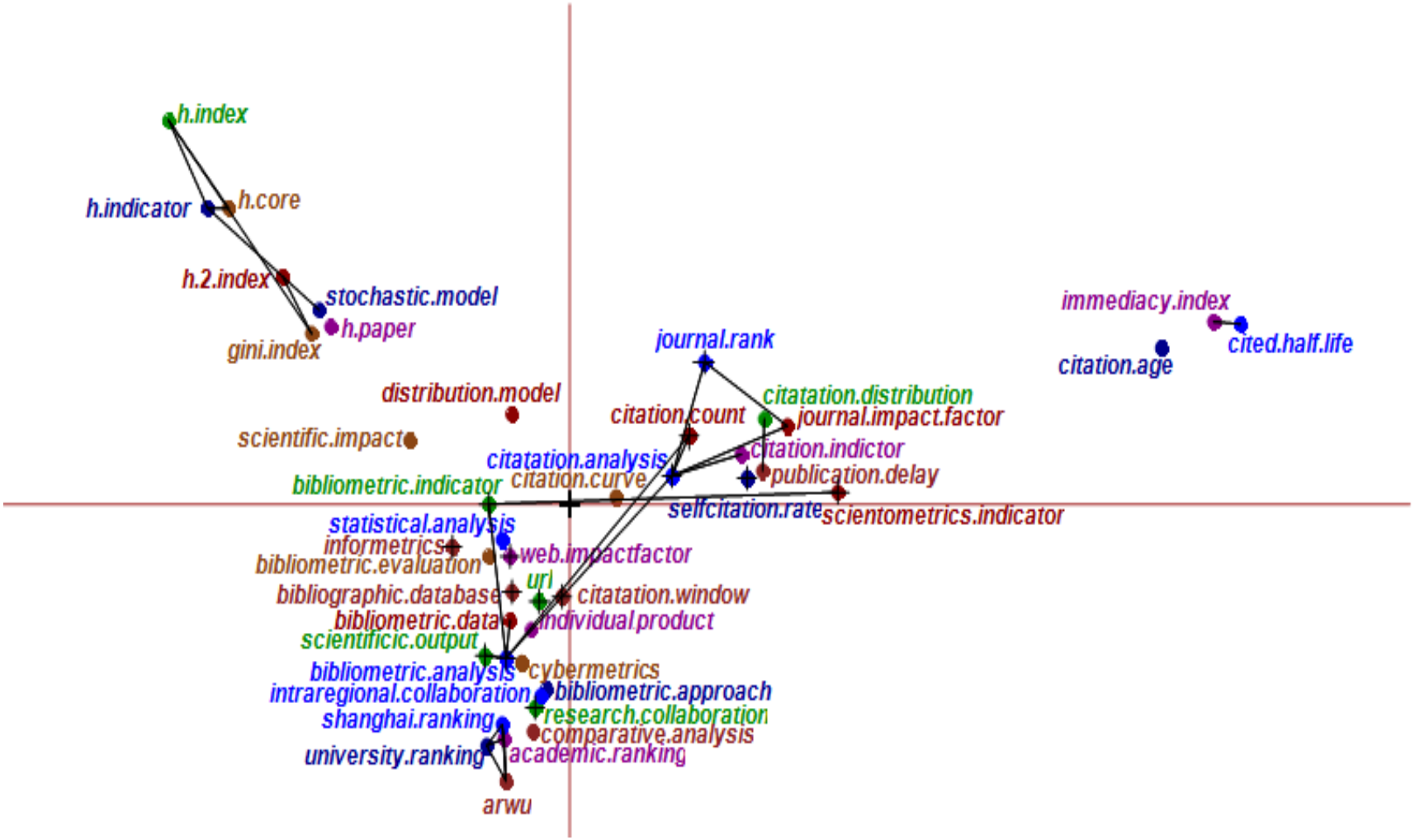

Figure 5.1.2: Co-word structure of cluster C1.1 in 2001-2010 (*Scientometrics*)

Data Source: *Primary data*

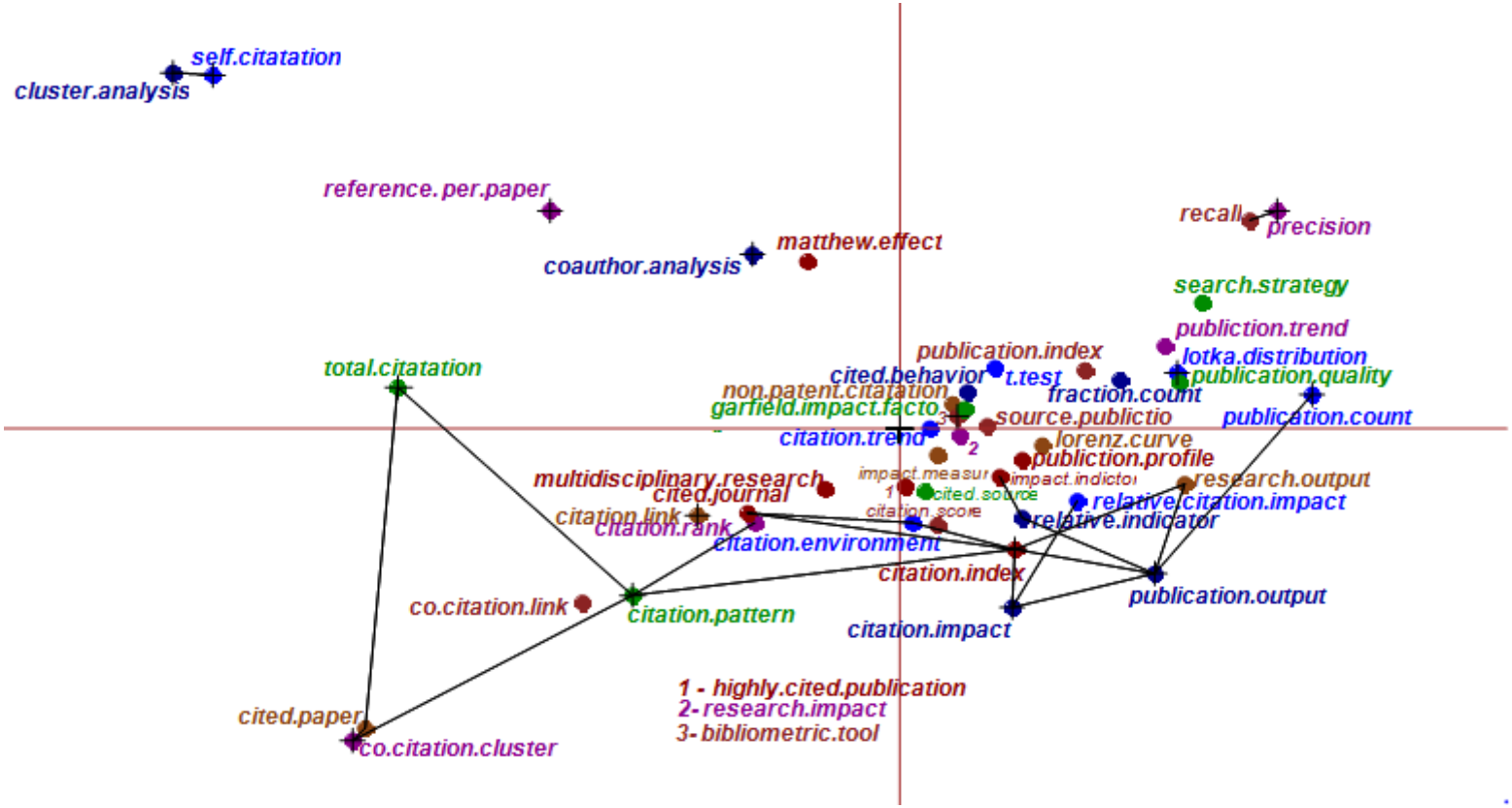

Figure 5.1.3: Co-word structure of cluster C1.2 in 2001-2010 (*Scientometrics*)

Data Source: *Primary data*

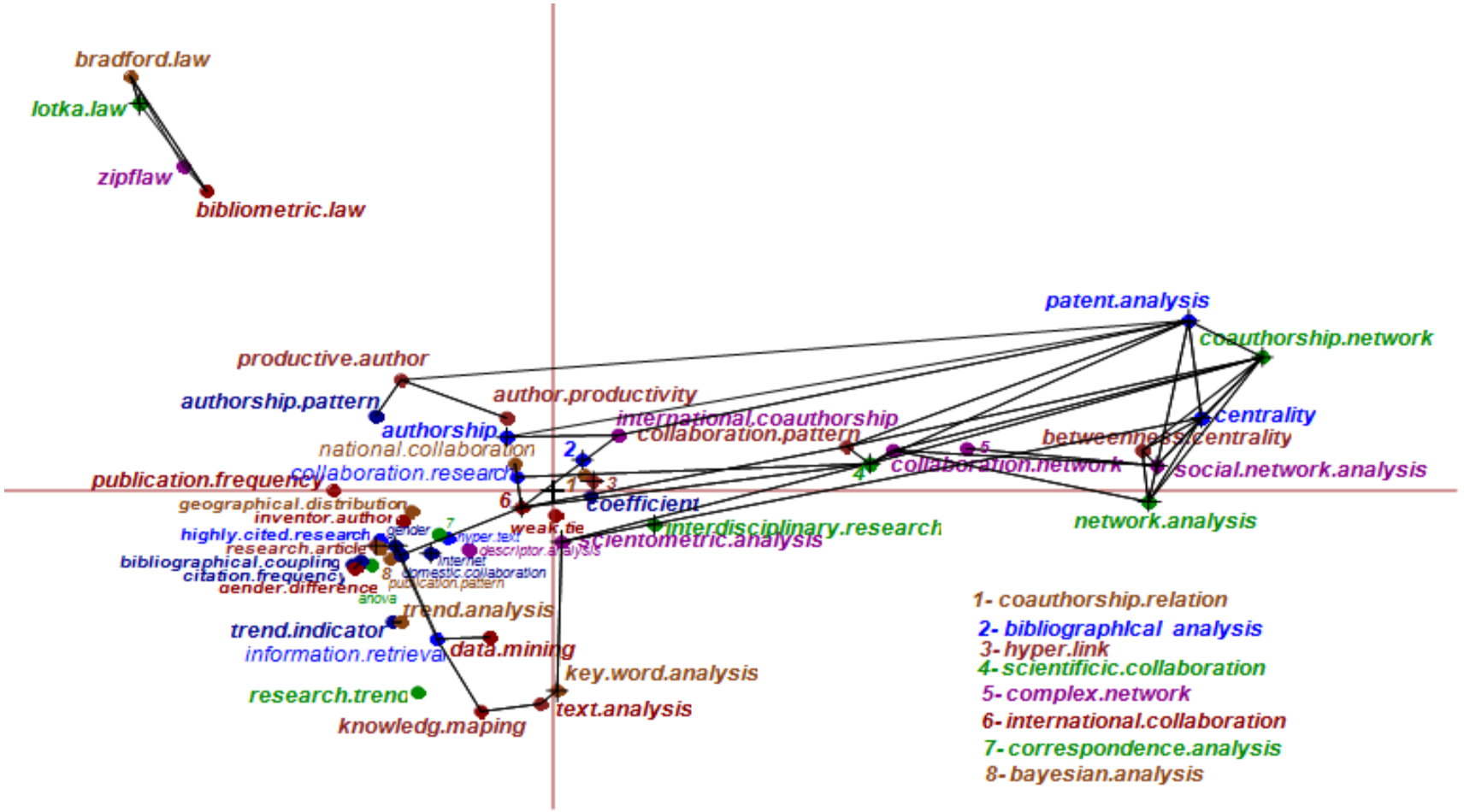

Figure 5.1.4: Co-word structure of cluster C1.3 in 2001-2010 (*Scientometrics*)

Data Source: *Primary data*

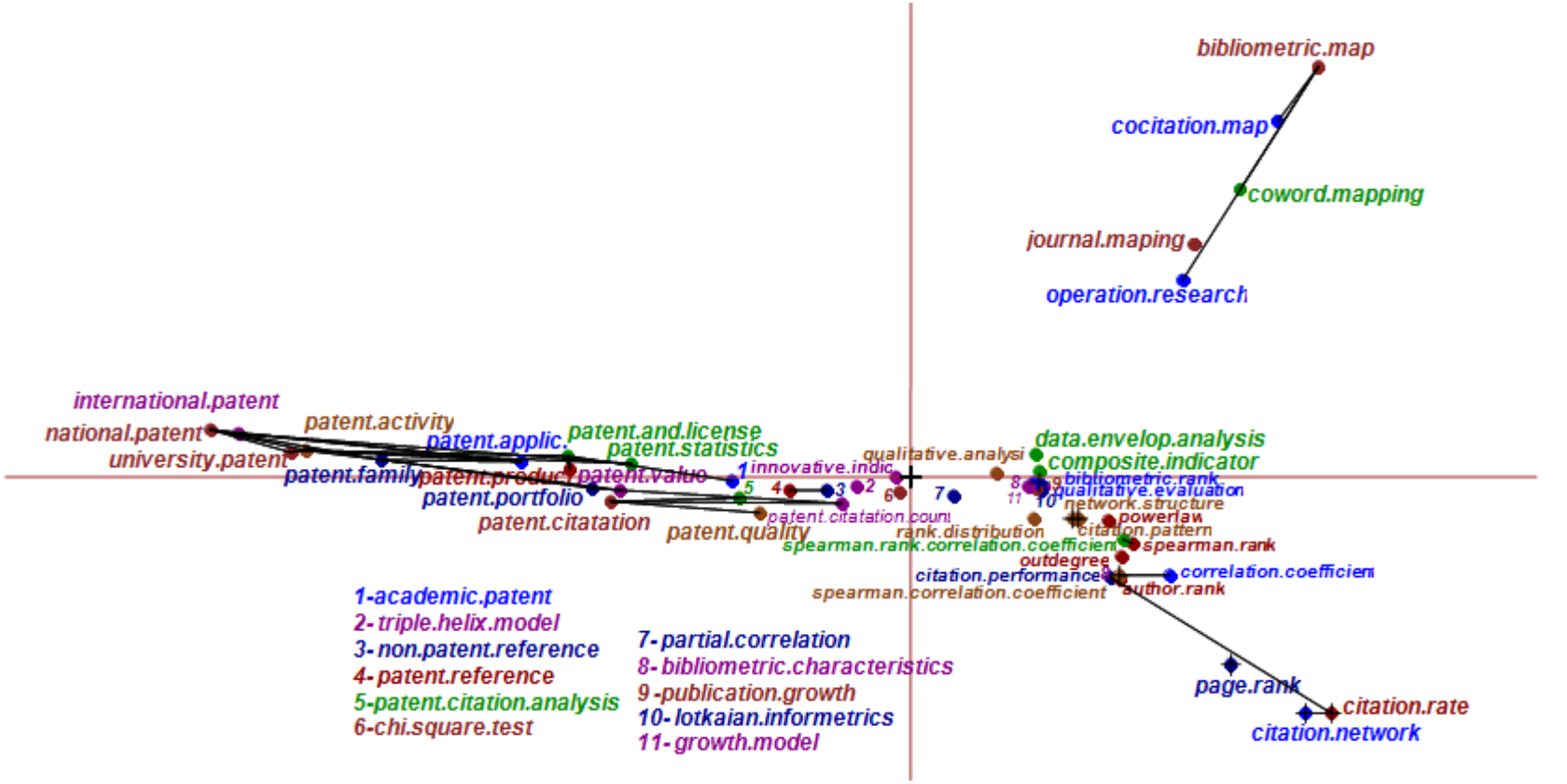

Figure 5.1.5: Co-word structure of cluster C1.4 in 2001-2010 (*Scientometrics*)

Data Source: *Primary data*

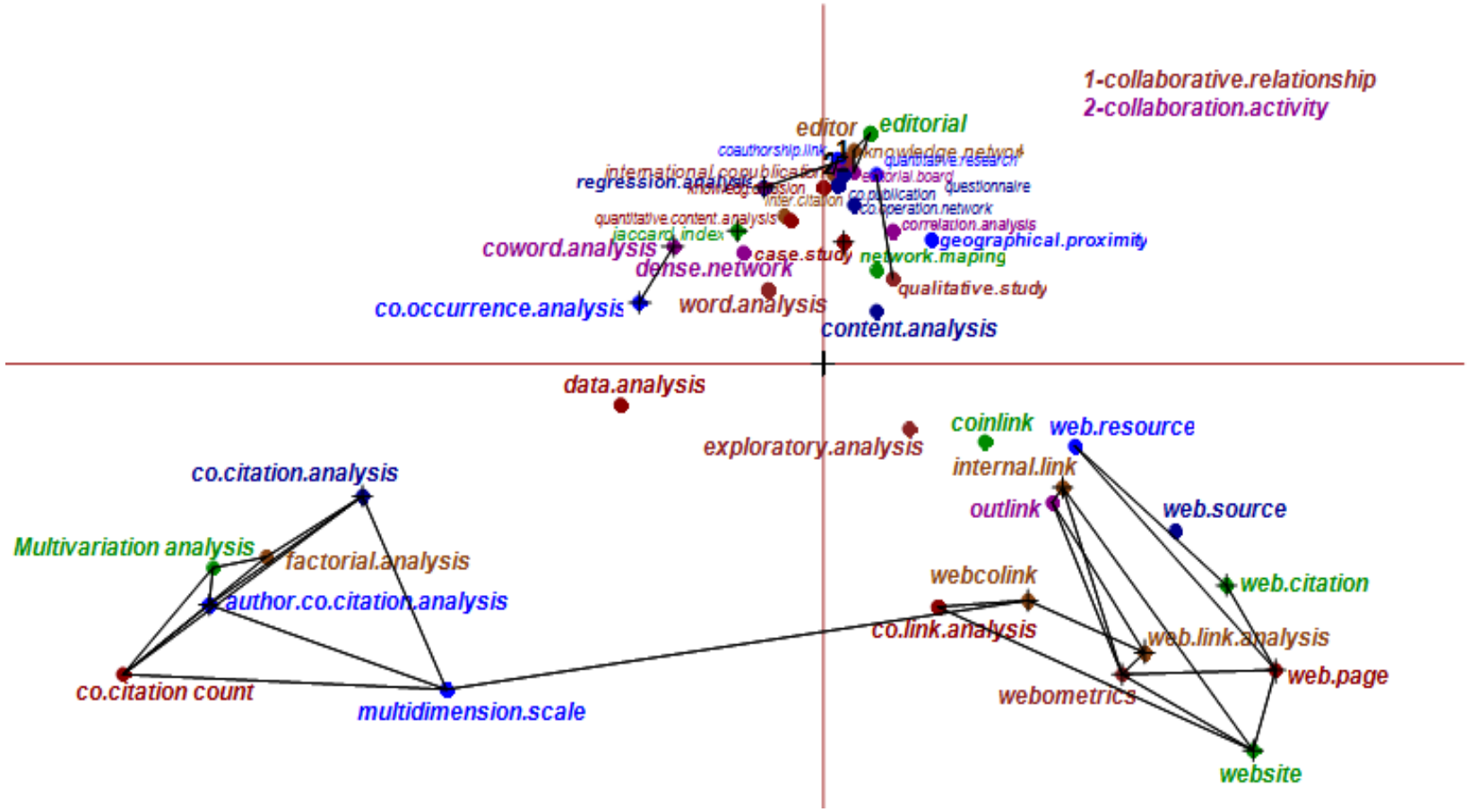

Figure 5.1.6: Co-word structure of cluster C1.5 in 2001-2010 (*Scientometrics*)

Data Source: *Primary data*

Table 5.1.1: Characteristics of co-word structures of clusters in 2001-2010 (*Scientometrics*)

S. No.	Characteristics	Clusters					Average Value
		C1.1	C1.2	C1.3	C1.4	C1.5	
		No.	No.	No.	No.	No.	
1	Inner Link	52	40	102	60	70	64.80
2	Outer Link	39	39	40	13	23	41.20
3	Total Link	91	79	142	73	93	95.60
4	Inner Link %	57	51	72	82	75	67.40
5	Outer Link %	43	49	28	18	25	32.60
6	Inner link Key	24	19	34	29	29	27.00
7	Outer Link Key	14	15	17	7	14	13.40
8	Total Key	44	46	55	51	47	48.60
9	Inner link Key %	56	42.22	62.96	56.86	61.70	55.95
10	Outer Link key %	33	33.33	31.48	13.73	29.79	35.00
11	Average Link Per key	2.12	1.76	2.63	1.43	1.98	1.98
12	Density	0.261	0.301	0.284	0.285	0.273	-
13	Centrality	0.254	0.267	0.250	0.300	0.275	-

Data Source: *Primary data*

From the Table 5.1.1, it can be observed that the intra-connection strength (inner link) of cluster C1.1, C1.3, C1.4, and C1.5 is much higher than its outer link. Whereas, the inner link of cluster C1.2 is slightly higher than its outer link. On average value, 67% of links are inner links and these links reflect the substantial relationship between keywords of clusters. The number of keywords, which bear inner link, is much higher than an outer link. Overall 56% keywords of clusters bear inner link while 35% key bear outer link only. On average, C1.1and C1.3 have more than 2 links (outer and inner links) and other cluster has less than 2 link/s per key.

Cluster C1.4 owns the highest centrality and higher density among the five clusters of this period. Its centrality is slightly higher to its density, it means this cluster owns not only connection within the cluster but also owns extensive connection with others clusters' keywords. This event indicates that this cluster's topics lies in the core of all research subject and research subject composed of its keywords are tending to mature.

Cluster C1.2 occupies the highest density and higher centrality. The inner connection of this clusters are intense which explains that the research topics have the capacity to maintain it and to develop over course of time. C1.1 and C1.3 have lowest centrality but its density is slightly higher, it means, its topics are immature in comparison to other clusters. The centrality of cluster C1.5 is slightly higher than its density means its topics are in a better strategic position in comparison to C1.1 and C1.2.

5.1.1.2 Intellectual Structure based on Co-word Analysis (2001-2005)

5.1.1.2.1 General Overview Structure

For the period 2001-2005, 188 keywords (see Table B1 of Appendix B) has been selected as the keywords research sample. The rest 52 keywords (see Table B2 of Appendix B) which do not have an appropriate frequency (less than 10) are excluded. The previous method was applied to generate the general overview map of Scientometrics field of the year 2001-2005 by MDS (Figure 5.1.7) and each cluster are labeled with top five most occurred keywords. A link with thin line shows a strong relationship between clusters that has a Salton index value of >0.35.

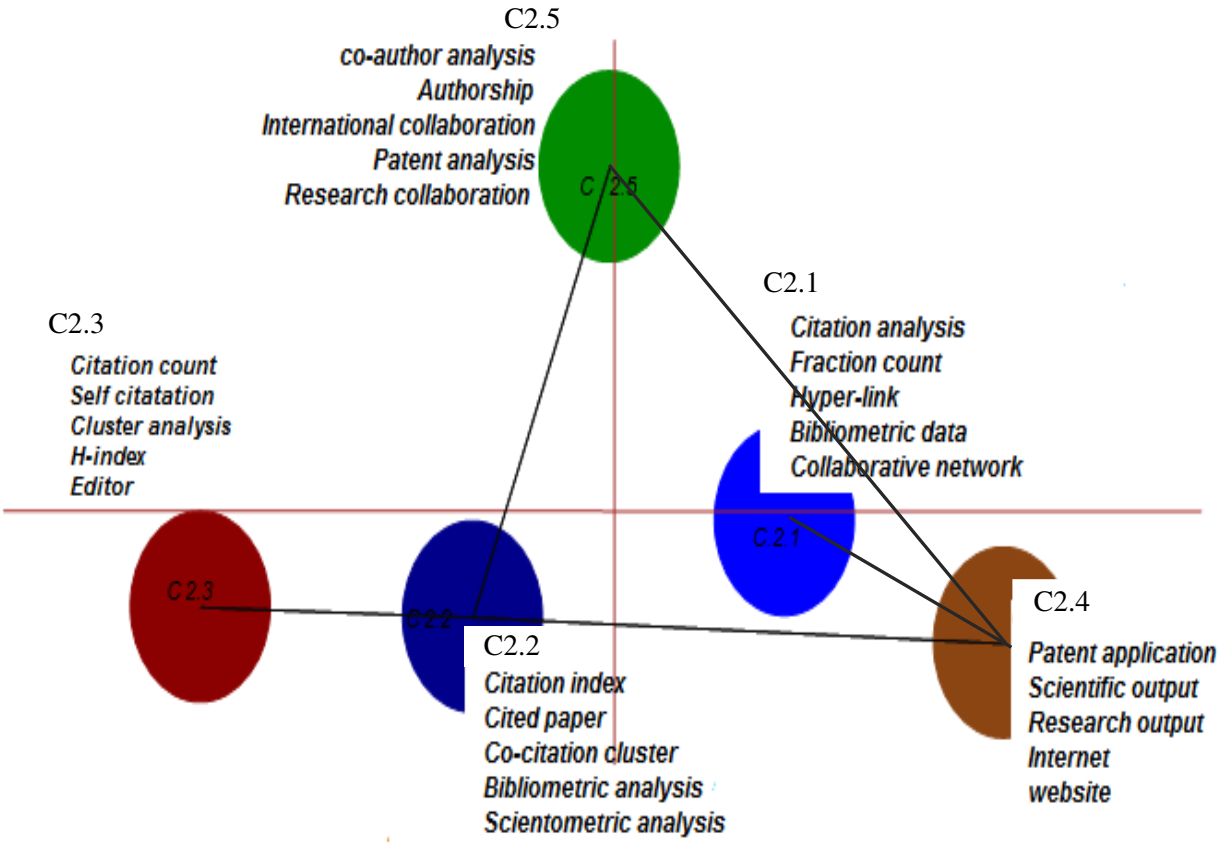

Figure 5.1.7: General overview structure of *Scientometrics* in 2001-2005

Data Source: *Primary data*

5.1.1.2.2 Co-word Structure of Clusters

In order to plot co-word structure of each cluster of 2001-2005, keywords have been used as input variables to map the sub-domain based on the correlation matrix of 188 keywords. Thus fives detailed sub-domain (cluster) structure (Figure 5.1.8–5.1.12) are plotted to visualise specific characters of each sub-domains (clusters) in the Scientometrics field.

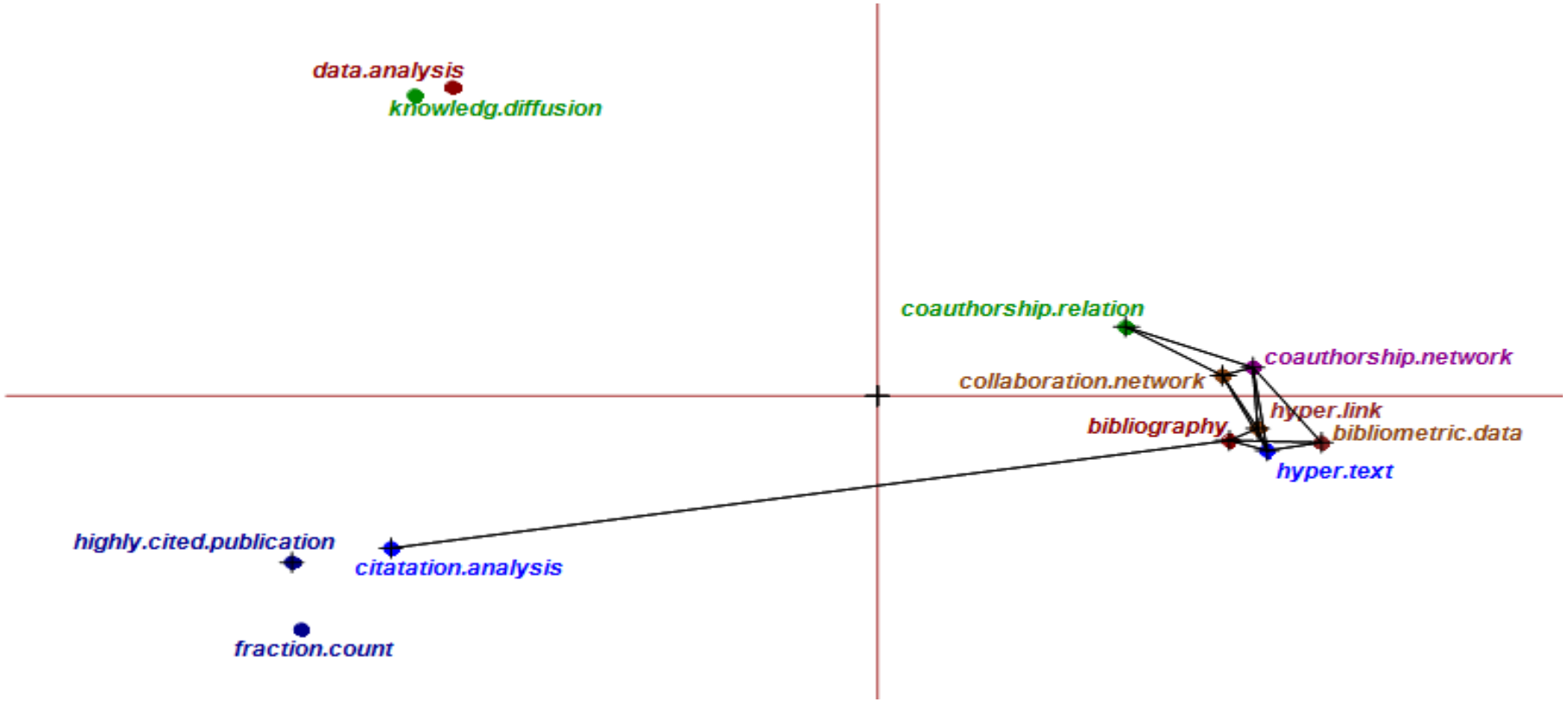

Figure 5.1.8: Co-word structure of cluster C2.1 in 2001-2005 (*Scientometrics*)

Data Source: *Primary data*

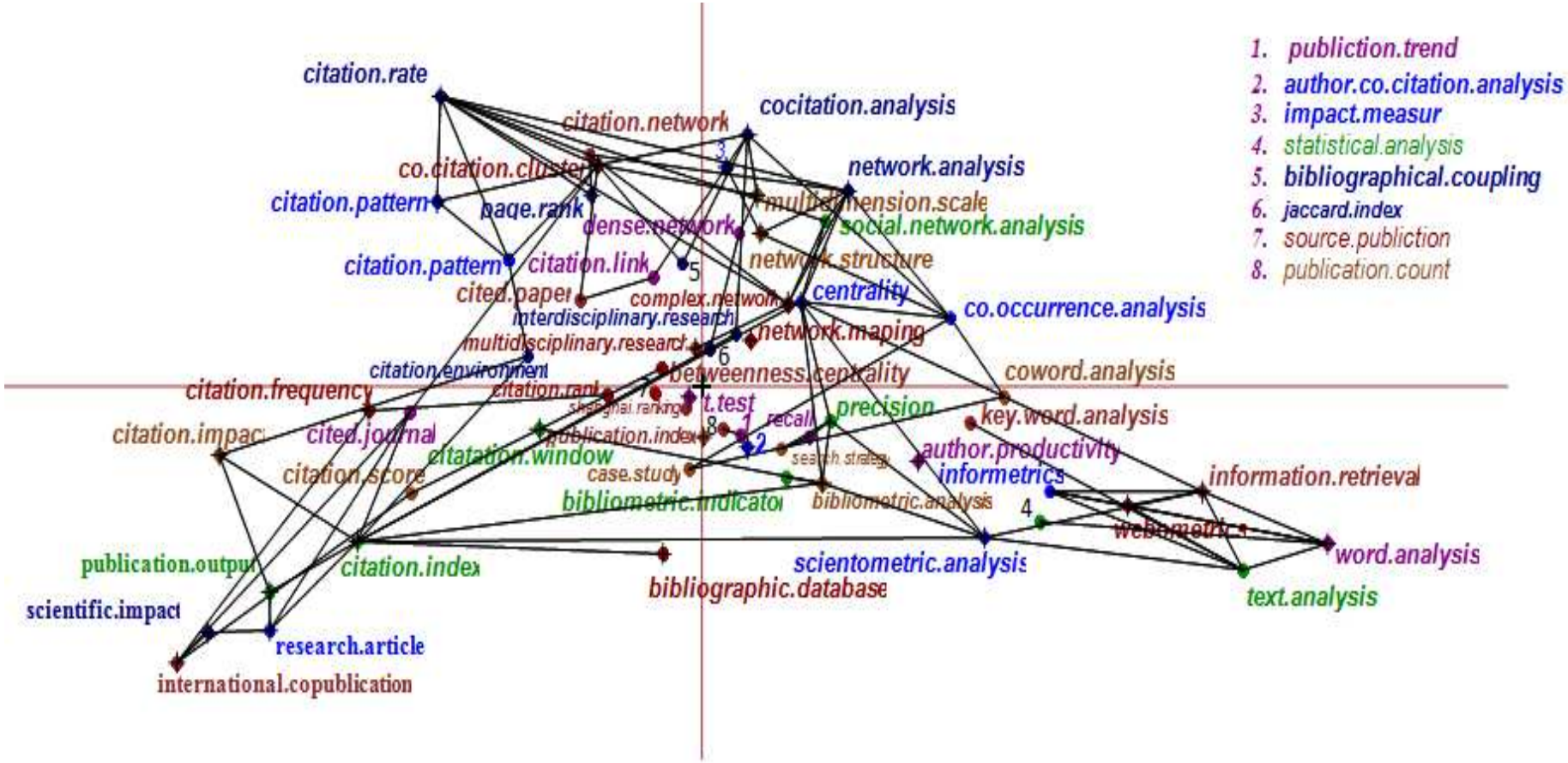

Figure 5.1.9: Co-word structure of cluster C2.2 in 2001-2005 (*Scientometrics*)

Data Source: *Primary data*

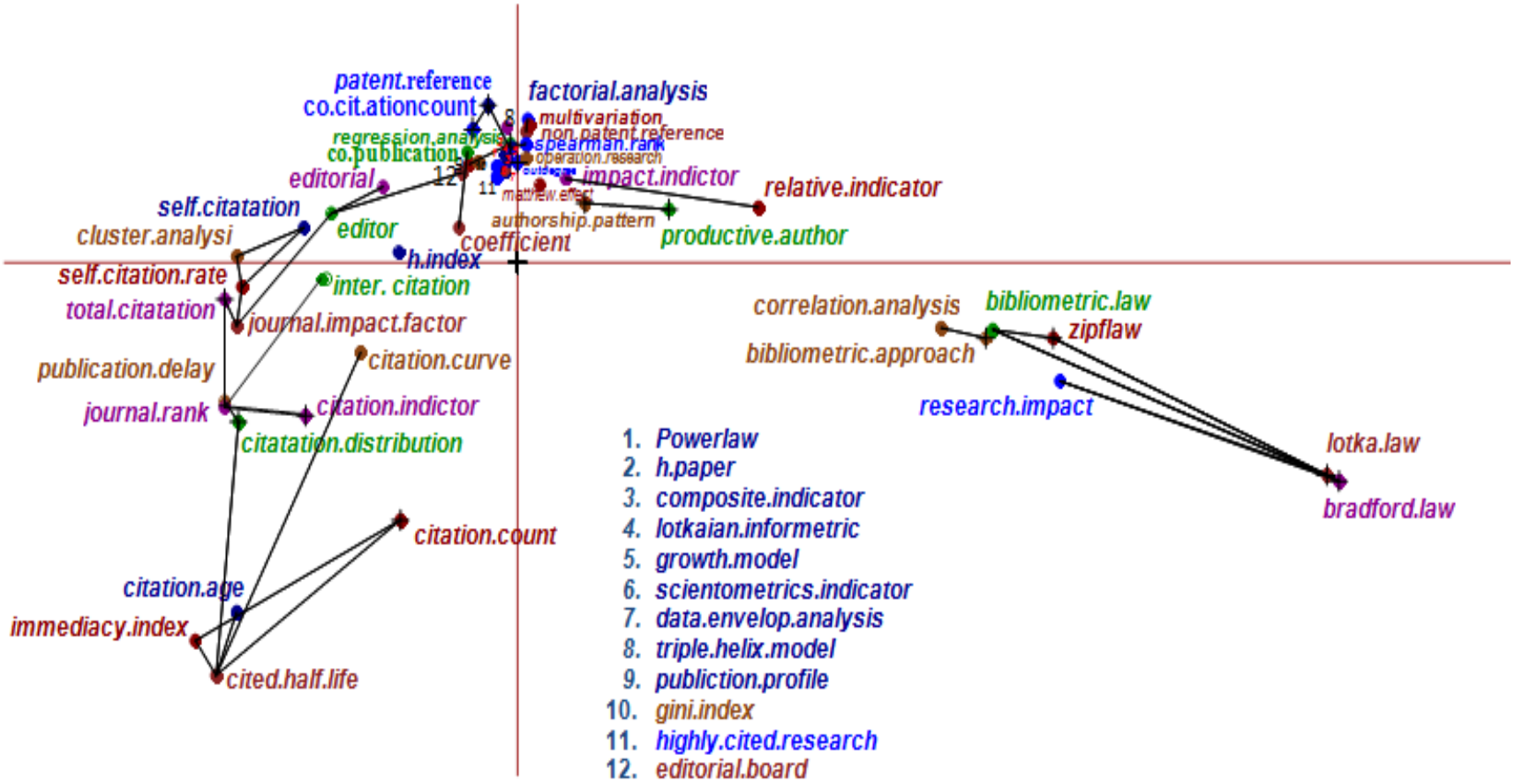

Figure 5.1.10: Co-word structure of cluster C2.3 in 2001-2005 (*Scientometrics*)

Data Source: *Primary data*

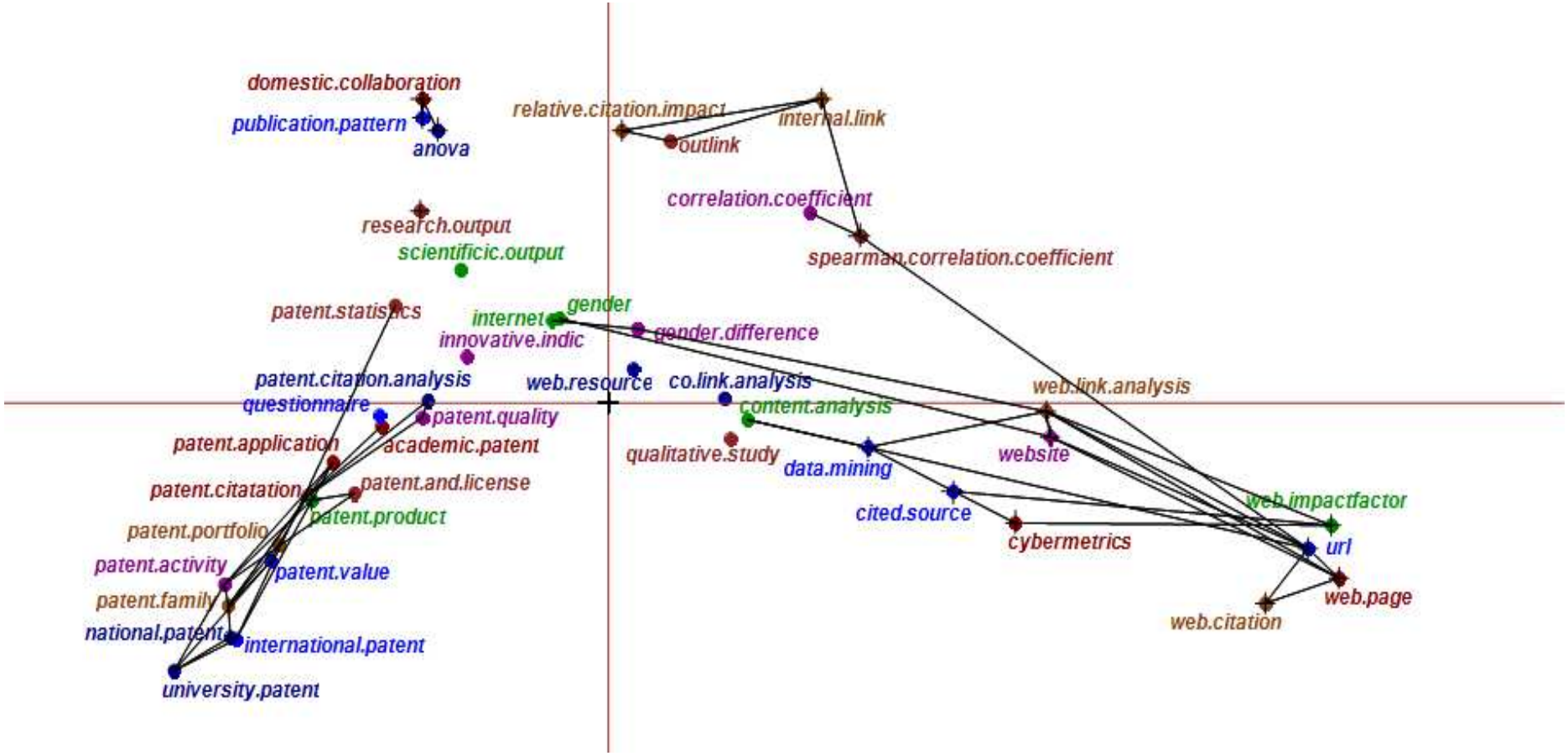

Figure 5.1.11: Co-word structure of cluster C2.4 in 2001-2005 (*Scientometrics)*

Data Source: *Primary data*

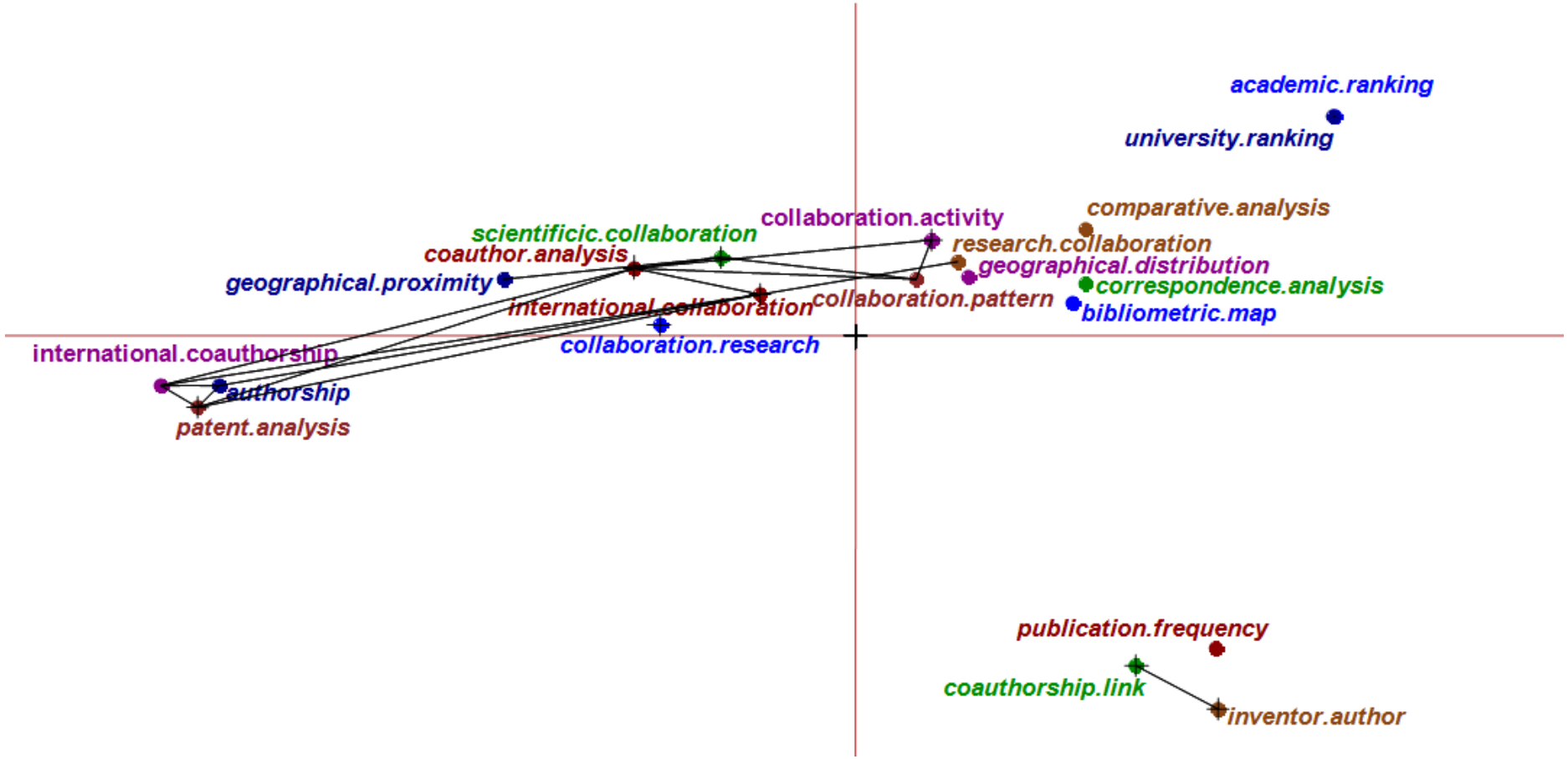

Figure 5.1.12: Co-word structure of cluster C2.5 in 2001-2005 (*Scientometrics*)

Data Source: *Primary data*

The research topics of cluster C2.1 are related to Bibliographical analysis, Citation analysis, Hyper link, Collaboration network, Knowledge diffusion. Cluster C2.2 belongs to research topics related to Keyword analysis, Precision, Interdisciplinary research, Case study, Informetrics. Cluster C2.3 describes topics on cluster analysis, self-citation, H-index, Editorial board, Power law, Journal impact factor, Citation distribution. Cluster C2.4 focuses on Scientific output, Web page, Website, Internet, URL, Co-link analysis, Content analysis, Correlation coefficient. Finally, Cluster C2.5 appears to focus on Co-author analysis, Authorship, International collaboration, Patent analysis, Scientific collaboration, University rank, and Correspondence analysis.

Table 5.1.2: Characteristics of co-word structure of clusters in 2001-2005 (*Scientometrics*)

S. No.	Characteristics	Clusters					Average Value
		C2.1	C2.2	C2.3	C2.4	C2.5	
		No.	No.	No.	No.	No.	
1	Inner Link	28	184	70	98	36	83.20
2	Outer Link	42	49	23	31	13	31.60
3	Total Link	70	233	93	129	49	114.80
4	Inner Link %	40	79	75	76	73	68.60
5	Outer Link %	60	21	25	24	27	31.40
6	Inner link Key	8	53	40	36	14	30.20
7	Outer Link Key	9	31	14	17	8	15.80
8	Total Key	12	60	53	41	20	37.20
9	Inner link Key %	66.67	88.33	75.47	87.80	70	77.65
10	Outer Link key %	75	51.67	26.42	41.46	40	46.91
11	Average Link Per key	5.83	3.88	1.75	3.15	2.45	3.41
12	Density	0.266	0.277	0.342	0.315	0.301	-
13	Centrality	0.256	0.246	0.246	0.272	0.270	-

Data Source: *Primary data*

The observation of the co-word network of different clusters of the period 2005-2007, shows that the cluster C2.2 and C2.4 have more nodal keywords relatively. The keyword Co-authorship network, Collaboration network, Hyper link, and Bibliometric data and Bibliography, in C2.1; Citation rate, Co-citation analysis, Co-citation cluster analysis, Network analysis, Centrality, Co-occurrence analysis, Citation environment, Citation index, Information retrieval, Text analysis, World analysis, Scientometrics analysis in C2.2; Cited half life, Citation age, Citation count, Journal rank, Journal impact factor, Self citation rate, Lotka law, Complex network in C2.3; University patent, Patent activity, Data mining, Domestic collaboration, Internal link, Web

impact factor, Web-link analysis, URL in C2.4; Patent analysis, Co-authorship analysis, International co-authorship, and Collaboration pattern in C2.5 are active keywords which occupy more link with other keywords and have established as main research topics of this period.

Table 5.1.2 shows the characteristics of five clusters of the year 2001-2005. The cluster C2.2, C2.3, and C2.4 have a much higher number of internal links than its outer links but C2.1 is on contrary. The table shows abundant internal connection among keywords. C2.2 and C2.4 have about 83% inner link key that is highest. the C2.1 has 67%, which is lowest. On the contrary, C2.1 has the highest number of outer link key, which indicates a strong relationship with other clusters. On average, 77.65% key is inner link key while only 46.91% key has outer links. Thus, these links show a stable internal composition in each cluster but week extensive relation among clusters.

The cluster C2.1 has the highest number of links (inner & outer link) per key, which show coherent network among keywords while C2.3 had the lowest number of link/s per key. Overall, the average number of links per key is three. It clearly suggests a dense link between keywords.

In the period 2001-2005, the cluster C2.3 and C2.4 hold the highest density respectively. It means both clusters own intense inner connection and it shows that the research topics of these clusters had already been cared and able to maintain itself to develop over the course of time. The cluster 2.4 and 2.5 had the highest centrality accordingly which indicates that the topics of the clusters considered important by Scientometrics research community. Cluster C2.1 and C2.2 both have lower density and centrality. It means the most of the topics of both cluster are immature and underdeveloped.

5.1.1.3 Intellectual Structure based on Co-word Analysis of 2006-2010

5.1.1.3.1 General Overview Structure

In the period 2006-2010, there were 12 keywords of 243 keywords that were not included for the study (see Table B3 of appendix B) as these keywords did not appear with appropriate frequency (it occurred less than ten times in the corpus). Thus, 231 keywords (see Table B4 of Appendix B) were considered for research sample. The previous method was used to generate the general overview structure of Scientometrics field of the year 2006-2010 by plotting MDS (Figure 5.1.13) and each sub-domain (cluster) was labeled with top five most frequent keywords of the cluster.

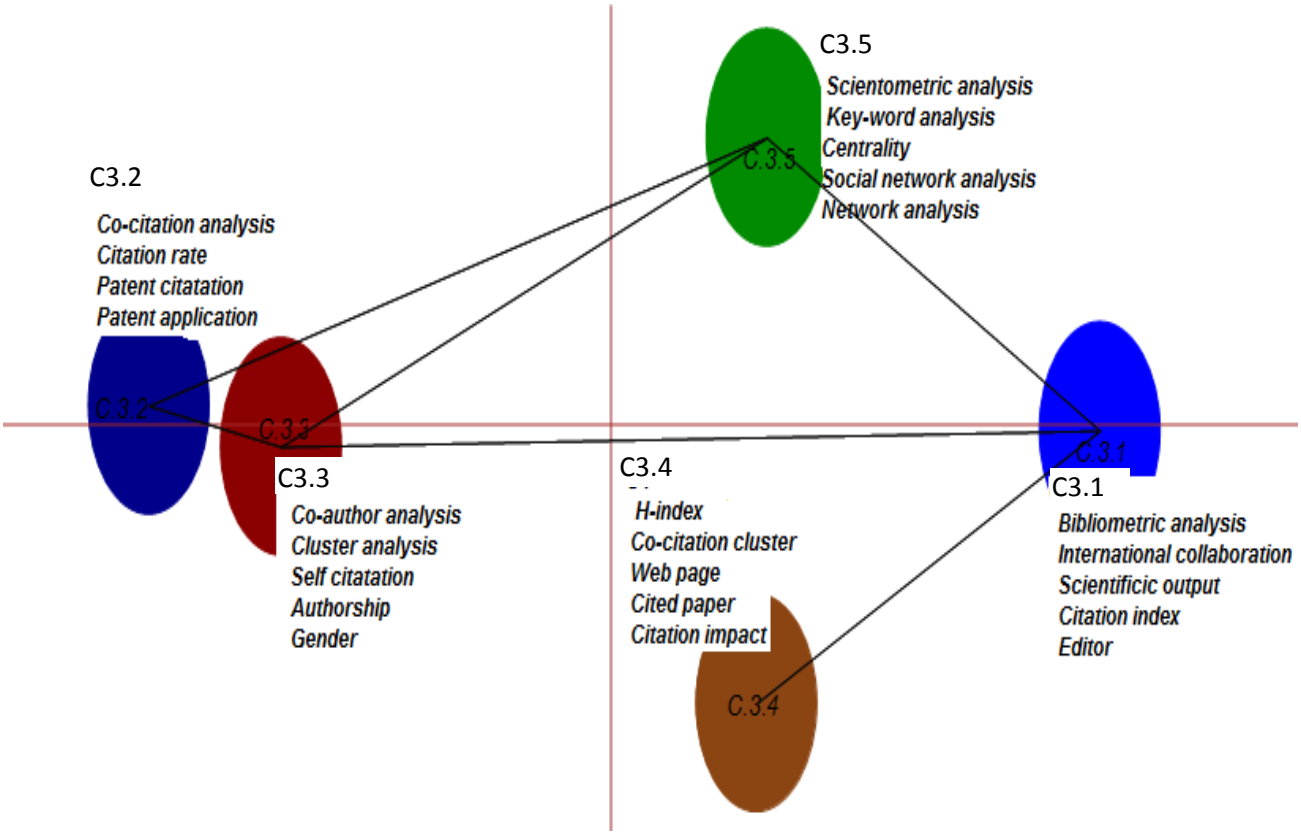

Figure 5.1.13: General overview structure of *Scientometrics* in 2006-2010

Data Source: *Primary data*

5.1.1.3.2 Co-word Structure of Clusters

In order to plot co-word structure of each cluster of the period 2006-2010, each cluster's keywords selected as input variables to map the sub-domain based on correlation matrix of 231 keywords. Thus, fives detailed sub-domain (cluster) structure (Figures 5.1.14-5.1.18) were plotted to visualise specific characteristics of each sub-domains (clusters) of the Scientometrics field in the year 2006-2010.

In the year 2006-2010, the cluster C3.1, C3.2, C3.3, C3.4, and C3.5 has 50, 76, 37, 37, and 31 keywords respectively. Cluster 3.1 includes the research topics related to Bibliometrics, Scientific output, Citation index, Editor, International collaboration, Citation analysis. Cluster C3.2 consists of keywords related to Website, Co-citation analysis, Citation rate, Patent citation, Patent application, Co-word analysis. Cluster C3.3 contains topic related to Co-author analysis, Cluster analysis, Interdisciplinary research, Hyper link. Cluster C3.4 includes topics on H-index, Co-citation cluster, Web page, Cited paper, Citation impact, Internet. Cluster C3.5 includes research related to Scientometrics, Collaboration pattern, Keyword analysis, Centrality, Social network analysis, Network analysis, Patent analysis, Knowledge mapping.

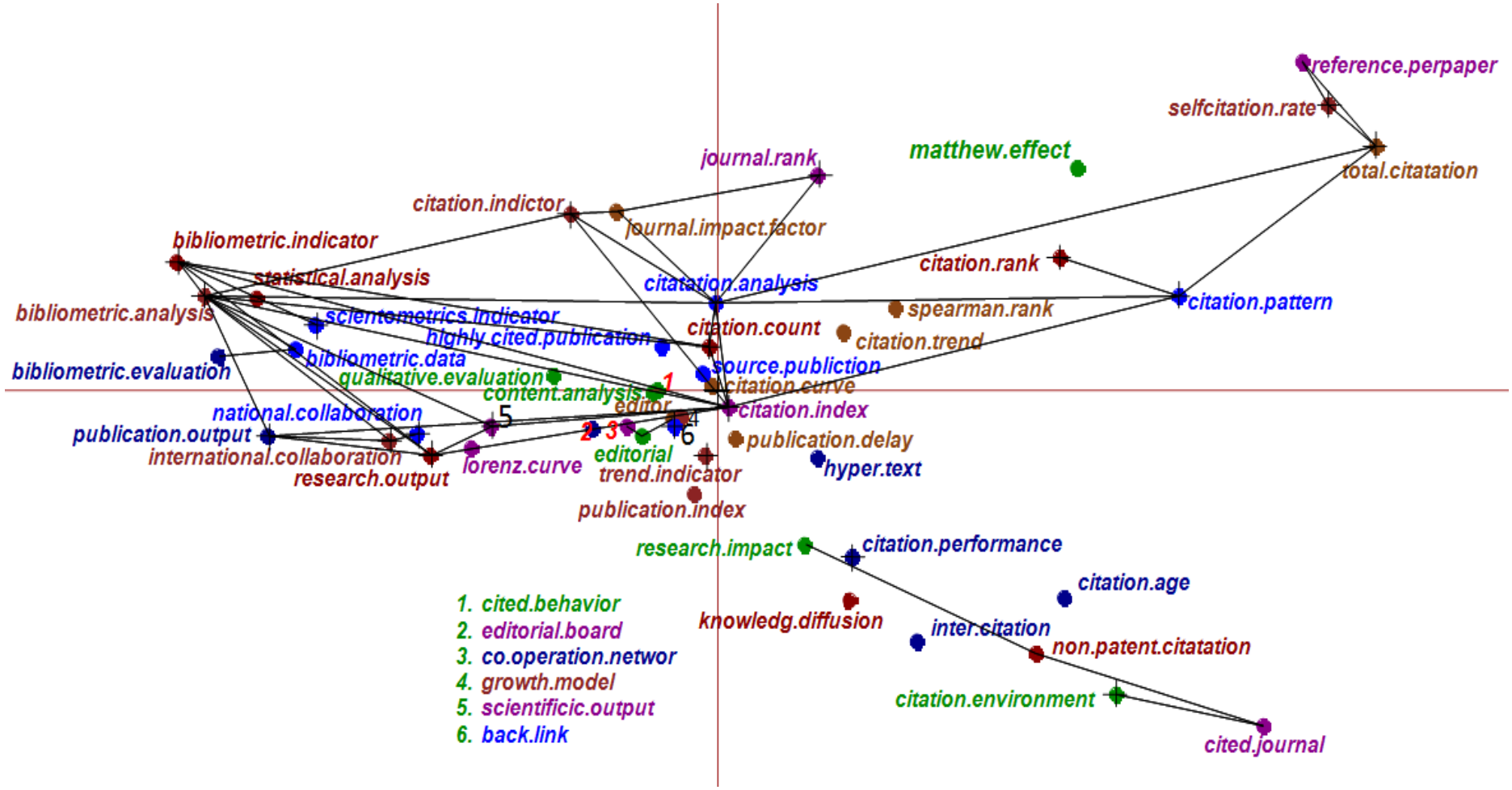

Figure 5.1.14: Co-word structure of cluster C3.2 in 2006-2010 (*Scientometrics*)

Data Source: *Primary data*

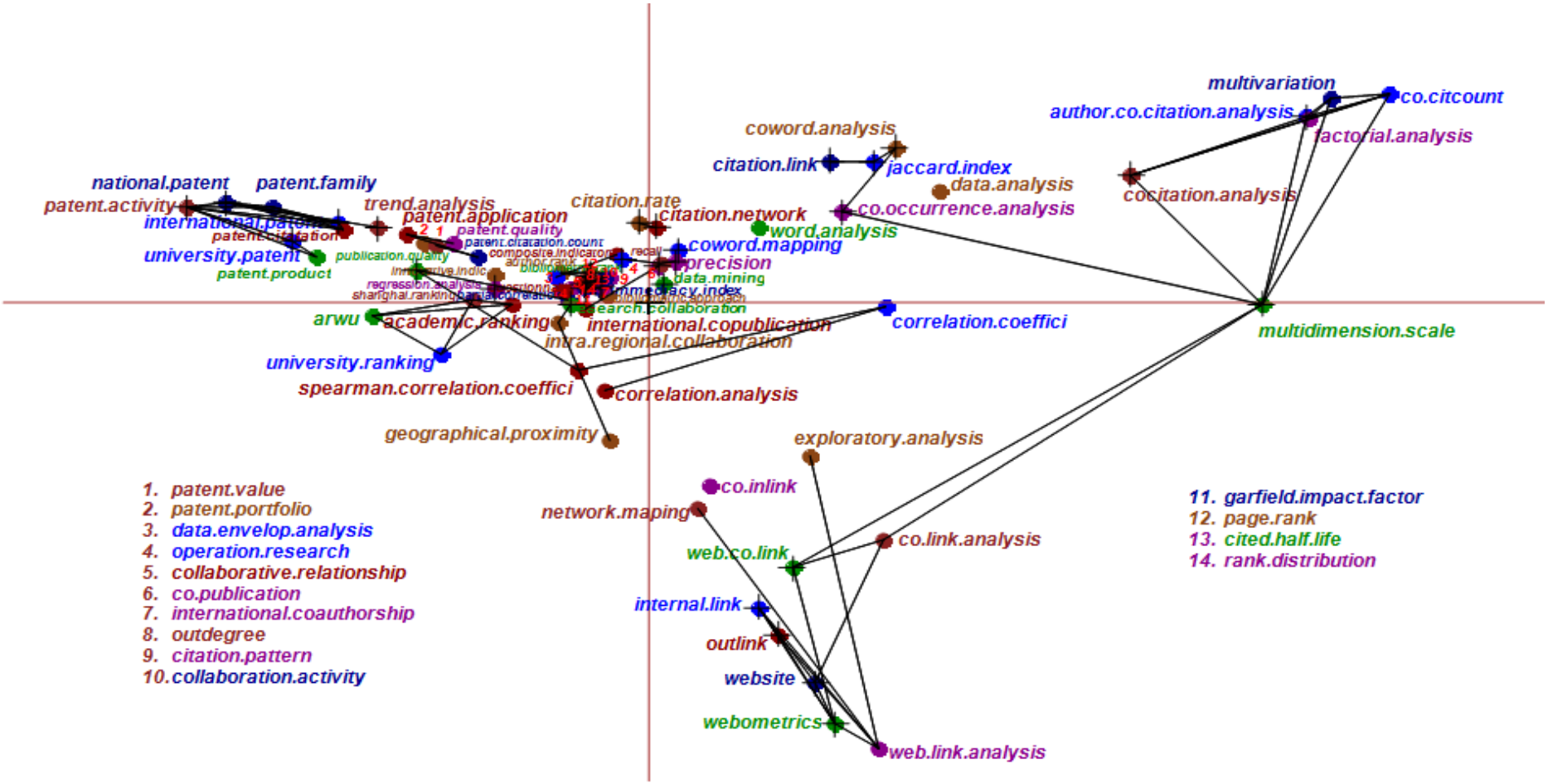

Figure 5.1.15: Co-word structure of cluster C3.2 in 2006-2010 (*Scientometrics*)

Data Source: *Primary data*

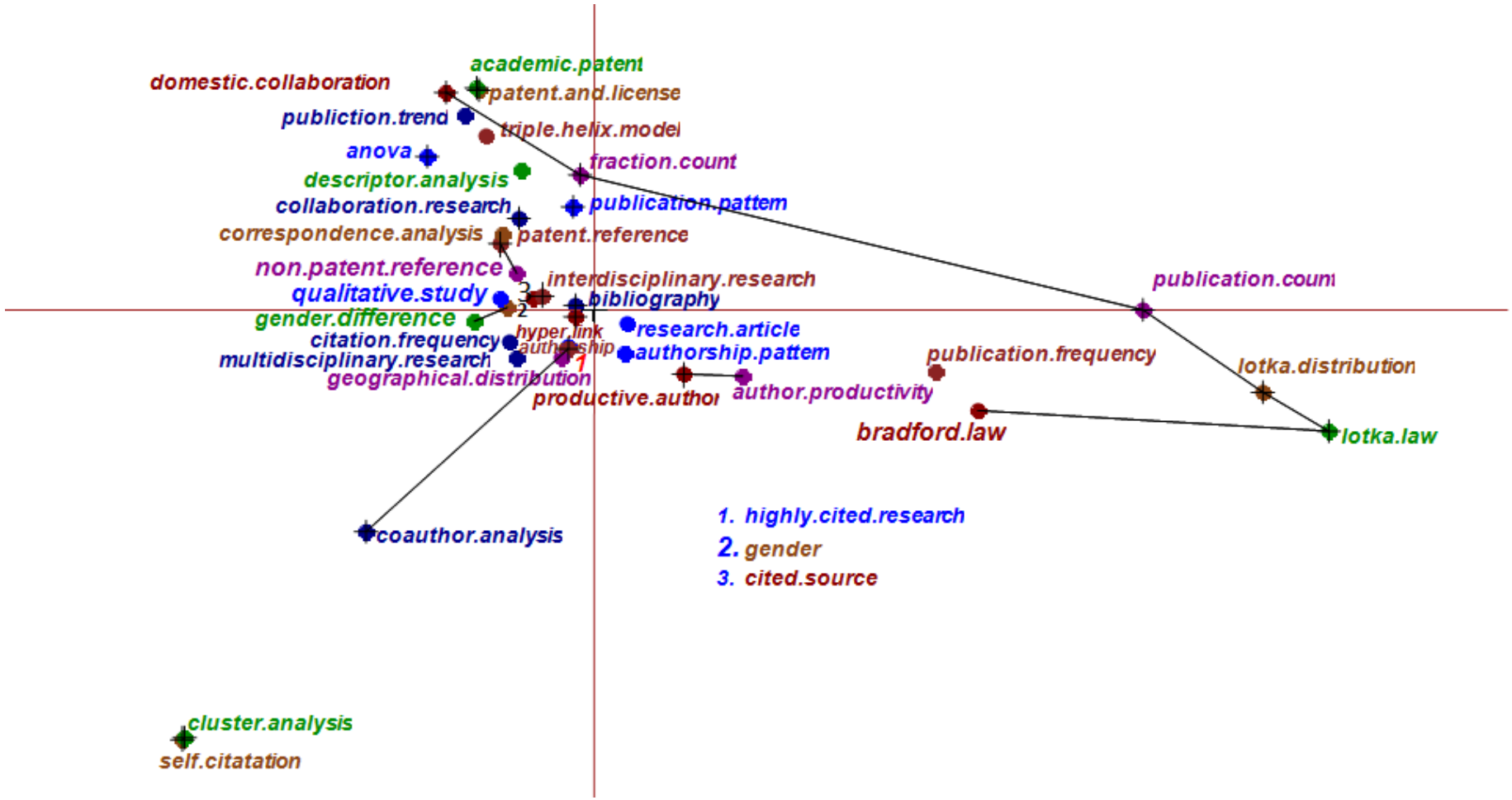

Figure 5.1.16: Co-word structure of cluster C3.3 in 2006-2010 (*Scientometrics*)

Data Source: *Primary data*

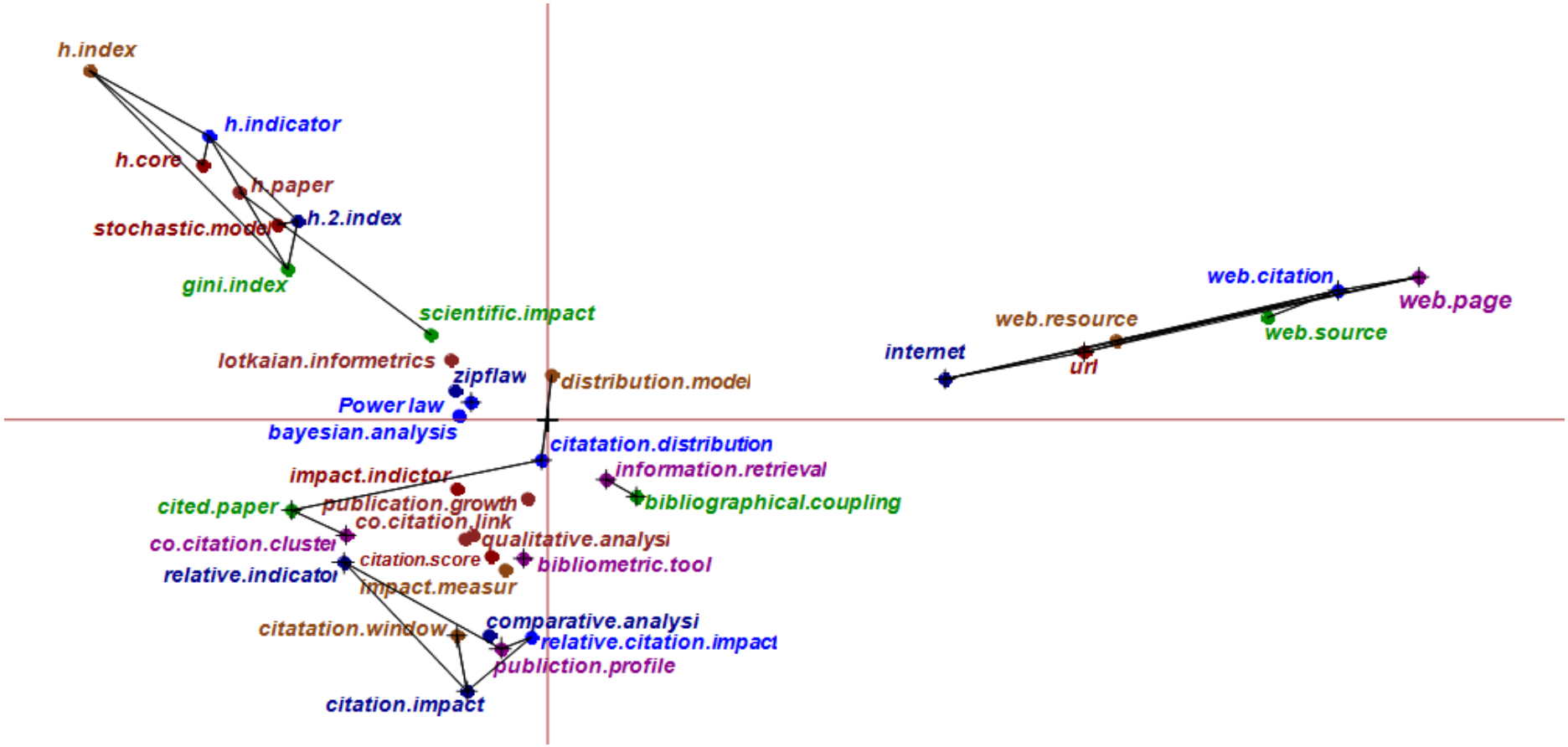

Figure 5.1.17: Co-word structure of cluster C3.4 in 2006-2010 (*Scientometrics*)

Data Source: *Primary data*

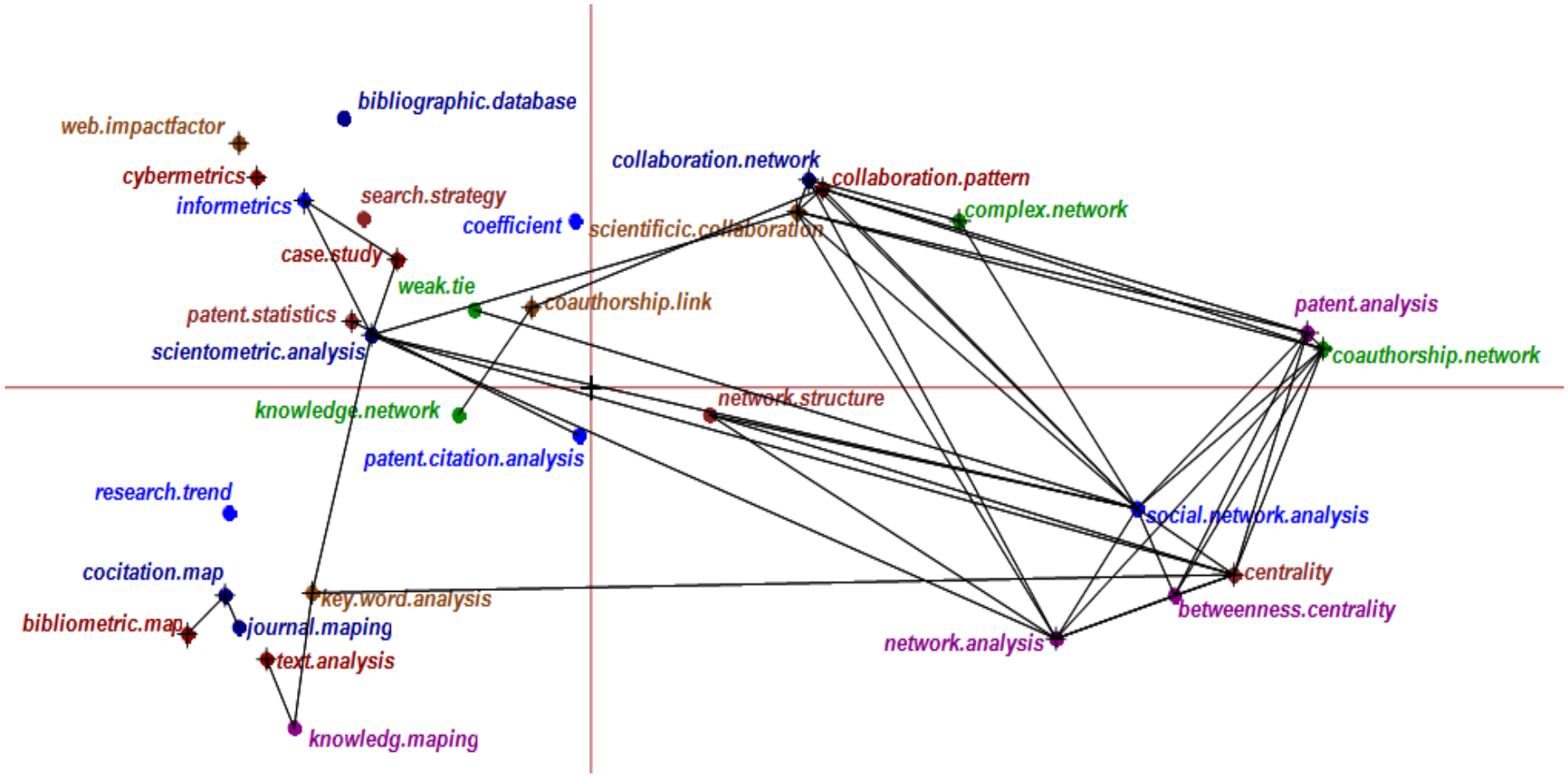

Figure 5.1.18: Co-word structure of cluster C3.5 in 2006-2010 (*Scientometrics*)

Data Source: *Primary data*

The observation of the plotted networks (Figure 5.1.15−5.1.18) shows that Bibliometric indicator, Bibliometric analysis, International collaboration, Publication output, Citation indicator, and Citation analysis are active topics in C3.1. The topics related to Patent, Co-citation ,Websites, MDS, Web co-link, Out link, Internal link, Web link analysis, academic ranking in C3.2; Lotka law in C3.3; H-index, H-indicator, web citation, URL, Citation impact in C3.4; Informetrics, Scientometrics, Network analysis, Co-authorship network, Patent analysis Scientific collaboration, Collaboration pattern, Network analysis and Keywords analysis in C3.5 are active keywords which are associated with more keywords in the cluster and focused main research themes of this period.

Table 5.1.3: Characteristics of co-word structure of clusters in 2006-2010 (*Scientometrics*)

S. No.	Characteristics	Clusters					Average Value
		C3.1	C3.2	C3.3	C3.4	C3.5	
		No.	No.	No.	No.	No.	
1	Inner Link	88	140	22	54	94	79.60
2	Outer Link	62	64	35	34	47	48.40
3	Total Link	150	204	57	88	141	128
4	Inner Link %	59	69	39	61	67	59
5	Outer Link %	41	31	61	39	33	41
6	Inner link Key	28	59	18	25	25	31
7	Outer Link Key	21	34	19	15	19	19
8	Total Key	50	76	37	37	31	46.20
9	Inner link Key %	56	77.63	48.65	67.57	80.65	66.10
10	Outer Link key %	42	44.74	16.22	40.54	61.29	40.96
11	Average Link Per key	3	2.68	1.54	2.38	4.55	2.83
12	Density	0.254	0.283	0.402	0.300	0.279	-
13	Centrality	0.247	0.267	0.260	0.258	0.248	-

Data Source: *Primary data*

From Table 5.1.3, it can be noticed that each cluster had inner link more than its outer link except cluster C3.3. Cluster C3.2 has highest number of outer link and cluster C3.4 is on contrary. The cluster C3.4 has approximately 41% outer link key. On average, each cluster has 66.10% inner link key which shows strong relationship between keywords; overall 40.96% key are outer link key which has connection with other cluster. It reflects not only intense network within the cluster but also show loose linkage with other clusters. Cluster C3.5 has highest number of link per key (approximately 5 link) which is evidence of abundant links among keywords and coherent network.

In the period 2006-2010, C3.3 has highest density and a strong centrality among clusters, here centrality is less than its density, it means the topics which embedded in the C3.3 had already formed their own subfields with strong internal composition. C3.1 owns lowest density and

centrality in the whole research network, which indicates its immaturity during this period. C3.2 is one with the highest centrality indicating its strong linkage with other clusters. The cluster C3.2, C3.4 and C3.5 also have more density than its centrality, which indicates its intense connection between keywords. It indicates that the topics of the clusters were considered important and developing condition.

5.1.2 D-Lib Magazine

A total of 1251 raw keywords were collected from 403 articles of *D-Lib Magazine*. These keywords were standardised using the previous method of standardisations and in turn, 412 unique keywords were found for co-word analysis.

The average frequency of keywords per article is 22.68. The range of keywords in an article varies from 6 to 91. A total of 207 (51.36%) articles have more than 30 keywords out of which one paper has 91 keywords. There are 147 (36.48%) articles that have 21–30 keywords; 62(15.38%) articles have 11–20 keywords and 4 (0.99%) articles have up to 10 keywords. Thus, 99.00 % articles contain more than 10 keywords.

In order to understand the intellectual structure of the journal *D-Lib Magazine*, co-occurrence of 412 keywords were analysed for the period 2001-2010. Further, the period (2001-2010) has been divided into the year 2001-2005 and 2006-2010.

5.1.2.1 Intellectual Structure based on Co-word Analysis (2001-2010)

5.1.2.1.1 General Overview Structure

A general overview structure (see Figure 5.1.19) was generated using methods applied for *Scientometrics* journal to understand the positional concept (relative position) of clusters keywords of *D-Lib Magazine* in the year 2001-2010.

The position of a cluster (sub-domains) relatively to each other in the graph depicts the relation of its keyword with other clusters' keywords. Each cluster was represented by its top five frequently occurred keywords. A link between clusters has been developed by thin lines in the Figure 5.1.19 shows a strong relationship that is based on the Slaton index value that is >0.35.

5.1.2.1.2 Co-word Structure of Clusters

A detailed co-word structure (Figure 5.1.20−5.1.24) of each cluster presented in Figure 5.1.19, are plotted to visualise characteristics of each sub-domain (cluster). A thin line represent a link between two keywords with the Salton Index value that is >0.2. The keyword with crass

marks represents outer link keyword (the keyword that has link with other clusters' keywords) in detailed co-word structure network.

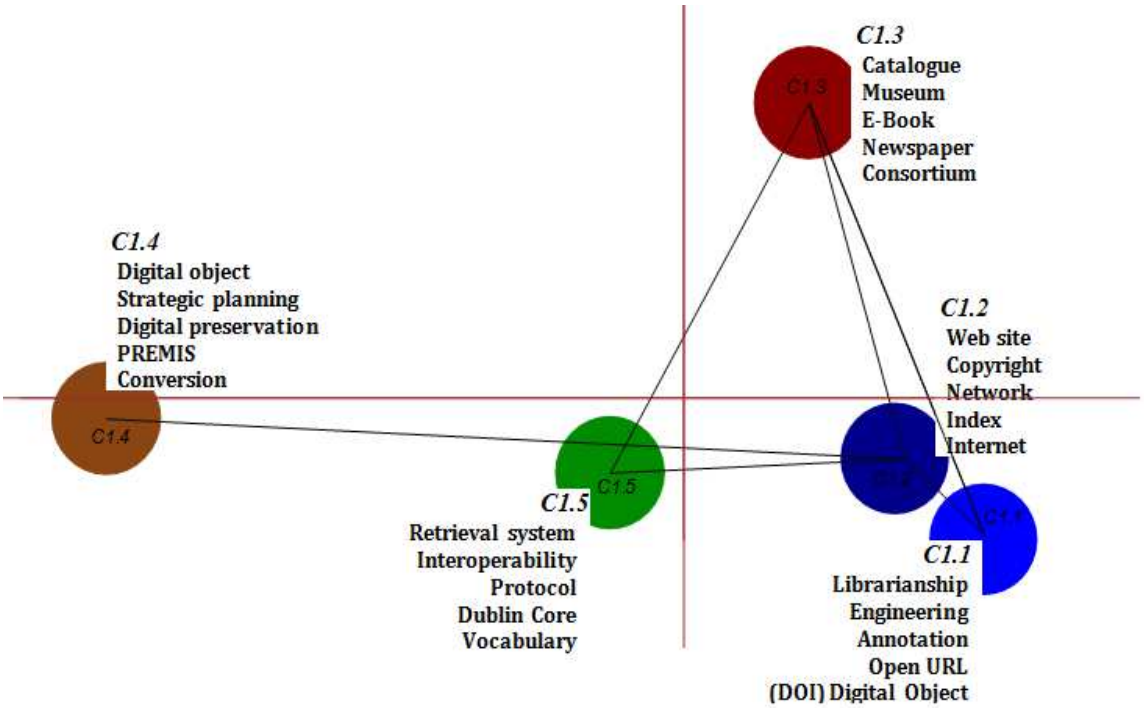

Figure 5.1.19. General overview structure of *D-Lib Magazine* in 2001-2010

Data Source: *Primary data*

Custer C1.1 includes 62 keywords associated with Librarianship, Open URL, DOI, Scientific publishing, E-journal, Innovation, E-resources, World wide web and Scholarly communication. Cluster C1.2 has 117 keywords related to Web site, Copyright, Network, Index, Internet, Citation, DSpace, Periodicals, Infrastructure, and Search engine.

Cluster C1.3 consist of 132 keywords that belong to Catalogue, Museum, E-book, Newspaper, Workshops, NSDL, Visualization, Digital collections, Consortium, Photographs, OCLC. Cluster 1.4 has 24 keywords allied to Digital object, Strategic planning, Digital preservation, Conversion, Digital repository, Digital archive, File format. Cluster 1.5 includes 77 topics related to Retrieval system, Interoperability, Protocol, Dublin core, Vocabulary, Licenses, Automation, Semantic analysis, MARC, and DCMI.

It can be noticed in detail co-word structure network (Figure 5.1.20−5.1.24) that link strength of each keyword is not equal, and some do not have any link. The keywords, Digital learning, Digital divided, E-learning, E-entertainment, E-resources, E-journal, Information literacy, Information Society, Open URL framework, and Print journal have strong link in the cluster C1.1. In the Cluster C1.2, the topics Internet, Infrastructure, Network, Web page, HTML, Index, and Web site have more links relatively.

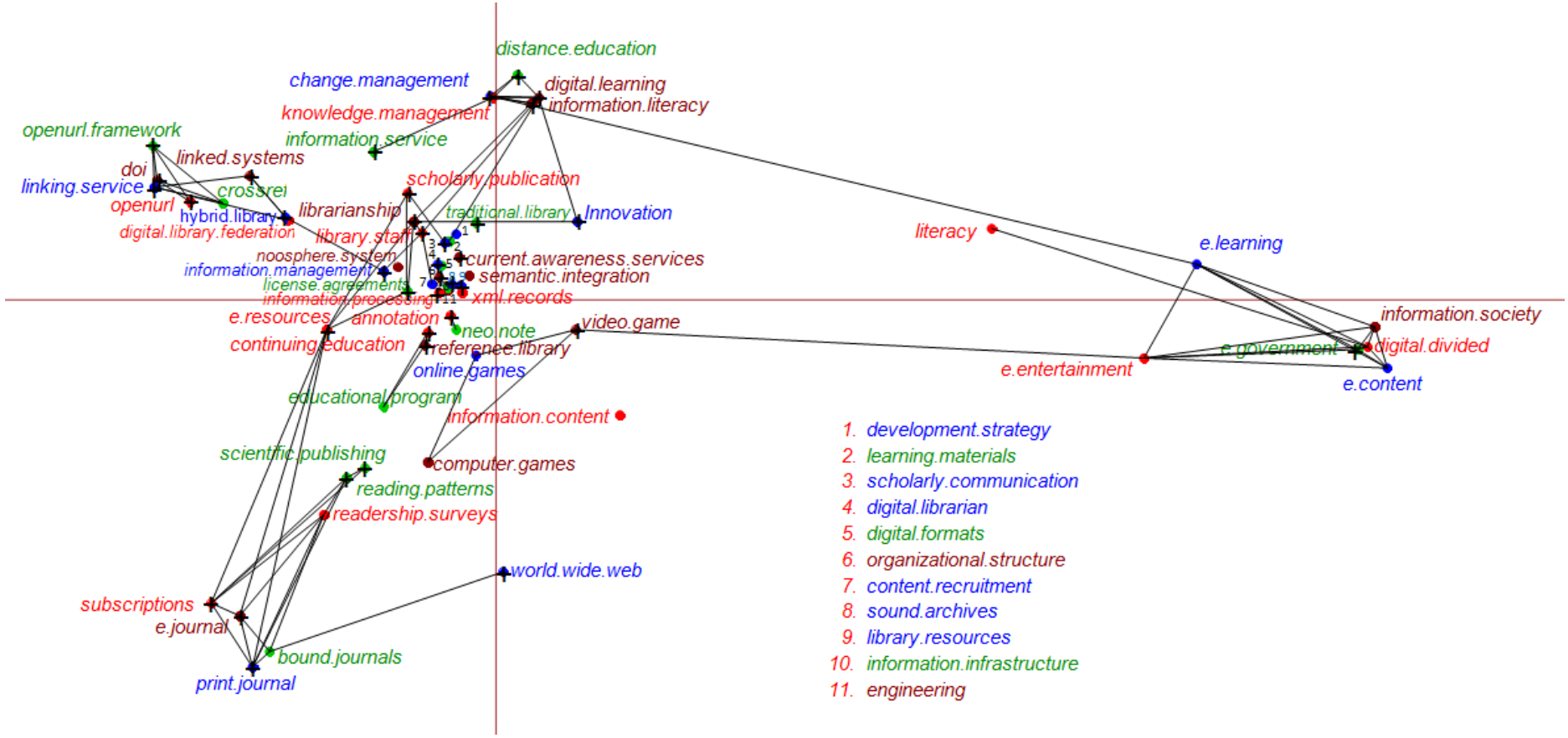

Figure 5.1.20: Co-word structure of cluster C1.1 in 2001-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

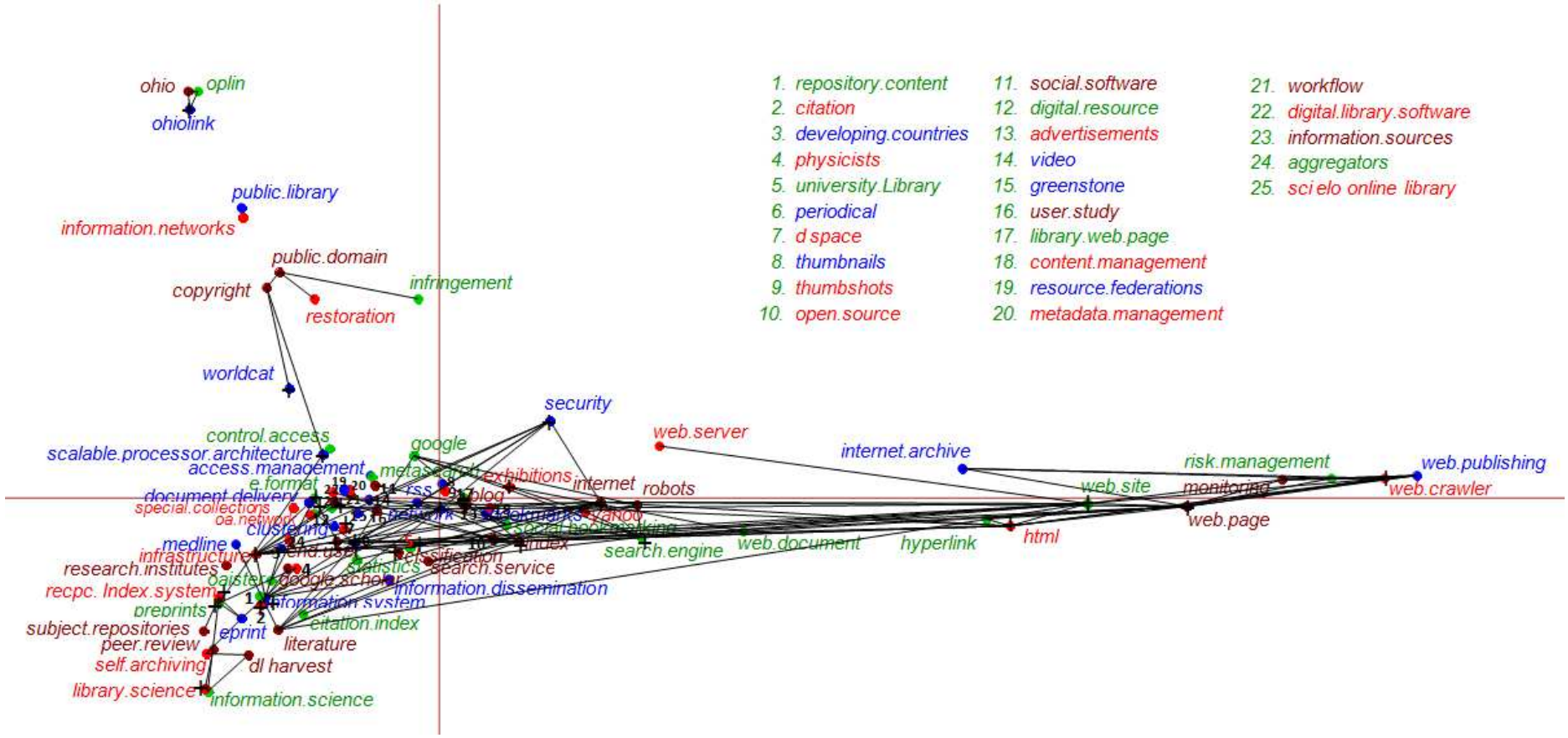

Figure 5.1.21: Co-word structure of cluster C1.2 in 2001-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

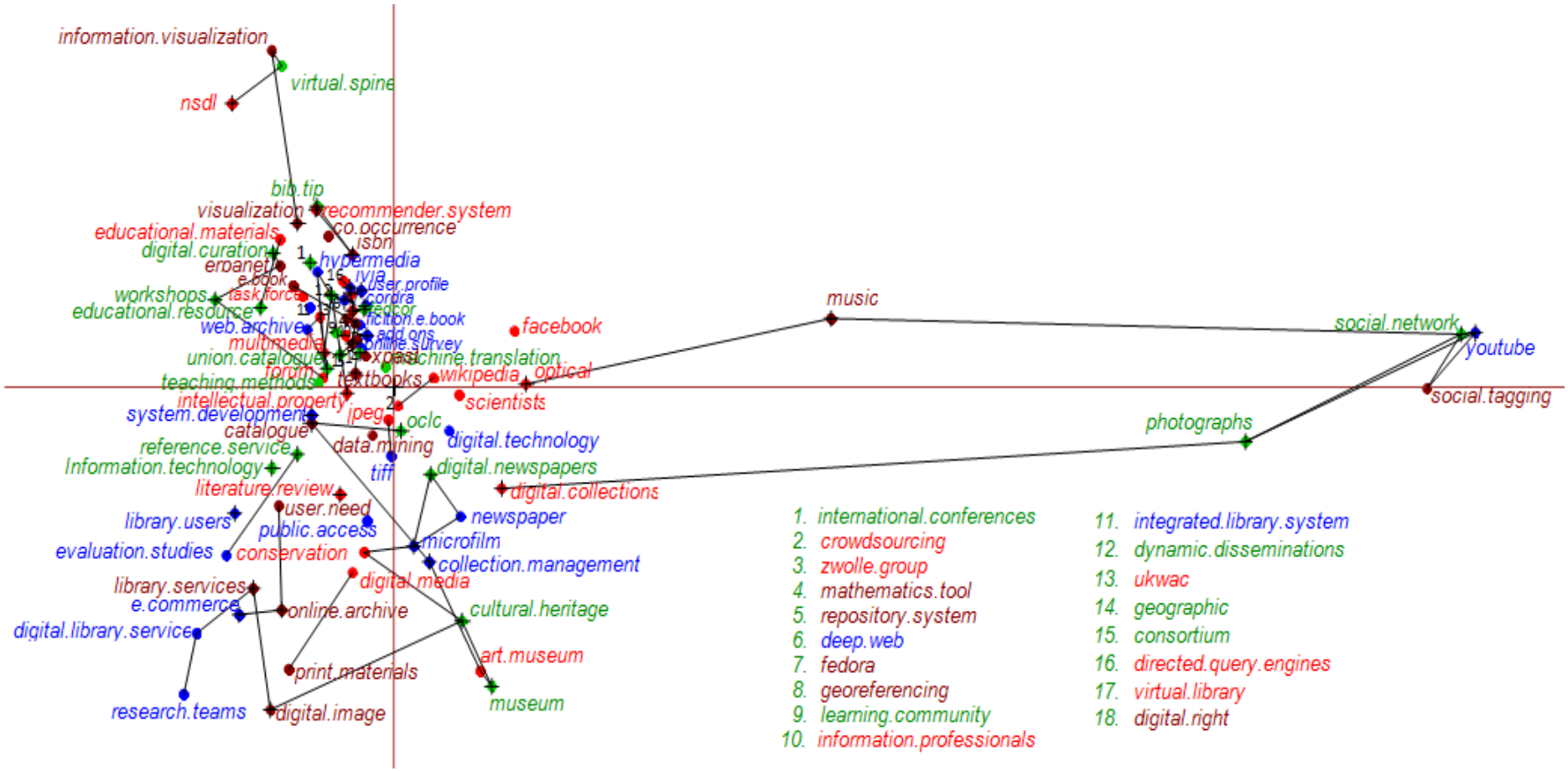

Figure 5.1.22: Co-word structure of cluster C1.3 in 2001-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

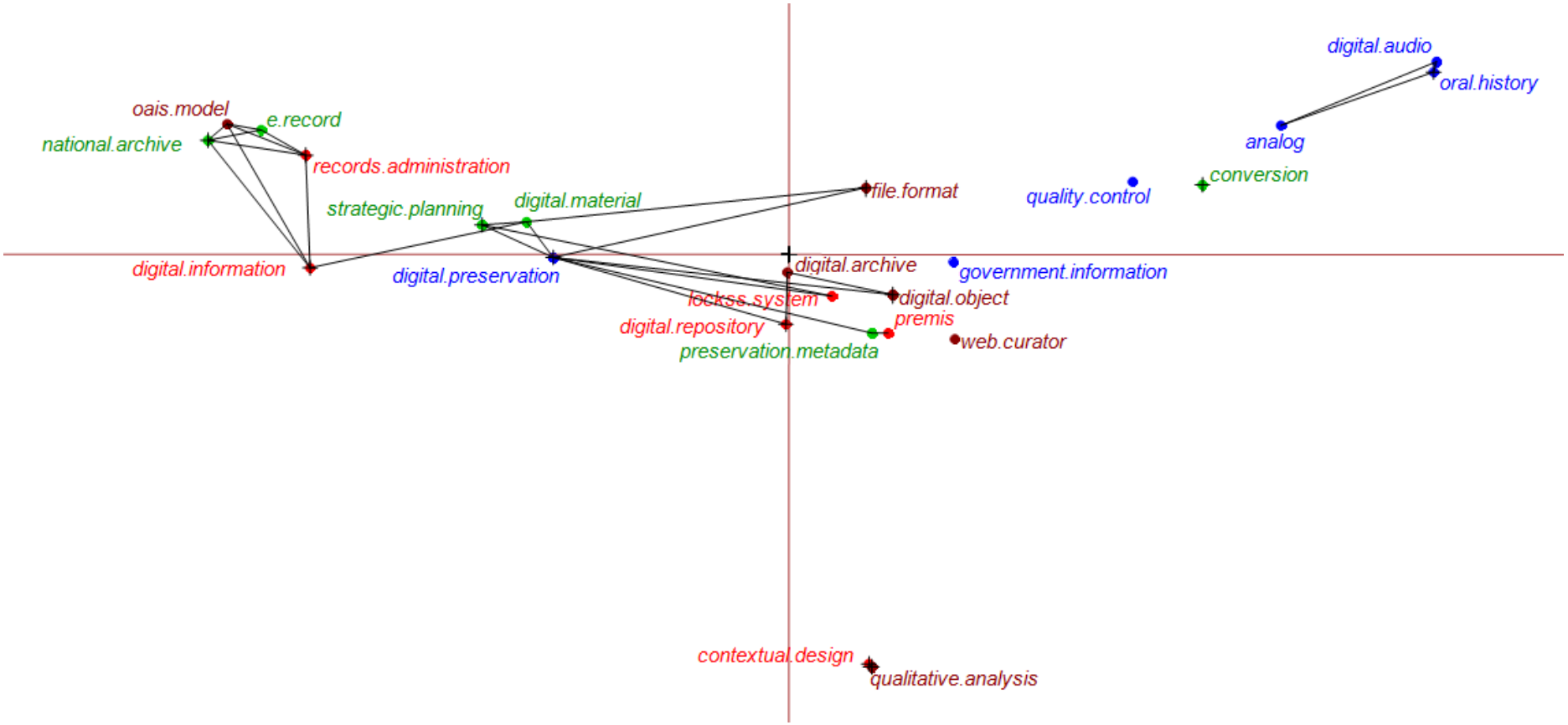

Figure 5.1.23: Co-word structure of cluster C1.4 in 2001-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

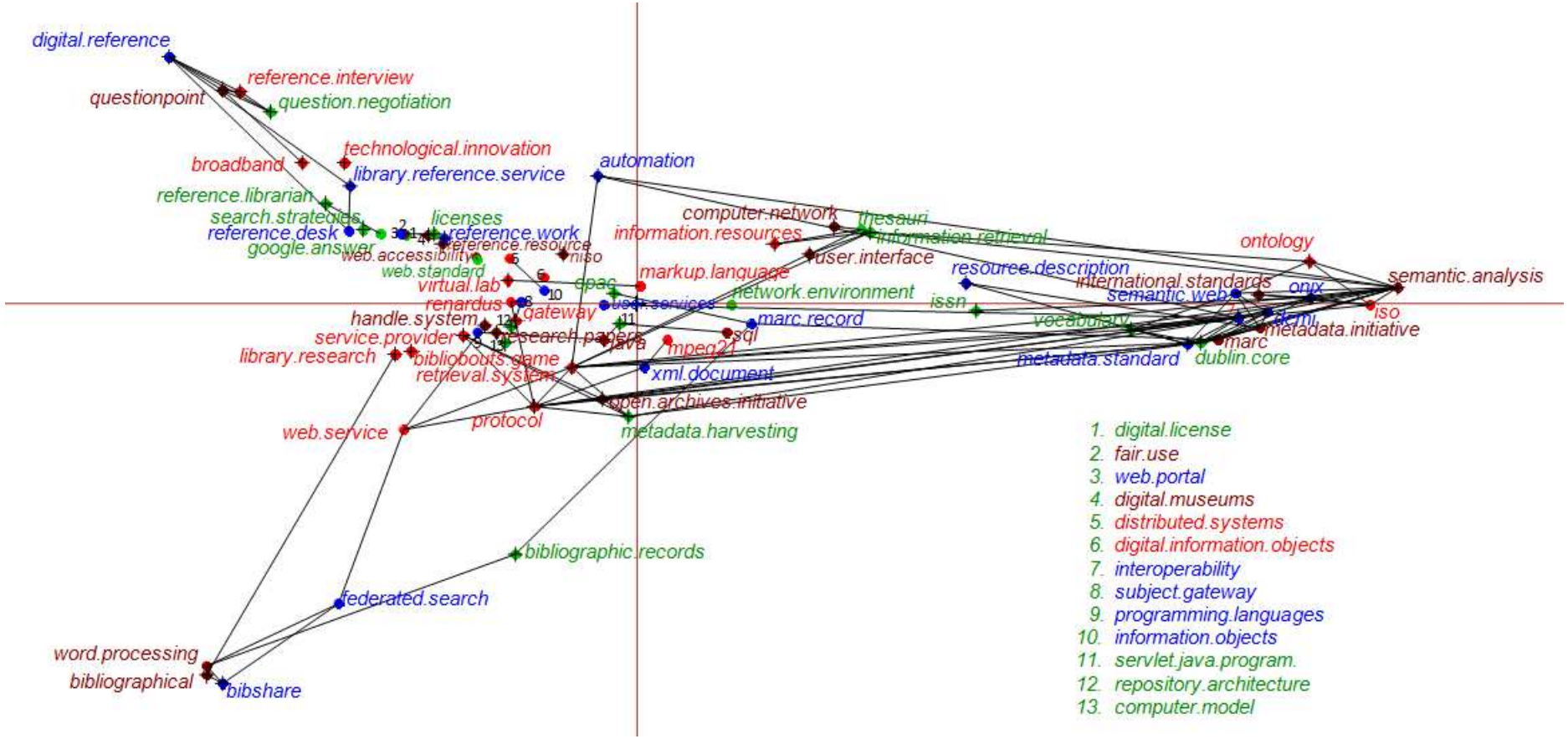

Figure 5.1.24: Co-word structure of cluster C1.5 in 2001-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

The keywords, Literature, Information search, Google, User behavior, Security, Social network, Evaluation studies, Search engine, Information visualization, Newspaper, Photographs, Social engagement, Cultural heritage, and Microfilm are occupied a maximum number of links in cluster C1.3. Cluster C1.4 includes Digital preservation, Digital information, OAIS model, National archives, and Records administration have maximum connections. The keywords, Dublin core, Interoperability, Federated search, Metadata harvesting, Metadata standard, Digital reference, Question negotiation, Protocol, Retrieval system, Ontology, and Semantic analysis are active keywords, in cluster C1.5.

Table 5.1.4 presents characteristics of the clusters exist in *D-Lib Magazine* during the period 2001-2010. It can be observed that the inner link of different clusters (C1.1, C1.3, C1.4, and C1.5) is higher than its outer link. It can also be seen that 60.80% link of each cluster is inner links; these links reflect the strong relationship between keywords within clusters.

Table 5.1.4: Characteristics of co-word structure of clusters in 2001-2010 (*D-Lib Magazine*)

S.No.	Characteristics	Clusters					Average Value
		C1.1	C1.2	C1.3	C1.4	C1.5	
		No.	No.	No.	No.	No.	
1	Inner Link	162	358	196	54	222	198.40
2	Outer Link	99	218	140	33	148	127.60
3	Total Link	261	576	336	87	370	326.00
4	Inner Link %	62	62	58	62	60	60.80
5	Outer Link %	38	38	42	38	40	39.20
6	Inner link Key	49	106	105	20	66	69.20
7	Outer Link Key	38	69	67	12	48	46.80
8	Total Key	62	117	132	24	77	82.40
9	Inner link Key %	79	91	80	83	86	83.80
10	Outer Link key %	61	59	51	50	62	56.60
11	Average Link Per key	4.21	4.92	2.55	3.62	4.81	4.022
12	Density	0.285	0.278	0.313	0.276	0.29	-
13	Centrality	0.239	0.238	0.238	0.232	0.239	-

Data Source: *Primary data*

The number of inner link keywords is also higher than the outer link keywords. The average value of inner link key percentage is 83.80, while 56.60% key of each cluster bears outer link. Average link per key of, C1.1, C1.3, and C1.5 has more than 4 links whereas clusters C1.3 and C1.4 have less than 4 links.

During the period 2001-2010 in *D-Lib Magazine*, C1.3 owns the highest density; it means the topics of the cluster have good representation and capacity to maintain itself over the period of time among clusters. Cluster C1.1 and C1.5 have the highest centrality respectively but it is lesser than its density with good differences, and the clusters have more than four links per

key which show that strong bond within a cluster. It can be understood from above description that the topics of cluster C1.1 and C1.5 are important research area considered by researchers. The density of cluster C1.2 and C1.4 is relatively less but higher than its centrality and has a good number of link per key, it suggests robustness of the cluster and capability to maintain itself.

5.1.2.2 Intellectual Structure based on Co-word Analysis (2001-2005)

5.1.2.2.1 General Overview Structure

During the period 2001-2005, 320 keywords of 412 keywords are selected as a research sample. The rest 92 Keywords (see Table B7 of Appendix B) do not have an appropriate frequency (≥10 occurrences) are excluded. The previous method was applied to generate the general overview intellectual structure of *D-Lib Magazine* for the 2001-2005 (see Figure 5.1.25) and each cluster was represented by its five most occurred keywords and a network of the thin line show a strong relationship between cluster which has Salton index value >0.35.

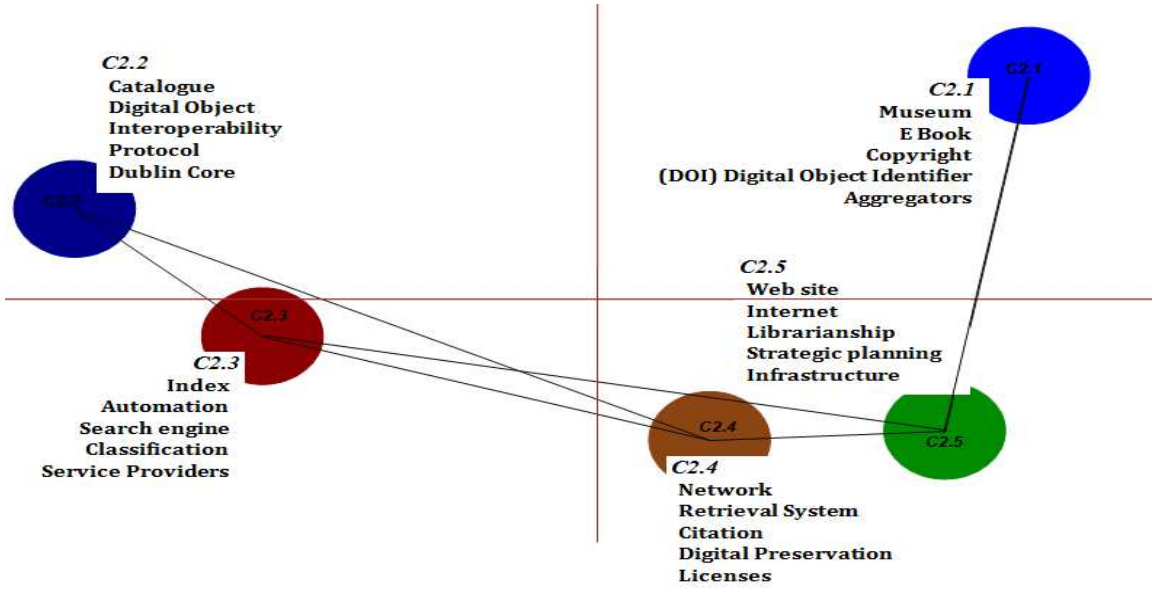

Figure 5.1.25: General overview structure of *D-Lib Magazine* in 2001-2005

Data Source: *Primary data*

5.1.2.2.2 Co-word Structure of Clusters

In order to plot detailed co-word structure, keywords of each cluster are selected as input variable to map the sub-domain based on the correlation matrix of 320 keywords. Thus fives detail co-word structure of sub-domains (Figure 5.1.26−5.1.30) are plotted to visualise specific characters.

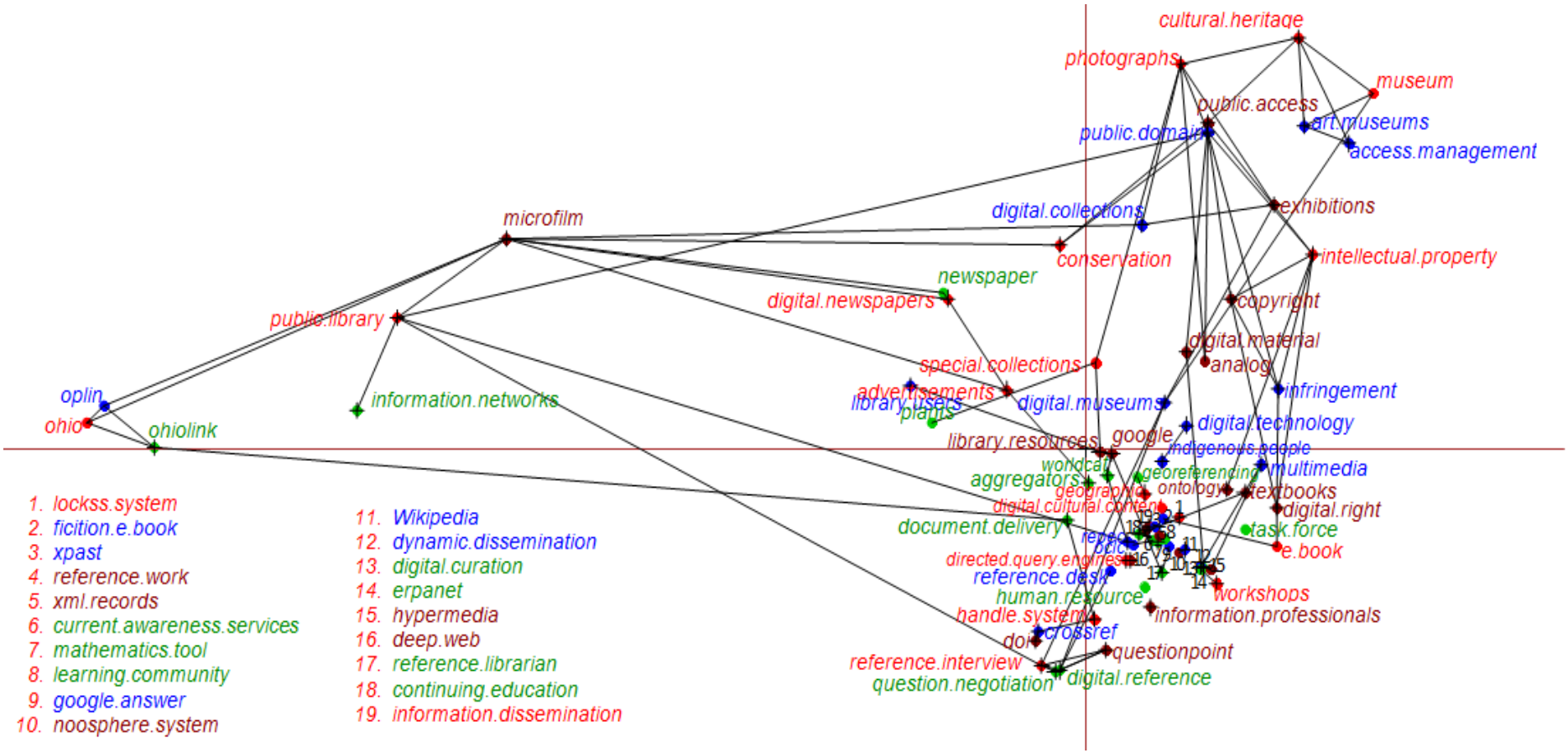

Figure 5.1.26: Co-word structure of cluster C2.1 in 2001-2005 (*D-Lib Magazine*)

Data Source: *Primary data*

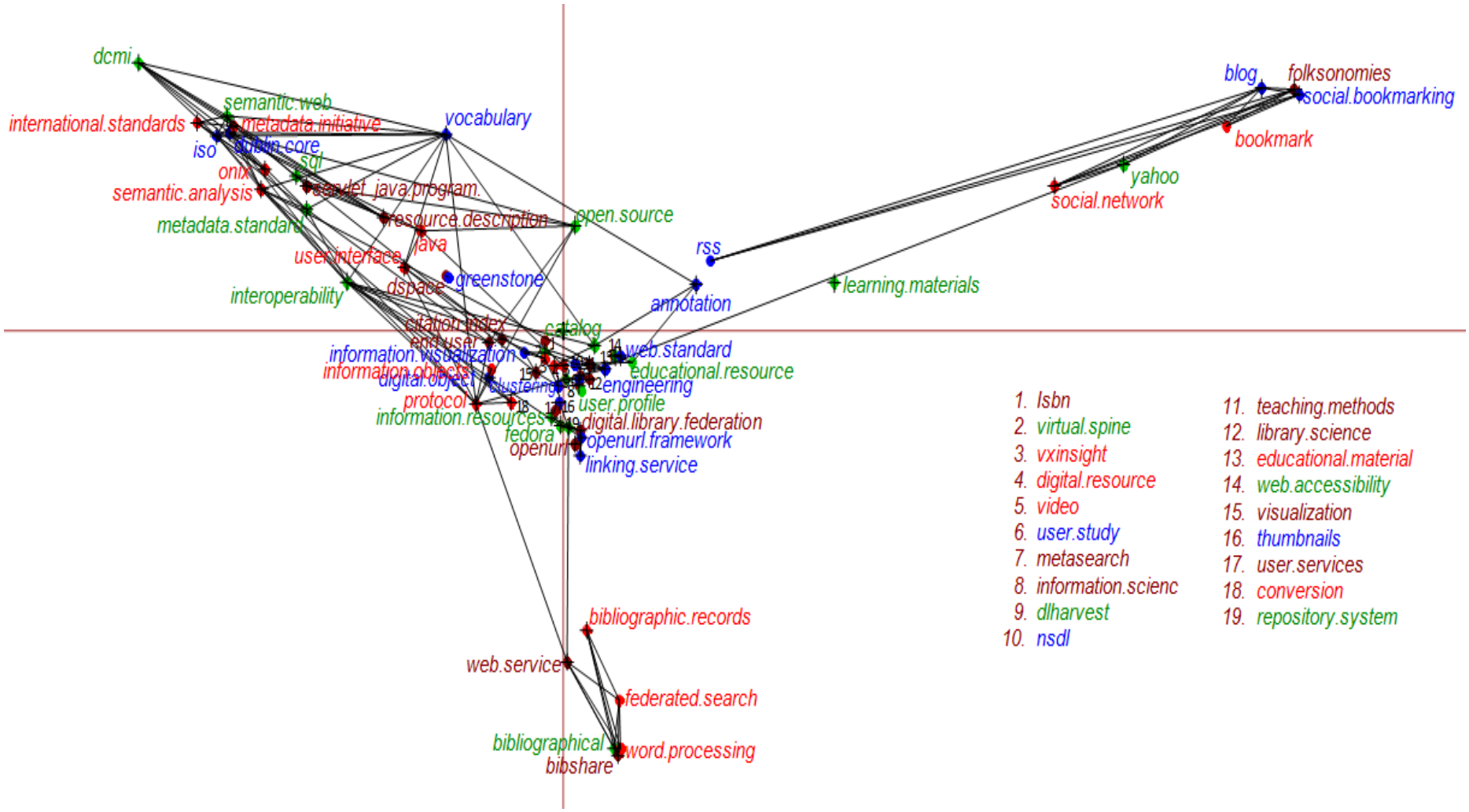

Figure 5.1.27: Co-word structure of cluster C2.2 in 2001-2005 (*D-Lib Magazine*)

Data Source: *Primary data*

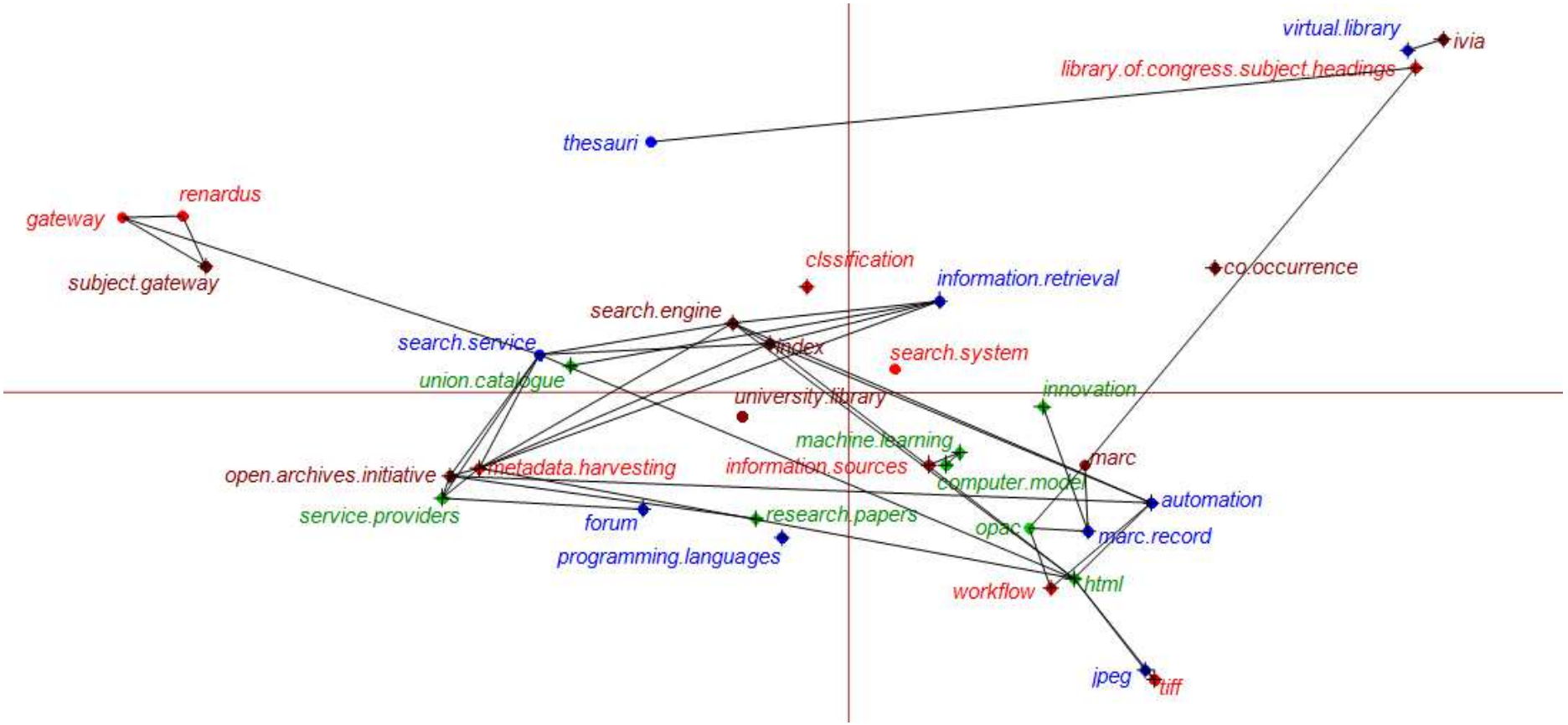

Figure 5.1.28: Co-word structure of cluster C2.3 in 2001-2005 (*D-Lib Magazine*)

Data Source: *Primary data*

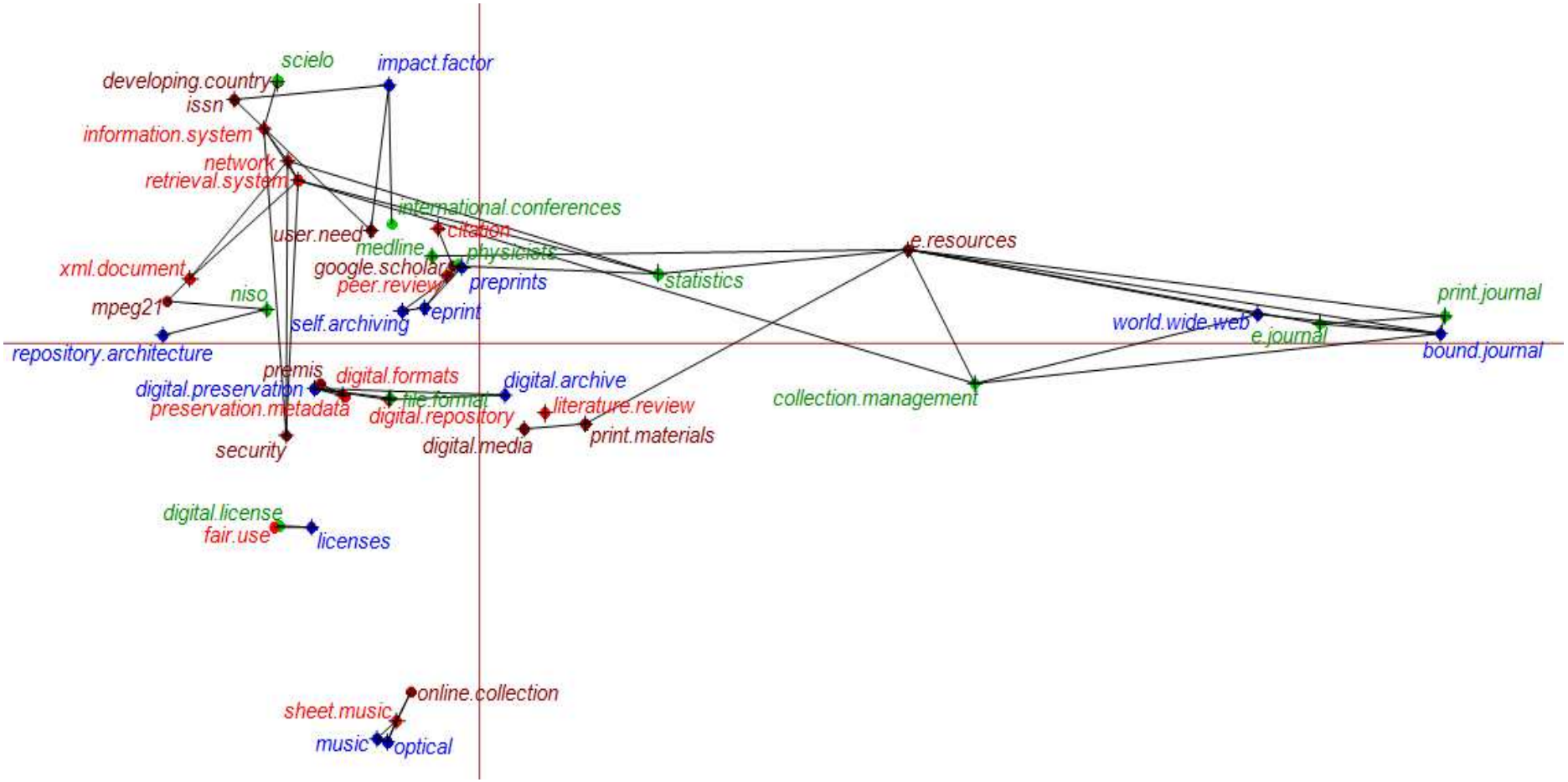

Figure 5.1.29: Co-word structure of cluster C4.4 in 2001-2005 (*D-Lib Magazine*)

Data Source: *Primary data*

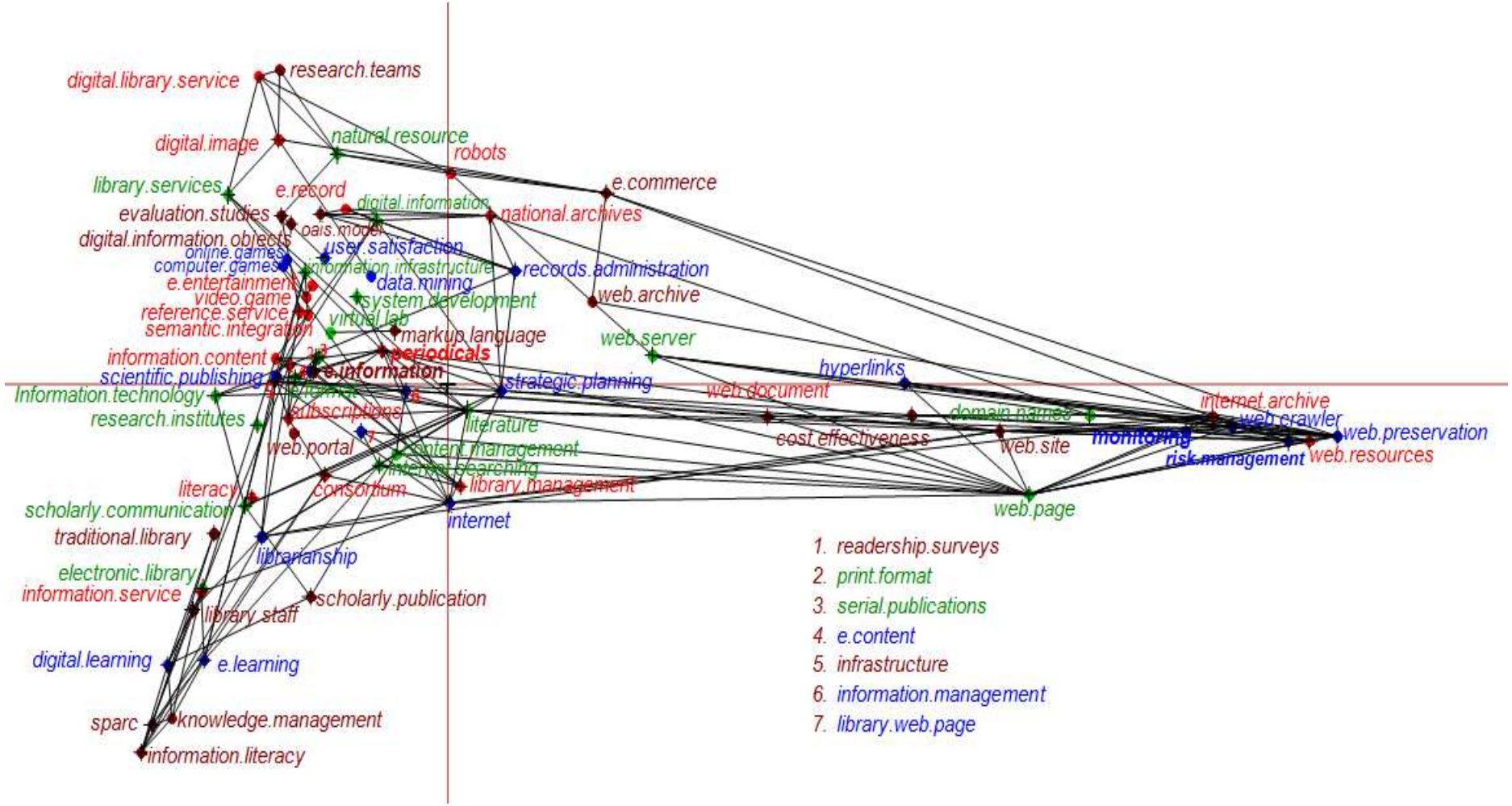

Figure 5.1.30: Co-word structure of cluster C5.5 in 2001-2005 (*D-Lib Magazine*)

Data Source: *Primary data*

Cluster C2.1 includes 93 research topics related to Museum, E-book, Copyright, DOI, Google, Newspaper, OCLC, Multimedia, Digital reference, LOCKSS system, Digital material, Intellectual property, Cultural heritage. Cluster C2.2 consists of 71 research topics related to Catalogue, Digital object, Interoperability, Protocol, Dublin core, Engineering, DSpace, Open URL, Vocabulary, Greenstone, Conversion, RSS (Really simple Syndication), Open source. Cluster C2.3 includes 34 topics on Index, Automation, Search engine, Classification, HTML, Gateway, MARC, Innovation, Metadata harvesting, Open Archives Initiative, JPEG, Virtual library, Information retrieval, Renardus, OPAC, TIFF (Tagged Image File Format). Cluster C2.4 has 46 keywords and focuses on Network, Retrieval system, Citation, Digital preservation, Licenses, E-print, E-journal, MPEG21, Information system, Self archiving, Security, E-resources, Collection management, Digital Repository, World wide web. Finally, Cluster C2.5 appears with 76 topics related to Web site, Internet, Librarianship, Strategic planning, Periodicals, Infrastructure, Web page, Scientific publishing, Reference service topics.

Observing the co-word network (Figure 5.1.26−5.1.30) of different clusters during this period (2001-2005), it has been found that C2.1, C2.2, and C2.5 much more than their outer link while Cluster C2.3 and C2.4 are on the contrary. The keywords Aggregator, Digital reference, Reference interview, Document Delivery, OhioLink, Public Library, Microfilm, Public domain, Photographs, Museum, Cultural heritage, Digital Material, Handle system, Intellectual property, Library resource, Ontology, Wikipedia and Copyright in C2.1; DCMI, Catalogue, Citation index, Dublin core, End user, User interface, Engineering, Information resource, Federated search, Bibliographic records, RSS, Web services, ISO, Interoperability, Java, Open source, Open URL framework, Protocol, Semantic analysis, Vocabulary in C2.2; Automation, Service provider, HTML, Index, Information retrieval, Innovation, MARC, OPAC, Metadata harvesting, Open Archives Initiative, Gateway, Search engine, Search service, University library in C2.3; Retrieval system, Network, Impact factor, Collection management, Digital preservation, Digital repository, File format, Information system, Network, Security, statistics, Bound journal, World wide web, E resources in C2.4; Internet, Literature, Infrastructure, Consortium, Strategy planning, Web site, Web page, Web preservation, E-commerce, Web archive, National archive, Information literacy, Knowledge management, Scholarly publication, Digital image, Library service, Digital library service, Record administration, Strategic planning, Librarianship, Scholar communication, Reference

service in C2.5 are active keywords which occupy more link with other keywords and focused main research topics of this period. In Table 5.1.5, different characteristics of five clusters of the year 2001-2005 can be seen.

Table 5.1.5 shows that during the year 2001-2005, the cluster C2.1, C2.2, and C2.5 have amuch higher number of internal links than its outer link but cluster C2.3 and C2.4 is on contrary. The table also shows that there are 211.60 inner links and 225.60 outer links per cluster that is evidence of rich internal connection among keywords. Cluster C2.1 and C2.5 have highest inner link which shows strong network among keywords while cluster C2.3 has the lowest percentage of inner link key and the highest percentage of outer link key indicates a strong relationship with other clusters. On the average, there are 45.60% links of each cluster are inner links while 54.40% are outer links which shows a weak internal composition in each cluster and a better extensive relation among clusters.

Table 5.1.5: Characteristics of co-word structure of clusters in 2001-2005 (*D-Lib Magazine*)

S. No.	Characteristics	Clusters					Average Value
		C2.1	C2.2	C2.3	C2.4	C2.5	
		No.	No.	No.	No.	No.	
1	Inner Link	232	258	86	116	366	211.60
2	Outer Link	173	240	209	231	275	225.60
3	Total Link	405	498	295	347	641	437.20
4	Inner Link %	57	52	29	33	57	45.60
5	Outer Link %	43	48	71	67	43	54.40
6	Inner link Key	82	65	29	44	72	58.40
7	Outer Link Key	62	57	31	36	59	49.00
8	Total Key	93	71	34	46	76	64.00
9	Inner link Key %	88	92	85	96	95	91.20
10	Outer Link key %	67	80	91	78	78	78.80
11	Average Link Per key	4.35	7.01	8.68	7.54	8.43	7.20
12	Density	0.309	0.292	0.285	0.282	0.272	-
13	Centrality	0.243	0.247	0.24	0.243	0.241	-

Data Source: *Primary data*

On the average, Cluster C2.5 has the highest number of link (inner & outer link) per key but lowest density and centrality which shows that topics of this cluster immature and developing. Whereas, the cluster C2.1 has the lowest number of link per key and has highest density and centrality is also relatively good. It means this cluster does not only own intense inner connection but also has a good connection with other clusters. Thus it can be said that topic of this cluster has already been cared and able to maintain itself to develop over the course of time and considered important by Digital library community. The centrality of cluster C2.2 is

highest among clusters, which indicate the problem of this area is considered crucial and important for research.

5.1.2.3 Intellectual structure based on Co-word Analysis of 2006-2010

5.1.2.3.1 General Overview Structure

During the period 2006-2010, A big change has been seen in the intellectual structure of *D-Lib Magazine* that a total of 156 keywords (see Table B8 of Appendix B) have not appeared (it occurred less than ten times or no occurrences in the corpus).There are 53 new keywords (see Table B9 of Appendix B) which appeared during this year. Thus, 256 keywords were taken for research sample (see Table B10 of Appendix B). The earlier method was applied to generate the general overview of the intellectual structure of *D-Lib Magazine* for the period 2006-2010 (Figure 5.1.31) and each sub-domain (cluster) was labeled by top five most frequent occurred keywords of the cluster.

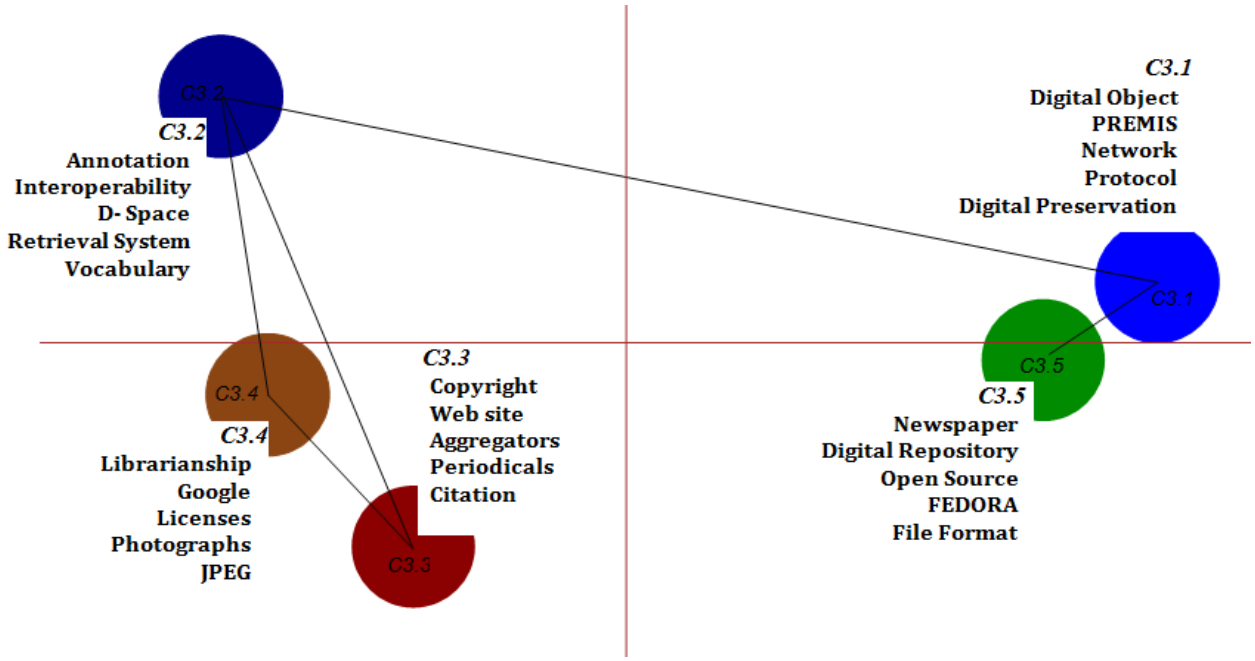

Figure 5.1.31: General overview structure of *D-Lib Magazine* in 2006-2010

Data Source: *Primary data*

5.2.2.3.2 Co-word Structure of Clusters

In order to plot detailed co-word structured of each cluster (see Figure 5.1.31) of the period 2006-2010, each cluster's keywords selected as input variables to map the sub-domain based on the correlation matrix of 256 keywords. Fives detailed co-word structure of sub-domains (Figure 5.1.32−5.1.36) were plotted to visualise characteristics that are recorded in Table 5.1.6.

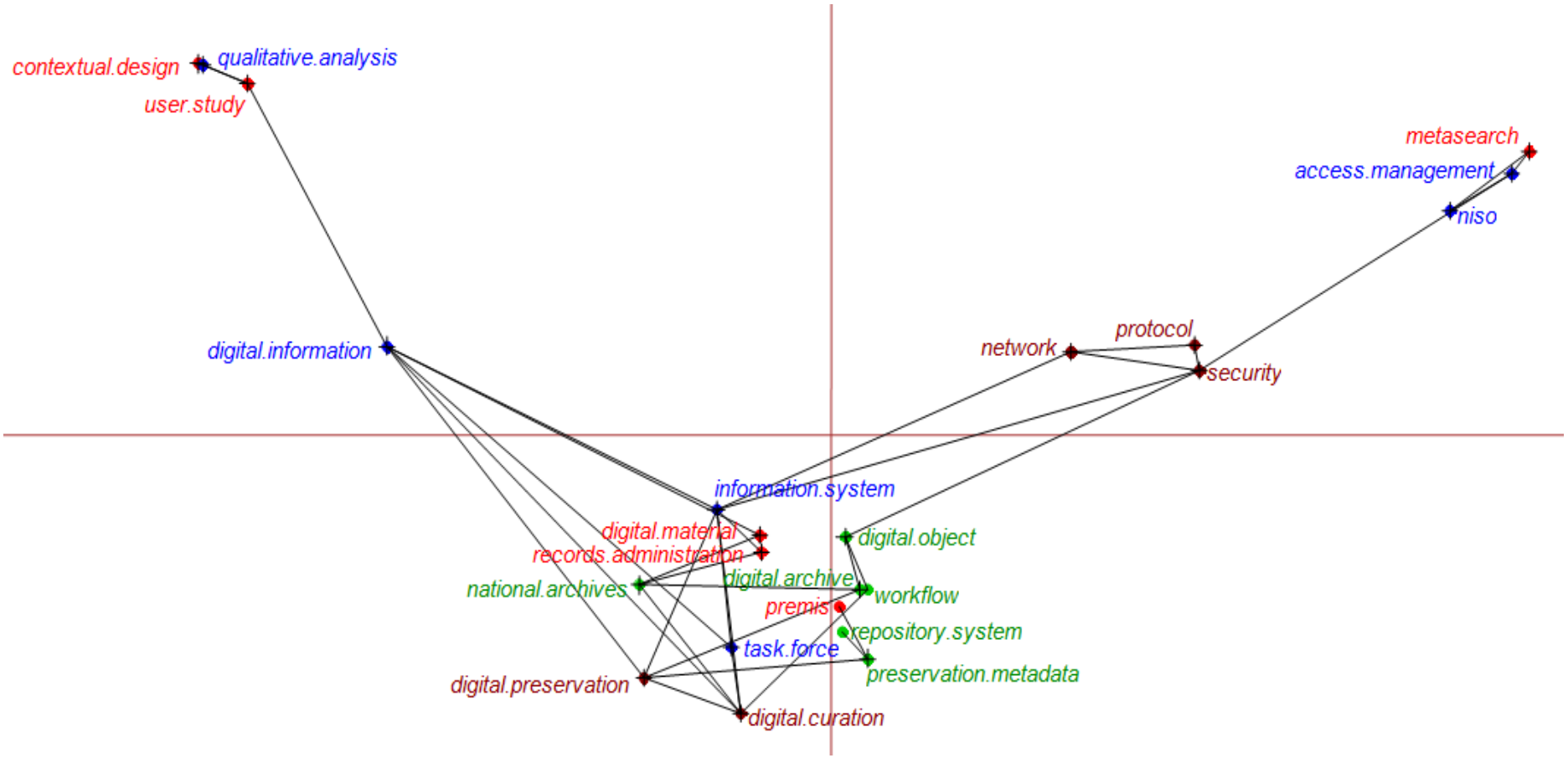

Figure 5.1.32: Co-word structure of cluster C3.1 in 2006-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

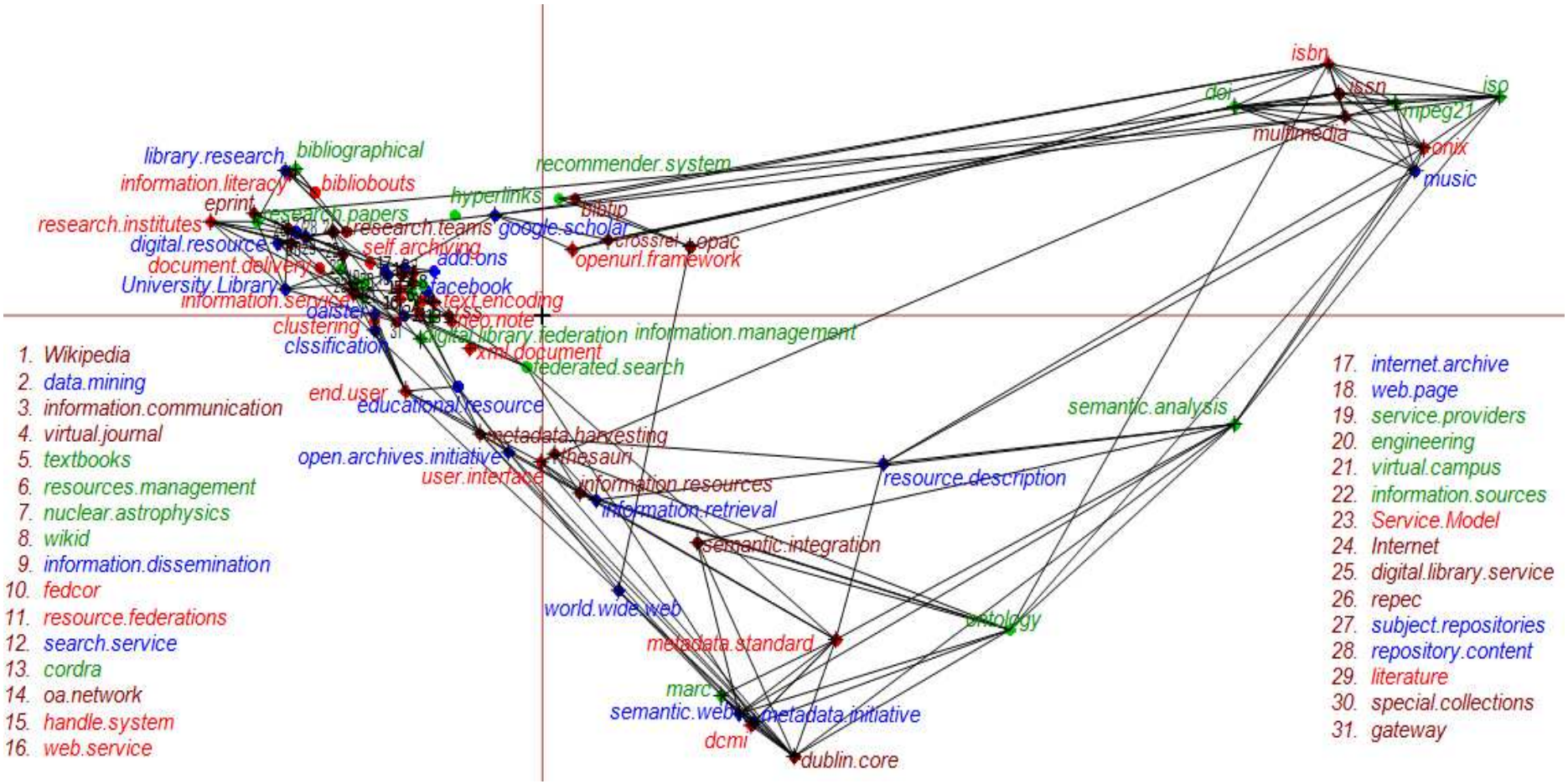

Figure 5.1.33: Co-word structure of cluster C3.2 in 2006-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

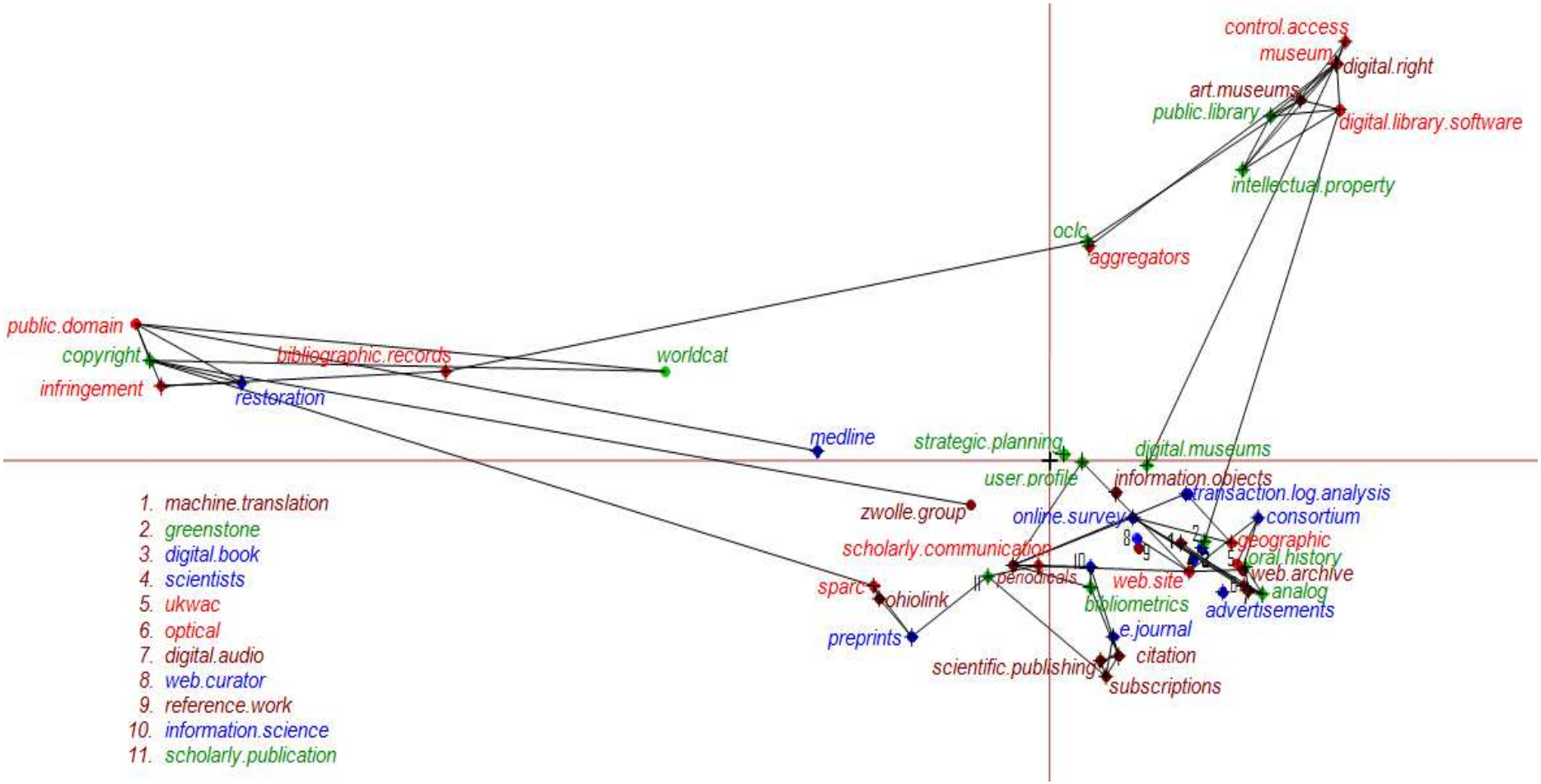

Figure 5.1.34: Co-word structure of cluster C3.3 in 2006-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

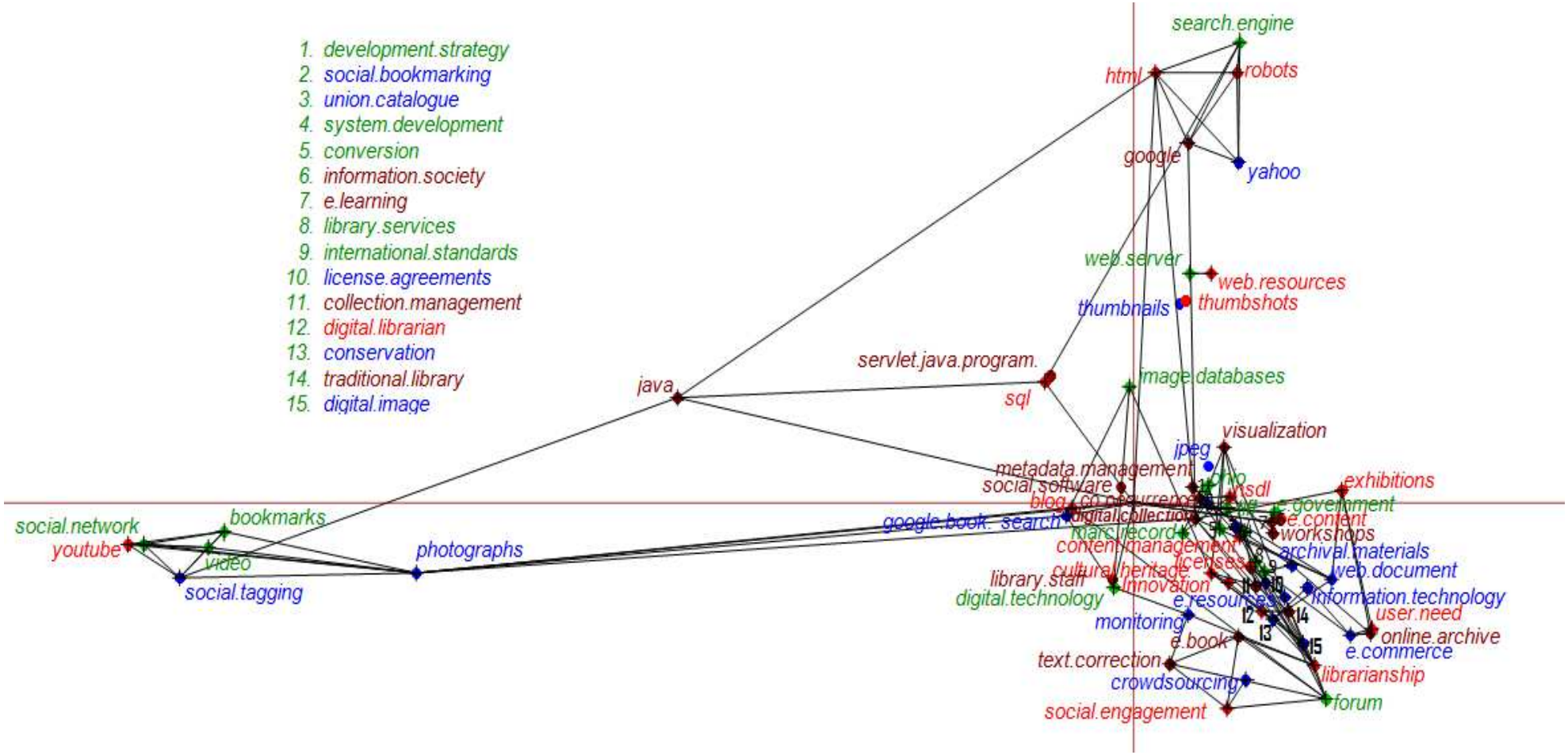

Figure 5.1.35: Co-word structure of cluster C3.4 in 2006-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

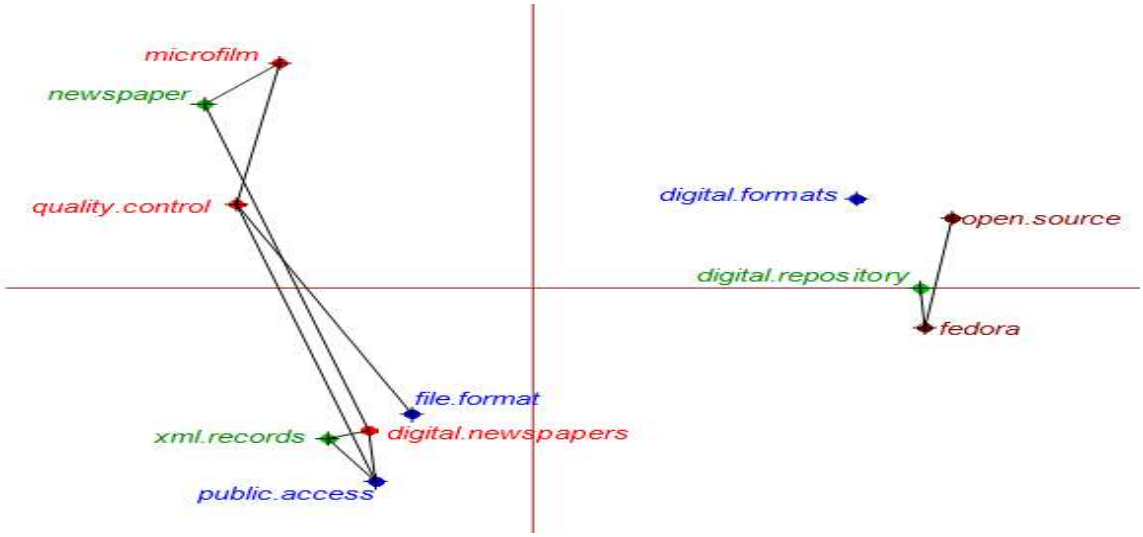

Figure 5.1.36: Co-word structure of cluster C3.5 in 2006-2010 (*D-Lib Magazine*)

Data Source: *Primary data*

In the year 2006 to 2010, the cluster C3.1, C3.2, C3.3, C3.4, and C3.5 has 23, 100, 52, 70, 11 keywords respectively. Cluster C3.1 includes the research topics related to Digital object, PREMIS, Network, Protocol, Digital preservation, Security, Digital archive, Information system, Preservation, Metasearch, Collection management. Cluster C3.2 consist of keywords Annotation, Interoperability, DSpace, Retrieval system, Vocabulary, Index, Open URL, Catalogue, Infrastructure, Semantic analysis, Web service, Internet, Dublin core. Cluster C3.3 contains topic related to Copyright, Website, Aggregators, Periodicals, Citation, Strategic planning, Museum, Automation, Restoration, Scientific publishing, Information science, Consortium, Intellectual property. Cluster C3.4 includes topics on Librarianship, Licenses, Photographs, Digital collections, Search engine, Conversion, Thumbnails, HTML, Innovation, Cultural heritage, Blog, Visualization, E-resources, Collection management. And cluster C3.5 includes research topics on Newspaper, Digital repository, Open source, File format, Microfilm, quality control, Public access, XML records.

The observation of plotted networks (Figure 5.1.32–5.1.36) identifies that Information system, Digital curation, Digital information, Digital preservation, Network, Security, National archives in C3.1; Dublin core, Resource description, Semantic web, Semantic analysis, Semantic integration, Ontology, World wide web, Multimedia, DOI, ISO, ISBN, Onix, Music, Umiversity library, End user, OPAC, Google scholar, MPEG21, Interoperability, Metadata initiative, Metadata standard, Retrieval system, Catalogue, Semantic analysis in C3.2; Scholarly communication, Online survey, Periodicals, Scientific publication, Consortium, Intellectual property right, Digital right, Copyright, Automation, Digital library software,

Restoration, Web site, Public domain, Museum in C3.3; Librarianship, Photographs, Digital collections, HTML, Cultural heritage, Digital image, Social tagging, Bookmark, Forum, E-book, Web document, E-commerce, Digital image, Exhibition, Text correction, Social engagement, Image database, HTML, Search engine, yahoo, Google, Java, Visualization, YouTube, Social network in C3.4; Digital newspapers, Quality control, Public access, Digital repository in C3.5 are active keywords which associated with more keywords in the cluster and focused main research themes of this period.

As shown in Table 5.1.6, cluster C3.2, C3.3, and C3.4 had inner link more than its outer link, while outer link of cluster C3.1 and C3.5 is higher than its internal link. Cluster C3.2 has 66% of internal link whereas cluster C3.5 has lowest percentage (29%) of internal links. Cluster C3.5 has the highest percentage (71%) of outer links among the clusters. On average each cluster has 94% inner link keys which establish internal relationship between keywords and 83.40 % keys has outer links. These links reflect not only intense network within the cluster but also show good linkage with other clusters. Cluster C3.2 and C3.1 have the highest number of link per key. On average value, it is 6.97 which is evidence of abundant links among keywords and coherent network.

Table 5.1.6: Characteristics of co-word structure of clusters in 2006-2010 (*D-Lib Magazine*)

S. No	Characteristics	Clusters					Average Value
		C3.1	C3.2	C3.3	C3.4	C3.5	
		No.	No.	No.	No.	No.	
1	Inner Link	72	522	138	244	20	199.20
2	Outer Link	107	273	173	236	49	167.60
3	Total Link	179	795	311	480	69	366.80
4	Inner Link %	40	66	44	51	29	46.00
5	Outer Link %	60	34	56	49	71	54.00
6	Inner link Key	23	93	47	69	10	48.40
7	Outer Link Key	20	69	43	61	10	40.60
8	Total Key	23	100	52	70	11	51.20
9	Inner link Key %	100	93	90	99	91	94.60
10	Outer Link key %	87	69	83	87	91	83.40
11	Average Link Per key	7.78	7.95	5.98	6.86	6.27	6.97
12	Density	0.290	0.295	0.300	0.319	0.256	-
13	Centrality	0.245	0.248	0.243	0.244	0.237	-

Data Source: *Primary data*

Cluster C3.4 has highest density and centrality is much lesser than its density. It means the topics, which embedded in the C3.4, had already formed their own subfields with strong internal relationship. The cluster C3.5 owns lowest density and centrality in whole research network that indicates immaturity of the research topics during this period. The cluster C3.1,

C3.2, and C3.3 each has more density than its centrality that indicates its intense connection between keywords; it means, the topics of these clusters have already cared and able to develop over the course of time.

5.2 Citation Pattern

A citation is a reference to published or unpublished source of information. Studies of citation pattern of journals examine the source of knowledge used by a group of scholars or a scholar to give a shape to their original research. This section discusses the analysis of the data collected and presented under different table headings as per the need of second objectives of the study.

5.2.1 Scientometrics (Journal)

There are total 16627 references that have been considered for the study of citation pattern of *Scientometrics* journal and analysed under following subsections:

5.2.1.1 Types of Cited Resources

This section provides statistics on the type of cited resources. All cited resources are broadly categorized into two: Print-resources, and E-resources. Table 5.1.1 shows that approx. 97% citations come from print-resources while only 3% citations come from e-resources for the journal *Scientometrics.* It shows the availability and the validity of print-resources even in the age of electronic publication. Table 5.2.2 presents a breakdown of recorded citation in Table 5.2.1 by number and percentage of citation according to the form of literature. It is understood from Table 5.2.2 that journals constitute the largest category among different form of resources. Out of the 16627 cited publication, 11627 (69.93%) are from journals, 2405 (14.467%) from books, and only 744 (4.47%) from Proceedings.

Table 5.2.1: Types of cited resources in *Scientometrics*

S. No.	Types of Resources	Number of Citations	Percentage of Citation
1	Print Resources	15673	96.93
2	E-Resources	954	3.07
	Total	16627	100

Data Source: *Primary data*

The high proportion of journals' citation in *Scientometrics* Journal is consistent with the established theory that the majority of scholarly communication in the Scientometrics community follows this medium. There is a low dispersion of citations among the remaining

categories that collectively, they comprise less than 12% of the total. It is noteworthy that in the age of electronic publication only 954 (3.07%) citations referred electronic resource, of which 453 (2.72%) are Web pages.

Table 5.2.2 Forms of cited resources in *Scientometrics*

S. No.	Forms of Resources	Number of Citations	Percent of Citation
1	Journal	11627	69.93
2	Book	2405	14.46
3	Proceeding	744	4.47
4	Web resource	453	2.72
5	Report	420	2.53
6	Reference-book	242	1.46
7	Magazine	214	1.29
8	Dissertation	72	0.43
	Other	450	2.71
	Total	16627	100.00

Data Source: *Primary data*

5.2.1.2 Subject of Cited Resources

The macro-analysis of the 16627 citations, based on subject distribution, provides a subject profile of cited resources in Table 5.2.3. All citations were categorized into eighteen subjects. The Table 5.2.3 shows that resources on Bibliometric studies (bibliometric law, bibliometric indicator, authorship and collaboration analysis, and bibliometric analysis) are the most used subject and comprised of 2365 (14.22%) citations followed by Citation analysis 2233 (13.43%), Scholarly publication 1764 (10.61%), Bibliometric index 1292 (7.77%), Scientometrics 738 (4.71%), Webometrics 680 (4.09%), and Social network 579 (3.48%) citations; The next four subjects, Content analysis, Patent analysis, Sociology of science, and Statistics produced 562 (3.38%), 557 (3.35%), 453 (2.72%), and 442 (2.66%) citation respectively. Altogether the above mentioned eleven subjects consist of 11710 (70.43%) citations. The rest subjects and Others in Table 3 comprise 4917 (30.31%) citations.

Of the 11627 citations that falls under the journal literature, 6800 (58.48%) cited articles are classed under the top five subject headings Bibliometric Study, Citation analysis, Scholarly Publication, Bibliometric index and Scientometrics which produce 2168 (18.65)%, 1777 (15.28%), 1276 (10.97%), 1031 (8.87%) and 548 (4.71%) citations respectively (see Table 5.2.3).

In term of citation to Book, 272 (11.31%) citations are classed under Sociology, 237 (9.85%) citations in Scholarly Publication, and 171 (7.11%) citations in Statistics, 157 (6.53%) citations in Citation analysis, and 120 (4.99%) citations in Social network analysis. These subjects together produced 39.79% of the total number of books' citation.

Table 5.2.3: Distribution of cited resources in *Scientometrics* by subject

S. No.	Subject	Citation to Journals		Citation to Books		Citation to Proceeding		Citation to Web Resource		Citation to Reports		Citation to Reference Books		Citation to Magazines		Citation to Dissertations		Citation to Others		Total number of Citation	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	Bibliometric Study	2168	18.65	56	2.33	41	5.51	6	1.32	21	5.00	25	10.33	8	3.74	9	12.50	31	6.89	2365	14.22
2	Citation Analysis	1777	15.28	157	6.53	95	12.77	77	17.00	29	6.90	34	14.05	26	12.15	19	26.39	19	4.22	2233	13.43
3	Scholarly Publication	1276	10.97	237	9.85	53	7.12	29	6.40	56	13.33	26	10.74	35	16.36	9	12.50	43	9.56	1764	10.61
4	Bibliometric Index	1031	8.87	17	0.71	103	13.84	25	5.52	3	0.71	2	0.83	56	26.17	0	0.00	55	12.22	1292	7.77
5	Scientometrics	548	4.71	77	3.20	26	3.49	15	3.31	77	18.33	18	7.44	3	1.40	8	11.11	11	2.44	783	4.71
6	Webometrics	522	4.49	31	1.29	73	9.81	28	6.18	6	1.43	3	1.24	8	3.74	5	6.94	4	0.89	680	4.09
7	Social Network Analysis	362	3.11	120	4.99	44	5.91	17	3.75	5	1.19	9	3.72	6	2.80	2	2.78	14	3.11	579	3.48
8	Content Analysis	383	3.29	78	3.24	59	7.93	7	1.55	5	1.19	10	4.13	2	0.93	5	6.94	13	2.89	562	3.38
9	Patent Analysis	390	3.35	66	2.74	23	3.09	3	0.66	12	2.86	6	2.48	0	0.00	1	1.39	56	12.44	557	3.35
10	Sociology of Science	138	1.19	272	11.31	8	1.08	2	0.44	12	2.86	8	3.31	2	0.93	0	0.00	11	2.44	453	2.72
11	Statistics	226	1.94	171	7.11	16	2.15	8	1.77	8	1.90	7	2.89	2	0.93	1	1.39	3	0.67	442	2.66
12	Academic Research	221	1.90	44	1.83	13	1.75	26	5.74	28	6.67	2	0.83	3	1.40	1	1.39	25	5.56	363	2.18
13	Innovative System	114	0.98	83	3.45	4	0.54	1	0.22	13	3.10	2	0.83	8	3.74	1	1.39	9	2.00	235	1.41
14	Triple Helix	150	1.29	21	0.87	6	0.81	1	0.22	3	0.71	0	0.00	1	0.47	0	0.00	5	1.11	187	1.12
15	Infometrics	76	0.65	37	1.54	7	0.94	0	0.00	0	0.00	0	0.00	0	0.00	2	2.78	6	1.33	128	0.77
16	Library Research	55	0.47	16	0.67	7	0.94	3	0.66	0	0.00	8	3.31	1	0.47	0	0.00	4	0.89	94	0.57
17	Econometrics	36	0.31	13	0.54	2	0.27	1	0.22	1	0.24	6	2.48	0	0.00	0	0.00	1	0.22	60	0.36
18	Model	48	0.41	8	0.33	0	0.00	1	0.22	0	0.00	2	0.83	0	0.00	0	0.00	2	0.44	61	0.37
	Other	2106	18.11	901	37.46	164	22.04	203	44.81	141	33.57	74	30.58	53	24.77	9	12.50	138	30.67	3789	22.79
	Total	11627	100	2405	100	744	100	453	100	420	100	242	100	214	100	72	100	450	100	16627	100

Data Source: *Primary data*

There are 744 citations to Proceeding, of which, 103 (13.84%) citation accumulated in Bibliometric index and 95 (12.77%) citation in Citation Analysis, 73 (9.81%) citation in Webometrics, 59 (7.93%) citation in Content Analysis, and 53 (7.12%) citation in Scholarly publication. Thus, these subjects altogether produced 51.47% citation to the proceeding.

In case of web resources, most of the citations are concentrated in the subject Citation Analysis, Scholarly publication, Webometrics, Bibliometric Index and Network analysis which comprises 77 (17.00%), 29 (6.40%), 28 (6.18%), 25 (5.52%), 17 (3.75%), 15 (3.31%) citations respectively. Aggregately these subjects produced 41.89% citation of total citation to the web resource.

In reference to Reports, 77 (18.33%) citations found in the subject Scientometrics, 56 (13.33%) citation in Scholarly publication, 29 (6.90%) citation in Citation analysis, 28 (6.67%) in Academic research, and 21 (5.00%) in Bibliometric studies. Together these five subjects represent 50.23% citation of total citations to the Report and the rest 49.77% of citations are dispersed among the rest 13 subjects including others.

In respect of Reference Book, the most highly cited subject are Citation analysis followed by Scholarly publication, Bibliometric study, Scientometrics and Content Analysis, and these subject group produce 34 (14.05%), 26 (10.74%), 25 (10.33%), 18 (07.44%) and 10 (4.13%) consecutively. The rest thirteen subjects when group together produce 22.7% citations.

Out of 214 citations to Magazine, 117 (54.68%) citations concentrate on the topic of Citation analysis, Scholarly publication and Bibliometric index. There are 72 citations towards Dissertation, of which, 45 (62.50%) citations are accumulated in Bibliometric study, Citation analysis, Scholarly publication, and Scientometrics.

Regardless of the type of resources, Table 5.2.3 also shows that 54.83% of citation fall in six subjects i.e. Bibliometric study, Citation analysis, Scholarly publication, Bibliometric index, Scientometrics, and Webometrics. The rest twelve subject have 22.79% citations that are very close to the number of citation of Others subject group.

5.2.1.3 Dispersion of Cited Journals

Journals' title dispersion can be defined as the degree to which the number of cited articles are scattered through the number of journals (Al-Qallaf, 2003). The ranking of journals' titles according to their number of citations in a number of publications is a measure of their degree of importance to the citing authors as well as to the discipline that they reflect.

Table 5.2.4: Dispersion of cited journals and citations of *Scientometrics*

Rank	Cited Journals			Citations	
	No.	Cum. Number (a)	Log of a	No.	Cum. Number
r1	1	1	0.00	3161	3161
r2	1	2	0.69	987	4148
r3	1	3	1.10	595	4743
r4	1	4	1.39	343	5086
r5	1	5	1.61	285	5371
r6	1	6	1.79	221	5592
r7	1	7	1.95	195	5787
r8	1	8	2.08	178	5965
r9	1	9	2.20	174	6139
r10	1	10	2.30	163	6302
r11	1	11	2.40	113	6415
r12	1	12	2.48	80	6495
r13	1	13	2.56	64	6559
r14	2	15	2.71	112	6671
r15	1	16	2.77	55	6726
r16	1	17	2.83	52	6778
r17	1	18	2.89	50	6828
r18	1	19	2.94	48	6876
r19	1	20	3.00	47	6923
r20	1	21	3.04	42	6965
r21	1	22	3.14	80	7045
r22	2	24	3.18	39	7084
r23	1	25	3.22	38	7122
r24	1	26	3.30	72	7194
r25	3	29	3.40	102	7296
r26	3	32	3.43	33	7329
r27	1	33	3.50	64	7393
r28	2	35	3.56	62	7455
r29	2	37	3.61	60	7515
r30	2	39	3.66	56	7571
r31	2	41	3.69	27	7598
r32	1	42	3.71	26	7624
r33	1	43	3.81	100	7724
r34	4	47	3.83	24	7748
r35	1	48	3.85	23	7771
r36	1	49	3.91	66	7837
r37	3	52	4.06	168	8005
r38	8	60	4.14	95	8100
r39	5	65	4.19	54	8154
r40-r56	1471	1536	-	3527	11627

Data Source: *Primary data*

According to Bradford "If scientific journals are arranged in order of decreasing productivity of articles on a given subject, these may be divided into a nucleus of the periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the number of periodicals in the nucleus and succeeding zones will be as 1: n: n^2:..." (Bradford, 1934 as cited in Rao, 1998). Thus, the first zone is referred as a nucleus which is a highly productive zone, the second zone is a moderate productive zone and the third zone is a less productive zone. There are 1536 unique journal titles covering 11,627 journal citations which are used to test the productivity of cited journals.

Law of Bradford

As per the law of Bradford, the number of journals of each zone should follow the mathematical expression of 1: n: n^2: n^3: n^4: n^5 …. **::** A: B: C: D: E: F….

Where, 1 is a nucleus value, hence, a multiplier value can be calculated as follows:

The value of 1st Zone multiplier is Nil.

The value of 2nd Zone multiplier is B/A

The value of 3rd Zone multiplier is C/B

Table 5.2.4 presents the productivity of journals in descending order (for details see Table C1 of Appendix C) and the derived data (cum. No. and Log of a) in the table have been used to plot scattering pattern of the cited journals and citations. The data have been framed into three zones which are presented in Table 5.2.5. Each zone represents Bradford expression as 2:41:1493.

Table 5.2.5: Dispersion of journals and citation in Bradford's Zone

Zone	Cited Journals		Citations		Multiplier
	No.	%	No.	%	
1st	2	0.13	4148	35.68	NIL
2nd	39	2.54	3476	29.90	19.50
3rd	1493	97.33	4003	34.43	38.39
Total	1534	100	11627	100	28.95*

Data Source: *Primary data*
Note: **Mean value of Multiplier*

In reference to the data presented in Table 5.2.5:

No. of Journal in Nucleus Zone 1st zone = 2

Mean value of Multiplier (n) = 28.95

Then, it can be expressed as:

$$2 : 39 : 1493 :: 1 : n : n^2$$

$$2 : (2 \times 28.95) : (2 \times 28.95^2) \Rightarrow 1736.11$$

The number 1736.11 is greater than original number of total cited journals that is 1534.

$$\text{So,} \qquad \text{Percentage Error} = \frac{|1534 - 1736.11|}{1534} \times 100$$

$$= 13.17\%$$

The calculated percentage error (13.17%) is very high. Hence, it can be remarked that the data of cited journals in *Scientometrics* does not fit in Bradford's Law. The graphical representation of dispersion of cited journals and its citation is illustrated in Figure 5.2.1. The figure shows that the curve does not show the well-known shape (*J*) of the Bradford's law.

In this study, a nucleus of two Journals have been found that contributed approximately one-third of the total Journals' citations.

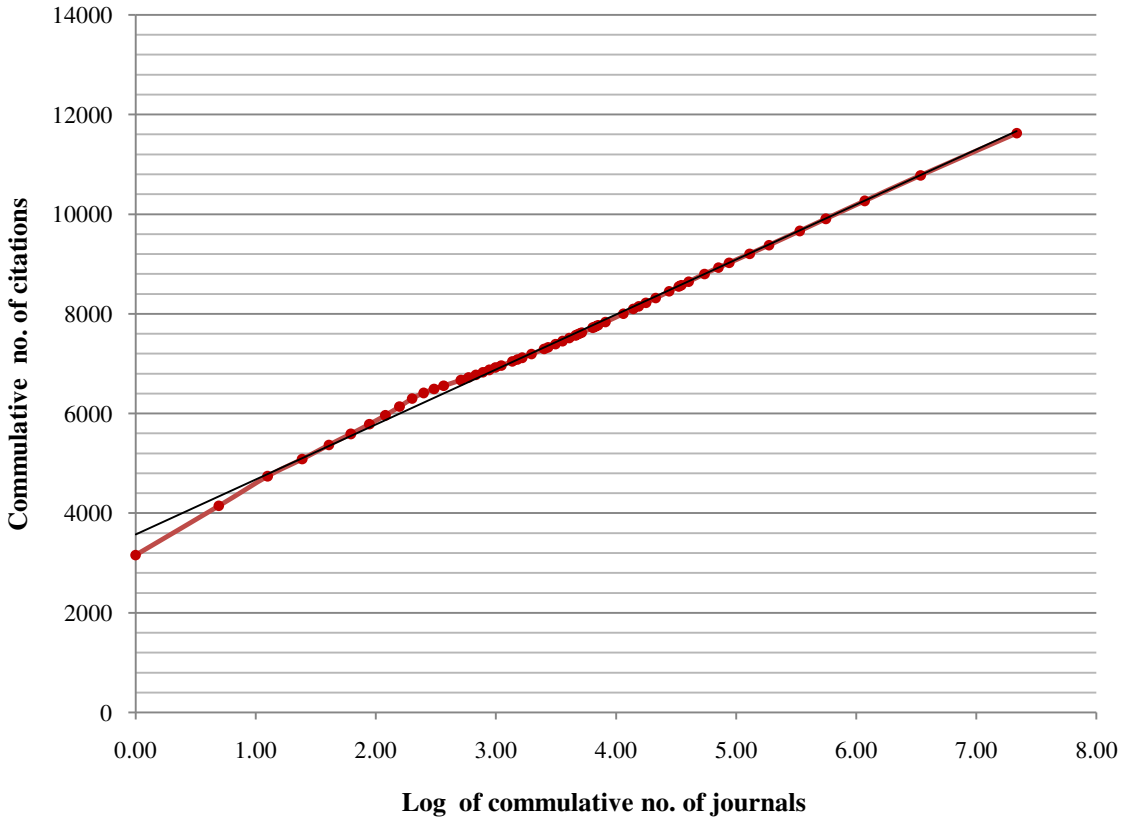

Figure 5.2.1: Dispersion of cited journals and citations in *Scientometrics*

Table 5.2.6 lists the top fifteen frequently cited journals in descending order (see Table C1 of Appendix C) with regards to the number of their references appeared in articles of *Scientometrics* journal. It shows that the most productive journal is *Scientometrics* followed by *Journal of the American Society for Information Science and Technology*, *Research Policy*, *Nature*, and *journal of Documentation*. Table 5.2.6 also throws light on the authors' tendency to cite articles appeared in well-established journal with greater frequency. It is worthwhile to mention that *Scientometrics* itself contributed a good number of citations; it clearly indicates that *Scientometrics* is a renounced journal in this field and plying a crucial role.

Table 5.2.6: Most frequently cited journals (journals from zone 1 & 2) in *Scientometrics*

S. No.	Journal			Citation			
	Tile	Country	Rank	No.	Cum. No.	%	Cum %
1	Scientometrics	Netherlands	1	3161	3161	27.19	27.19
2	Journal of the American Society for Information Science and Technology	US	2	987	4148	8.49	35.68
3	Research Policy	Netherlands	4	595	4743	5.12	40.79
4	Science	US	2	343	5086	2.95	43.74
5	Nature	UK	5	285	5371	2.45	46.19
6	Journal of Documentation	UK	6	221	5592	1.90	48.09
7	Journal of Information Science	UK	7	195	5787	1.68	49.77
8	Information Processing and Management	UK	8	178	5965	1.53	51.30
9	Research Evaluation	UK	9	174	6139	1.50	52.80
10	Social studies of science	UK	10	163	6302	1.40	54.20
11	Journal of Informetrics	Netherlands	11	113	6415	0.97	55.17
12	American Sociological Review	US	12	80	6495	0.69	55.86
13	Annual Review of Information Science and Technology	US	13	64	6559	0.55	56.41
14	Cybermetrics: International Journal of Scientometrics Informetrics and Bibliometrics	Spain	14	56	6615	0.48	56.89
15	Higher Education	Netherlands	14	56	6671	0.48	57.83

Data Source: *Primary data*

5.2.1.4 Characteristics of Cited Author

This section describes the authorship pattern of cited articles. There are 25 (0.20%) anonymous cited resources (see Table 5.2.9). A total of 11388 unique authors consist of primary authors, co-authors, and corporate bodies who have contributed 16602 citations. The majority of 8632 (75.80%) authors contributed only one citation. The most prolific author 'Glanzel, W' was cited 330 times as primary author (see Table 5.2.7) and 'Rousseau, R' was cited 175 times as co-authors (see Table 5.2.8).

Table 5.2.7: Most frequently cited primary authors in *Scientometrics*

Rank	Name	No. of Citation
1	Glanzel, W.	330
2	Garfield, E.	235
3	Leydesdorff, L.	224
4	Egghe, L.	215
5	Moed, H. F.	142
6	Thelwall, M.	140
7	Vanraan, A. F. J.	126
8	Meyer, M.	113
9	Schubert, A.	112
10	Braun, T.	108
11	Narin, F.	103
12	Rousseau, R.	85
13	Small, H.	84
14	Zitt, M.	73
15	Cronin, B.	70

Data Source: *Primary data*

Table 5.2.8: Most frequently cited co-authors in *Scientometrics*

Rank	Name	No. of Citation
1	Rousseau, R.	175
2	Schubert, A.	167
3	Glanzel, W.	148
4	Moed, H.F.	118
5	Thelwall, M.	115
6	Vanraan, A.F.J.	97
7	Leydesdorff, L.	71
8	Braun, T.	57
9	Debackere, K.	54
9	Persson, O.	54
9	ThijsB	54
10	Bassecoulard, E.	52
11	Meyer, M.	49
12	Daniel, H.D.	41
12	Visser, M.S.	41

Data Source: *Primary data*

The distribution of authorship patterns of cited resources is shown in Table 5.2.8. Single authored and two authored resources contributed 75.8% citation, out of them single (sole)

authored resources had a large portion of 45.8% of total citation and two authored resources account for 29.9%. Three authored resources contributed 12.3% citations and the rest 8.5% resources were authored by four or more than four authors. The data reveal that the majority of cited resources are authored by single author.

Table 5.2.9: Authorship of cited resources in *Scientometric*s

S. No.	Authorship	Cited Resources	
		No.	%
1	One	7622	45.84
2	Two	4978	29.94
3	Three	2038	12.26
4	Four	818	4.92
5	Five	289	1.74
6	Six	139	0.84
7	More than six	172	1.03
8	Corporate bodies	546	3.28
9	Anonymous	25	0.15
	Total	16627	100

Data Source: *Primary data*

5.2.1.5 Age of Cited Resources

Table 5.2.10 shows that out of 16627 cited items, the age of 16567 cited items could be determined, as the publication dates of other 60 citations were missing. The age of the

Table 5.2.10: Age of the cited resources in *Scientometrics*

Age (year)	Cited Resource			
	No.	Cum. No.	%	Cum. %
< 1	194	194	1.17	1.17
1-5	7250	7444	43.60	44.77
6-10	3530	10974	21.23	66.00
11-15	1869	12843	11.24	77.24
16-20	1114	13957	6.70	83.94
21-25	729	14686	4.38	88.33
26-30	564	15250	3.39	91.72
31-35	356	15606	2.14	93.86
36-40	271	15877	1.63	95.49
41-45	201	16078	1.21	96.70
46-50	124	16202	0.75	97.44
51-55	78	16280	0.47	97.91
56-60	40	16320	0.24	98.15
61-65	23	16343	0.14	98.29
66-70	24	16367	0.14	98.44
71-75	28	16395	0.17	98.60
75-80	45	16440	0.27	98.88
81-85	35	16475	0.21	99.09
86-90	13	16488	0.08	99.16
>90	79	16567	0.48	99.64
Missing	60	16627	0.36	100.00

Data Source: *Primary data*

citations is calculated by subtracting the year of publication of the cited item from the year of publication of the source item. The time span of citations ranges from <1 to 167 years. Citations more than 50 years old contribute to less than two percent of the total.

The age of the citations in the table has been measured with five-year intervals. The data shows that the number of citations for the most recent literature (5 years old or less) is approximately forty-five percent are higher than those in the next interval 6-10 years old. This reflects a typical pattern for Scientometrics literature. It is found that 194 (1.17%) citation belong to >1-year old publication and a big number of total citation that is 7250 (43.88%) fall between 1 to 5 year of age.

Table 5.2.10 also reveals a fact that the age of citation which falls between >1to5 years, are approximately 45% of the total citations. This percentage represents the value of Price's Index (PI) for citations in *Scientometrics*. Price argued that this percentage could be used to determine the archival or research front of a journal, institution, author, a single paper, etc. (Price, 1970 as cited in Al-Qallaf, 2003)

5.2.1.6 Origin Country of Cited Resources

One of the important characteristics of cited items is its origin place. Table 5.2.11 shows the citation distribution based on its origin country. Total 65 countries cover the 16551 citations of 16627 and the countries of rest 76 citations could not be determine due to unavailability of data. The table depicts that the United States with 5639 (33.91%) citations, Netherlands with 4552 (27.38%) citations and United Kingdom with

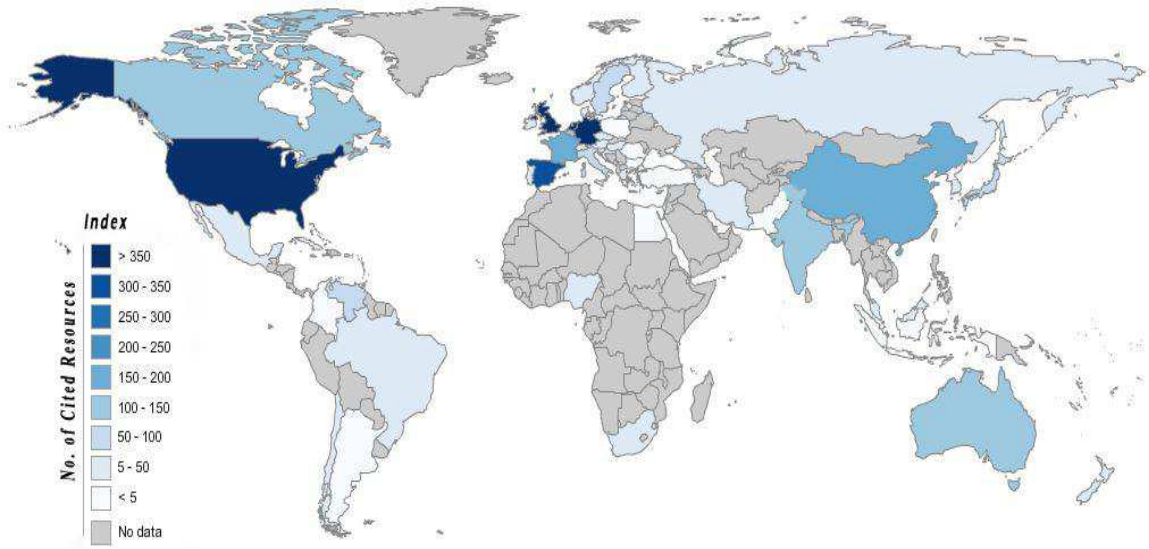

Figure 5.2.2: Geographical distribution of cited resources in *Scientometrics*

Data Source: *Primary data,* ***Source of Map:*** *StatMap*

3837 (23.08%) citations, all together account for 84% of citations. Other European countries like Germany, Spain, France, Belgium, Canada, Sweden, Venezuela and Italy contribute a small number of 1632 (9.81%) citations. In the Asia, China, India and Japan added 154 (0.93%), 126 (0.76%) and 59 (0.35%) citations respectively. This confirms that European countries have dominance on this subject. It can also be observed from Figure 5.2.2 that the four countries USA, UK, Netherlands and Germany are very active in this area.

Table 5.2.11: Distribution of cited resources by country in *Scientometrics*

S. No.	Country		Citation			
	Name	Rank	No.	Cum. No.	%	Cum. %
1	USA	1	5639	5639	33.91	33.91
2	Netherlands	2	4552	10191	27.38	61.29
3	UK	3	3837	14028	23.08	84.37
4	Germany	4	530	14558	3.19	87.56
5	Spain	5	345	14903	2.07	89.63
6	France	6	197	15100	1.18	90.82
7	China	7	154	15254	0.93	91.74
8	India	8	126	15380	0.76	92.50
9	Belgium	9	114	15494	0.69	93.19
10	Canada	9	114	15608	0.69	93.87
11	Australia	10	110	15718	0.66	94.53
12	Sweden	11	98	15816	0.59	95.12
13	Venezuela	12	74	15890	0.45	95.57
14	Japan	13	59	15949	0.35	95.92
15	Italy	14	50	15999	0.30	96.22
16	Luxembourg	15	47	16046	0.28	96.51
17	Switzerland	16	46	16092	0.28	96.78
18	Brazil	17	45	16137	0.27	97.05
19	Austria	18	38	16175	0.23	97.28
20	New Zealand	19	35	16210	0.21	97.49
21	Other	20-37	341	16551	2.05	99.54
	Missing	-	76	16627	0.46	100.00
Total			16627		100	

Data Source: *Primary data*

5.2.1.7 Languages of Cited Resources

It can be noticed from Table 5.2.12, the English language's publications have dominated a majority of citations in this study. A total of 16009 references out of 16627 are in English language and the rest citations are published in other 19 languages. References in English languages are account for 16009 (96.28%) citations. After English, Spanish, German, French

and Portuguese contributed 195 (1.17%), 173 (1.04%), 75 (0.45%) and 28 (0.17%) citations respectively.

Table 5.2.12: Distribution of cited resources by language (*Scientometrics*)

S. No.	Language	Cited Resource			
		No.	Cum. No.	%	Cum. %
1	English	16009	16009	96.28	96.28
2	Spanish	195	16204	1.17	97.46
3	German	173	16377	1.04	98.50
4	French	75	16452	0.45	98.95
5	Portuguese	28	16480	0.17	99.12
6	Italian	25	16505	0.15	99.27
7	Dutch	23	16528	0.14	99.40
8	Chinese	22	16550	0.13	99.54
9	Russian	18	16568	0.11	99.65
10	Croatian	12	16580	0.07	99.72
11	Catalan	9	16589	0.05	99.77
12	Swedish	9	16598	0.05	99.83
13	Persian	7	16605	0.04	99.87
14	Japanese	5	16610	0.03	99.90
15	Danish	4	16614	0.02	99.92
16	Galician	3	16617	0.02	99.94
17	Romania	3	16620	0.02	99.96
18	Solvenian	3	16623	0.02	99.98
19	Bosnian	2	16625	0.01	99.99
20	Turkish	2	16627	0.01	100.00
	Total	16627		100	

Data Source: *Primary data*

The above mentioned four languages cumulatively account for very low degree of 471 (2.83%) citations only. From Asia, Chinese and Japanese languages both contributed only 27 (0.16%) citations. The reason behind the overwhelming majority of English citations is the worldwide use of English language as a means of scholarly communications.

5.2.2 D-Lib Magazine

This section analyses the data of cited resources appended to the articles of *D-Lib Magazine* published during the framed period (year 2001-2010) for the study. There is a total of 5442 cited resources that have been collected from 403 articles. The different bibliographical components have been analysed as follows:

5.2.2.1 Types of Cited Resources

This section throws light on the statistics of the types of cited resources. All collected cited resources are broadly categorized into two− Print-resources, and E-resources. Table 5.2.13

shows that 39.60% of the total citations are print-resources while 60% citations comes from e-resources. This shows the better use of electronic resource in field of Digital library.

Table 5.2.13: Types of cited resources of *D-Lib Magazine*

S. No.	Types of Resources	Number of Citations	Percentage of Citation
1	Print Resources	2155	39.60
2	E-Resources	3287	60.40
	Total	5442	100

Data Source: *Primary data*

Table 5.2.14 presents a breakdown of Table 5.2.13 by the numbers and percentage of citation according to the forms of printed and electronic literature. The table shows that Web resources constitute the largest category among the different forms of resources. Out of the 5442 cited resources, 2312 resources are from web resources that is 42.48% of total cited resources. In this phenomena, a total of 1450 (28.30%) literature are cited from journals followed by 638 (11.72%) citations from Proceedings, 474 (8.17%) citations from Books and 193 (3.55%) citations from Reports and so on.

Table 5.2.14: Forms of cited resources of *D-Lib Magazine*

S. No.	Forms of Resources	Number of Citations	Percentage of Citation
1	Journal	1540	28.30
2	Book	474	8.71
3	Proceeding	638	11.72
4	Web Resource	2312	42.48
5	Report	193	3.55
6	Reference Book	22	0.40
7	Magazine	16	0.29
8	Dissertation	24	0.44
	Other	223	4.10
	Total	5442	100

Data Source: *Primary data*

A large proportion of web resource that is 70.34% of electronic resources shows the authenticity of information available on web resources for Digital Library research. The citations in *D-Lib Magazine*'s publication are highly concentrated in Web resources, Journals, Proceeding, and Book. There is a very low dispersion of citations among the rest categories that collectively comprise only 8.78% of the total citations.

5.2.2.2 Subject of Cited Resources

The macro-analysis of the subject of 5442 citations framed a subject profile of cited resources in Table 5.2.15. All citations were categorized into seventeen subjects. Table 5.2.15 reveals

that resources related to Digital library are the most used recourse that comprised of 972 (17.86%) citations. The subject Library management got 586 (10.77%) citation followed by, Internet 558 (13.43%), Digital archives & preservation 439 (8.07%), Electronic publication 433 (8.0%), Information technology 425 (7.81%), and Metadata 406 (7.46%) citations. The above mentioned seven subjects aggregately consist of 70.18% of total citations. The rest eleven subjects including Others received only 29.82% citations.

Table 5.2.15 also reveals the number of citation of different forms of cited resources in different subject category. In reference to Web resources, it accumulated highest number of citations. 362 (15.66%) citations' subject of the Web resources come under the subject Digital library, 283 (12.24%) citations come under the Internet, 266 (11.51%) citations come under the Metadata, 226 (9.78%) citations come under the Library management, 204 (8.82%) citations come under the Data archives & preservation, and 182 (7.87%) citations come under the Information technology. Thus, these subjects altogether produced 65.87% citation to Web resource and the rest eleven subjects bring 34.13% of total citation.

Of the 1540 cited resources that categorised under the Journals, (72.21%) resources are classed under the top seven subject headings Digital library, Electronic publication, Library Management, Internet, Information technology, Repository, Digital archives & preservation, Metadata, which consists of 302 (19.61)%, 175 (11.36%), 167 (10.84%), 193 (9.03%), 188 (7.66%), 107 (6.96%) 104 (6.75), and 63 (4.09%) resources correspondingly (see Table 5.2.15).

There are 744 citations to Proceeding, of the citations, 57.21 % citation concentrated in four subjects (Digital library, Internet, Digital archives & preservation, and Information technology in descending order) and rest 42.79% citation of proceedings are concentrated in 15 subjects including Others.

In reference to the Book, the highest number of citations 72 (15.19%) fell in the subject Library management followed by 63 (13.29%) citations in Digital Library, 50 (10.55%) citations in Electronic publication, 41 (8.65%) citations Information technology and 40 (8.44%) citations in Computer science, altogether these five subjects represent 56.12% citation of total citations of the Book. The rest 43.88% of citation are dispersed among the rest 13 subjects including others.

Table 5.2.15: Distribution of cited resources of *D-Lib Magazine* by subject

S. No.	Subject	Citation to Journal		Citation to Book		Citation to Web source		Citation to Proceeding		Citation to Report		Citation to Reference Book		Citation to Magazine		Citation to Dissertation		Citation to others		Total No. of Citation	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	Digital Library	302	19.61	63	13.29	362	15.66	174	27.27	34	17.62	3	13.64	2	12.50	5	20.83	27	12.10	972	17.86
2	Internet	139	9.03	23	4.85	283	12.24	79	12.38	7	3.63	1	4.55	1	6.25	1	4.17	24	10.8	558	10.25
3	Library Management	167	10.84	72	15.19	226	9.78	50	7.84	21	10.88	1	4.55	2	12.50	3	12.50	44	19.7	586	10.77
4	Electronic Publication	175	11.36	50	10.55	136	5.88	22	3.45	18	9.33	2	9.09	1	6.25	2	8.33	27	12.1	433	7.96
5	Metadata	63	4.09	18	3.80	266	11.51	35	5.49	11	5.70	0	0.00	0	0.00	0	0.00	13	5.8	406	7.46
6	Repository	107	6.95	15	3.16	98	4.24	28	4.39	21	10.88	1	4.55	0	0.00	0	0.00	16	7.2	286	5.26
7	Digital Archive & Preservation	104	6.75	29	6.12	204	8.82	60	9.40	23	11.92	2	9.09	2	12.50	1	4.17	14	6.3	439	8.07
8	Information Technology	118	7.66	41	8.65	182	7.87	52	8.15	13	6.74	1	4.55	2	12.50	3	12.50	13	5.8	425	7.81
9	Computer Science	42	2.73	40	8.44	56	2.42	35	5.49	5	2.59	0	0.00	0	0.00	3	12.50	7	3.1	188	3.45
10	Database	22	1.43	6	1.27	63	2.72	6	0.94	7	3.63	0	0.00	0	0.00	0	0.00	2	0.9	106	1.95
11	Data Mining	27	1.75	16	3.38	30	1.30	18	2.82	3	1.55	1	4.55	0	0.00	2	8.33	3	1.3	100	1.84
12	Interoperability	43	2.79	2	0.42	38	1.64	12	1.88	2	1.04	0	0.00	0	0.00	0	0.00	2	0.9	99	1.82
13	Copyright	31	2.01	8	1.69	34	1.47	12	1.88	4	2.07	1	4.55	0	0.00	2	8.33	5	2.2	97	1.78
14	User study	42	2.73	18	3.80	18	0.78	7	1.10	6	3.11	1	4.55	0	0.00	1	4.17	1	0.4	94	1.73
15	Bibliometric study	64	4.16	6	1.27	15	0.65	9	1.41	0	0.00	0	0.00	0	0.00	0	0.00	0	0.0	94	1.73
16	Social Network	18	1.17	0	0.00	48	2.08	16	2.51	0	0.00	0	0.00	0	0.00	0	0.00	5	2.2	87	1.60
17	Open Access Initiative	28	1.82	2	0.42	21	0.91	5	0.78	0	0.00	1	4.55	0	0.00	1	4.17	1	0.4	59	1.08
	Other	48	3.12	65	13.71	232	10.03	18	2.82	18	9.33	7	31.82	6	37.50	0	0.00	19	8.5	413	7.59
	Total	1540	100	474	100	2312	100	638	100	193	100	22	100	16	100	24	100	223	100.0	5442	100

Data Source: *Primary data*

In case of Report, most of the citations are concentrated in the subject Digital Library, Digital archives & preservation, Repository, Library management, Electronic publication which comprises of 34 (17.62%), 23 (11.92%), 21 (10.88%), 21 (10.88%), 18 (9.33%) citations respectively. These six subject groups produced 62.62% citation of total citation to report, aggregately.

There are 24 citations to Dissertation and these citations are concentrated in eleven subjects only. Of which, 58.33% citations are concentrated on the topic of Digital library, Library management, Computer science, and Information technology.

Reference book has 22 citations, of which, 31.8% citations are accumulated in Others group. There are only 11 subjects that have citations from Reference Book. The subject Digital library has 3 citations and most of the subject has one citation only.

In term of citation to Magazine, It has lowest number of citations in this phenomenon. Eleven subjects of 17 have no citation. The subject Digital library, Library management, Digital archives & technology, and Information technology each has two citations while internet, and Electronic publication each has only one citation.

Regardless of the forms of resources, Table 5.2.15 also shows that the subject Digital library, Library management, Internet, Digital archives & preservation, and Electronic publication acquire more number of citations relatively. These five subjects together produce 54.91% citations. The rest twelve subjects have 44.09% citations.

5.2.2.3 Dispersion of Cited Journals

This section presents the dispersion of journals' title that has been cited in *D-Lib Magazine*. There are total of 335 journals during the period 2001-2010, which attracted the attention of scholars to complete their articles that published under the umbrella of *D-Lib Magazine*. These 335 Journals got total 1540 citations in *D-Lib Magazine*.

Law of Bradford

As mention in the previous section (see 5.2.1.3), to satisfy Bradford's law, the number of journals of each zone should follow the mathematical expression of 1: n: n^2: n^3: n^4: n^5 …. **::** A: B: C: D: E: F….

Where, 1 is a nucleus value. Hence, a multiplier value can be calculated as follows:

The value of 1st Zone multiplier is Nil.

The value of 2nd Zone multiplier is B/A

The value of 3nd Zone multiplier is C/B

Table 5.2.16: Dispersion of cited journals and citations of *D-Lib Magazine*

Rank	Journal's title			Citation	
	No.	Cum. No. (a)	log of a	No.	Cum. No.
r1	1	1	0.00	448	448
r2	1	2	0.69	70	518
r3	1	3	1.10	46	564
r4	2	5	1.61	50	589
r5	2	7	1.95	46	635
r6	1	8	2.08	18	653
r7	2	10	2.30	34	687
r8	1	11	2.40	14	701
r9	2	13	2.56	24	725
r10	4	17	2.83	44	769
r11	6	23	3.14	60	829
r12	2	25	3.22	18	847
r13	6	31	3.43	48	895
r14	6	37	3.61	42	937
r15	6	43	3.76	36	973
r16	13	56	4.03	65	1038
r17	27	83	4.42	108	1146
r18	50	133	4.89	150	1296
r19	42	175	5.16	84	1380
r20	160	335	5.81	160	1540

Data Source: *Primary data*

Table 5.2.16 shows the productivity of journals in descending order and the derived data in the table has been used to plot dispersion of cited journals and citations. The data were framed into three zones which are presented in Table 5.2.17. Each zone represents Bradford expression as 3:53:279.

Table 5.2.17: Dispersion of journals and citation in Bradford's zone

Zone	Cited Journals		Citations		Multiplier
	No.	%	No.	%	
1st	2	0.60	518	33.64	NIL
2nd	53	15.87	520	33.77	26.50
3rd	279	83.53	502	32.60	5.26
Total	334	100	1540	100	15.88*

Data Source: *Primary data*

Note: **Mean value of Multiplier*

In reference to the data presented in Table 5.2.17:

No. of Journal in Nucleus Zone 1st zone = 2

Mean value of Multiplier (n) = 11.47

Then, it can be expressed as:

$$2 : 53 : 279 :: 1 : n : n^2$$

$$2 : (2 \times 15.88) : (2 \times 15.88^2) \Rightarrow 538.11$$

The number 538.11 is greater than original number of total cited journals that is 334.

$$\text{So,} \qquad \text{Percentage Error} = \frac{|334 - 538.11|}{334} \times 100$$

$$= 61.11\%$$

The percentage error that is 61.11% is too high to accept. Hence, it can be stated that data of *D-Lib Magazine* cited literatures does not fit in Bradford's Law. The graphical representation of dispersion of data is illustrated in Figure 5.2.3. It also shows that the curve does not show the well known shape (*J*) of Bradford's law.

In this study, a nucleus of two Journals was found that contributed approximately one third of the total Journals' citation.

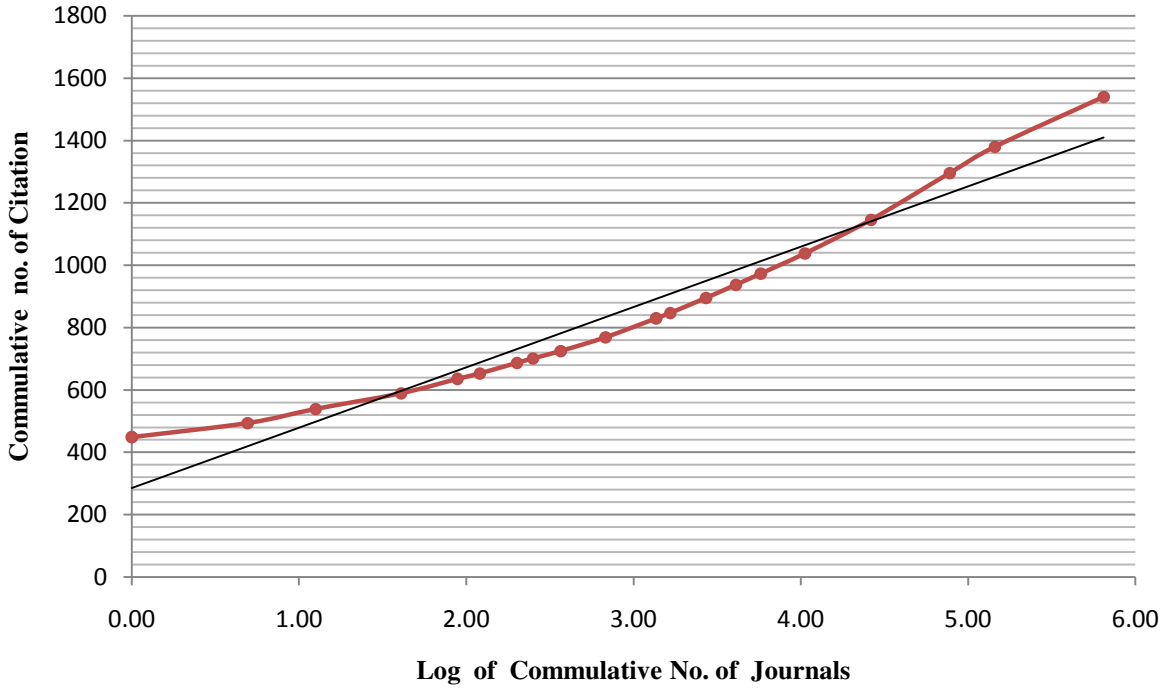

Figure 5.2.3 Dispersion of cited journals and citations in *D-Lib Magazine*

Table 5.2.18 lists top fifteen frequently cited journals in descending order (see Table C2 of Appendix C) with regards to the number of their references that appended in articles of *D-Lib Magazine*. It shows that the most productive journals is *D-Lib Magazine* in this phenomenon

followed by *Journal of the American Society for Information Science and Technology*, *Communications of the ACM*, *Library Hi Tech*, *College & Research Libraries*, *Library Trends*, *First Monday*, *Information Processing & Management*, and *Library Journal*. Table 5.2.18 also throws light on the authors' tendency to cite articles appeared in well-established journal. It is worthwhile to mention that *D-Lib Magazine* itself contributed a great number of citations; it clearly indicates that *D-lib Magazine* is a renounced journal in this field and playing an important role.

Table 5.2.18: Most frequently cited journals (Titles of Zone 1 & 2) in *D-Lib Magazine*

S. No.	Journal			Citation		
	Tile	Country	Rank	No.	Cum. No.	Cum. %
1	D-Lib Magazine	US	1	448	448	29.09
2	Journal of the American Society for Information Science and Technology	US	2	70	518	33.64
3	Communications of the ACM	US	3	46	564	36.62
4	Library Hi Tech.	US	4	25	589	38.25
5	College & Research Libraries	US	5	23	612	39.74
6	Library Trends	US	5	23	635	41.23
7	First Monday	US	6	18	653	42.40
8	Information Processing & Management	UK	7	17	670	43.51
9	Library Journal	US	7	17	687	44.61
10	International Journal on Digital Libraries	Germany	8	14	701	45.52
11	Journal of Information Services & Use	N. Zealand	9	12	713	46.30
12	Serials Review	UK	9	12	725	47.08
13	Information Technology & Libraries	US	10	11	736	47.79
14	Journal of Academic Librarianship	UK	10	11	747	48.51
15	Journal of Digital Information	UK	10	11	758	49.22

Data Source: *Primary data*

5.2.2.4 Characteristics of Cited Authors

This section describes the authorship pattern of cited resources. There are 5 (0.09%) resources that are anonymous (see Table 5.2.21). There are 4732 unique authors consist of primary authors, co-authors, and corporate bodies who contributed 5442 citations during the period (2001-2010). The majority, 2642 (44.16%) authors have contributed only one citation. The most prolific author 'Van De Sompel, H' has been cited 73 times as primary author (see Table 5.2.19) and has been cited 45 times as co-authors (see Table 5.2.20).

Table 5.2.19: Most frequently cited primary authors in *D-Lib Magazine*

Rank	Name	No. of Citation
1	Van De Sompel, H	73
2	Lagoze, C.	45
3	Tenopir, C.	34
4	Lynch, C.	29
5	King, D.W.	25
6	Harnad, S.	23
7	Kahn, R.	18
8	Hammond, T.	17
9	Arms, William Y.	16
9	Witten, Ian H.	16
10	Borgman, C. L.	15
10	Payette, S.	15
11	Powell, A.	14
11	Bekaert, J.	14
11	Lawrence, S.	14

Data Source: *Primary data*

The distribution of authorship pattern of cited resources in *D-Lib Magazine* are shown in Table 5.2.20. The table shows that Single authored and two authored resources together contributed 50.07% citation, out of them single (sole) authored resources had a large proportion of 34.77% of total citation and two authored papers account for 15.31 %. Three authored resources contributed 7.20% of total citations. There were 237 references which used 'et.al.' for co-authors that have been counted under the category of four authored article. There were 611 (11.23%) resources that were authored by four or more than four authors. These statistics reveals that the majority of

cited resources are authored by sole author. Table 5.2.20 also shows that a proportion of 31.40% of cited resources belong to corporate body. Most of the corporate body belongs to the resources which are categorized under the web resources.

Table 5.2.20: Most frequently cited co-author authors in *D-Lib Magazine*

Rank	Name	No. of Citation
1	Van De Sompel, H.	45
2	King, D. W.	44
3	Lagoze, C.	33
4	Hochstenbach, P.	28
5	Nelson, Michael L.	27
5	Warner, S.	27
6	Wilensky, R.	21
7	Beit-arie, O.	20
8	Liu, X	14
9	Blanchi, C.	11
9	Dushay, N.	11
9	Maly, K	11
9	Hannay, T.	11
9	Payette, S.	11
10	Bainbridge, B.	10

Data Source: *Primary data*

Table 5.2.21: Authorship of cited resources in *D-Lib Magazine*

S. No.	Authorship	Cited Resources	
		No.	%
1	One	1892	34.77
2	Two	833	15.31
3	Three	392	7.20
4	Four	365	6.71
5	Five	97	1.78
6	Six	55	1.01
7	More than six	94	1.73
8	Corporate bodies	1709	31.40
9	Anonymous	5	0.09
	Total	5442	100

Data Source: *Primary data*

5.2.2.5 Age of Cited Resources

Table 5.2.22 shows that the age of 4094 cited resources of 5442 cited resources could be determined only. As the publication dates of other 1348 (24.55%) citations were missing. The age of citations ranges from < 1 to 194 years. The citations which are more than 50 years old contributed only 0.22% of the total.

The data of Table 5.2.22 reveals that the number of citations for the most recent literature (5 years old or less) is 61.74%, this reflects a typical pattern of cited literature in *D-Lib Magazine*. It is found that 714 (13.16%) citations age are <1 year old and a big number of total citation that is 2636 (48.58%) fall between 1 to 5 year of age.

Table 5.2.22: Age of the cited resources in *D-Lib Magazine*

Age (Year)	Citation			
	No.	Cum. No.	%	Cum. %
< 1	714	714	13.12	13.12
1-5	2636	3350	48.44	61.56
6-10	489	3839	8.99	70.54
11-15	109	3948	2.00	72.55
16-20	55	4003	1.01	73.56
21-25	27	4030	0.50	74.05
26-30	21	4051	0.39	74.44
31-35	10	4061	0.18	74.62
36-40	9	4070	0.17	74.79
41-45	6	4076	0.11	74.90
46-50	6	4082	0.11	75.01
>50	12	4094	0.22	75.23
Missing	1348	5442	24.77	100.00

Data Source: *Primary data*

Table 5.2.22 also reveals a fact that the age of citation which falls between >1to5 years, are approximately 62 percent of the total citations. This percentage represents the value of Price's Index (PI) for citations in *D-Lib Magazine* and it could be used to determine the archival or research front of a journal, institution, author, a single paper, etc (Price, 1970 as cited in Al-Qallaf, 2003).

5.2.2.6 Origin Country of Cited Resources

Table 5.2.23 recorded the distribution of citations based on its origin country. Total 59 counties that cover the 5221 citations of 5442, and the countries of rest 221 citations could not be determined due to unavailability of data. The table depicts that the United States alone covered the highest number 3471 (63.97%) of citations followed by the United Kingdom with 669 (12.29%), Germany with 221 (4.06%), Netherlands with 119 (2.19%), and Australia with 101 (1.86%) citations. These five countries together produce 84.43% of total citation.

Table 5.2.23: Distribution of cited resources of *D-Lib Magazine* by country

S. No.	Country		Citation			
	Name	Rank	No.	Cum. No.	%	Cum. %
1	USA	1	3471	3471	63.78	63.97
2	UK	2	669	4140	12.29	76.30
3	Germany	3	221	4361	4.06	80.37
4	Netherlands	4	119	4480	2.19	82.57
5	Australia	5	101	4581	1.86	84.43
6	Canada	6	77	4658	1.41	85.85
7	Korea, Republic	7	68	4726	1.25	87.10
8	New Zealand	8	41	4767	0.75	87.85
9	Italy	9	40	4807	0.74	88.59
10	Switzerland	9	40	4847	0.74	89.33
11	Japan	10	34	4881	0.62	89.96
12	China	11	27	4908	0.50	90.45
13	Belgium	12	26	4934	0.48	90.93
14	France	12	26	4960	0.48	91.41
15	Spain	12	26	4986	0.48	91.89
16	Sweden	13	25	5011	0.46	92.35
17	Portugal	14	17	5028	0.31	92.66
18	Greece	15	16	5044	0.29	92.96
19	Austria	16	14	5058	0.26	93.22
20	Ireland	16	14	5072	0.26	93.48
21	Brazil	17	13	5085	0.24	93.72
22	India	18	11	5096	0.20	93.92
23	Other	18-27	125	5221	2.30	96.22
	Missing	-	221	5442	4.06	100
	Total		5442		100	

Data Source: *Primary data*

Other European countries such as Canada, Italy, Switzerland, Belgium, France, Spain, Sweden, Portugal, Greece, and Austria contributed 375 citations aggregately i.e. 4.70% of total citation. While Asian countries, Japan, China and India added 72 (1.32%) citations only. This confirms that European countries have dominance on this subject. It can also be observed from Figure 5.2.4 that the five countries USA, UK, Germany, Netherlands and Australia are very active in this filed.

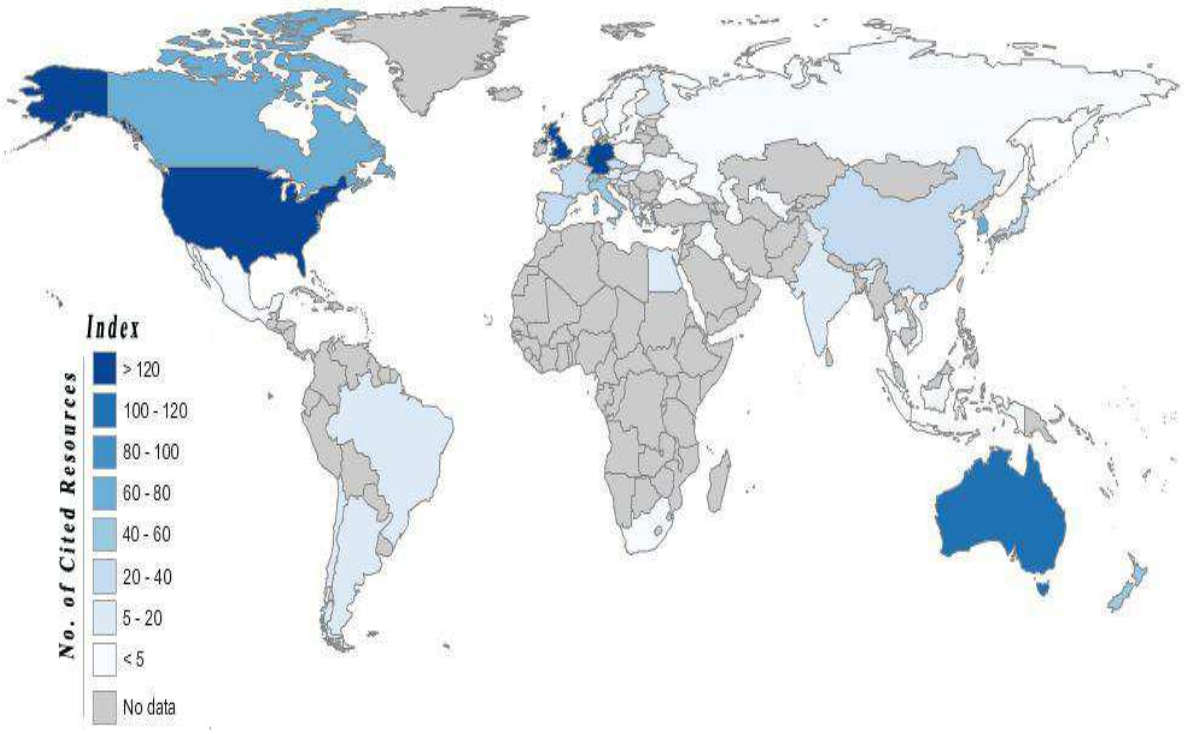

Figure 5.2.4: Geographical distribution of cited resources in *D-Lib Magazine*

Data Source: *Primary data* ***Source of Map****: StatMap.*

5.2.2.7 Languages of Cited Resources

It can be noticed from Table 5.2.24 that the cited resources in *D-Lib Magazine* during the year 2001-2010 were in 21 languages. English language's publications have dominated a majority of citations in this study. A total of 5388 out of 5442 cited resource are in English language. The rest 54 citations are published in 20 languages. The references appended to articles of *D-Lib Magazine* in English languages are account for 99.01% citations.

After English language, Spanish, Dutch, Germen and Portuguese language contributed 14 (0.26%), 8 (0.15%), 7 (0.13%) and 6 (0.11%) citations respectively. These four languages cumulatively accounted for 35 (0.64%) citations only. From Asia, only Japanese languages contributed only one citation.

Table 5.2.24: Distribution of cited resources of *D-Lib Magazine* by language

S. No.	Language	Cited Resources			
		No.	Cum. No.	%	Cum. %
1	English	5388	5388	99.01	99.01
2	Spanish	14	5402	0.26	99.26
3	Dutch	8	5410	0.15	99.41
4	German	7	5417	0.13	99.54
5	Portuguese	6	5423	0.11	99.65
6	Polish	3	5426	0.06	99.71
7	Catalan	2	5428	0.04	99.74
8	Italian	2	5430	0.04	99.78
9	Danish	1	5431	0.02	99.80
10	Estonian	1	5432	0.02	99.82
11	Filipino	1	5433	0.02	99.83
12	Hungarian	1	5434	0.02	99.85
13	Japanese	1	5435	0.02	99.87
14	Kurdish	1	5436	0.02	99.89
15	Latin	1	5437	0.02	99.91
16	Luxembourgish	1	5438	0.02	99.93
17	Malagasy	1	5439	0.02	99.94
18	Swedish	1	5440	0.02	99.96
19	Western Frisian	1	5441	0.02	99.98
20	Zulu	1	5442	0.02	100.00
	Total	5442		100	

Data Source: *Primary data*

5.3 Authorship Pattern and Collaborative Trend

Authorship pattern and collaboration is an important aspect of the bibliometric study. The study of authorship pattern deals with the number of authors of published article and of collaboration identifies the nature and measures the degree of collaboration existing among the authors who contributed his/her work to a journal.

5.3.1 Scientometrics (Journal)

A total of 1241 articles were selected for study from *Scientometrics* journal that had 1747 unique authors. These authors occurred 2908 times in selected articles during the year 2001-2010.

5.3.1.1 Distribution of Articles

Table 5.3.1 presents year-wise distribution of articles published in *Scientometrics*. The data of Table 5.3.1 reveals that there are a total of 1241 articles in *Scientometrics* journal that have been considered for the study.

Table 5.3.1: Distribution of articles of *Scientometrics*

Years	Articles	
	No.	%
2001	88	7.07
2002	80	6.43
2003	82	6.59
2004	87	6.99
2005	92	7.39
2006	147	11.81
2007	123	10.20
2008	128	10.28
2009	188	15.10
2010	226	18.15
Overall (2001-2010)	1241	100

Data Source: *Primary data*

The lowest number of articles i.e. 88 (7.1%) published in the first year 2001 and the highest number of articles i.e. 226 (18.2%) published in the year 2010. The volume of articles published in *Scientometrics* increased consistently from the period 2001 to 2010 (see Figure 5.3.1) excluding the year 2002 and 2007. An evidence of highest growth was found in year 2006 (see Figure 5.3.1). The uptrend line can be seen in Figure 5.3.1 that shows the positive growth in the publications.

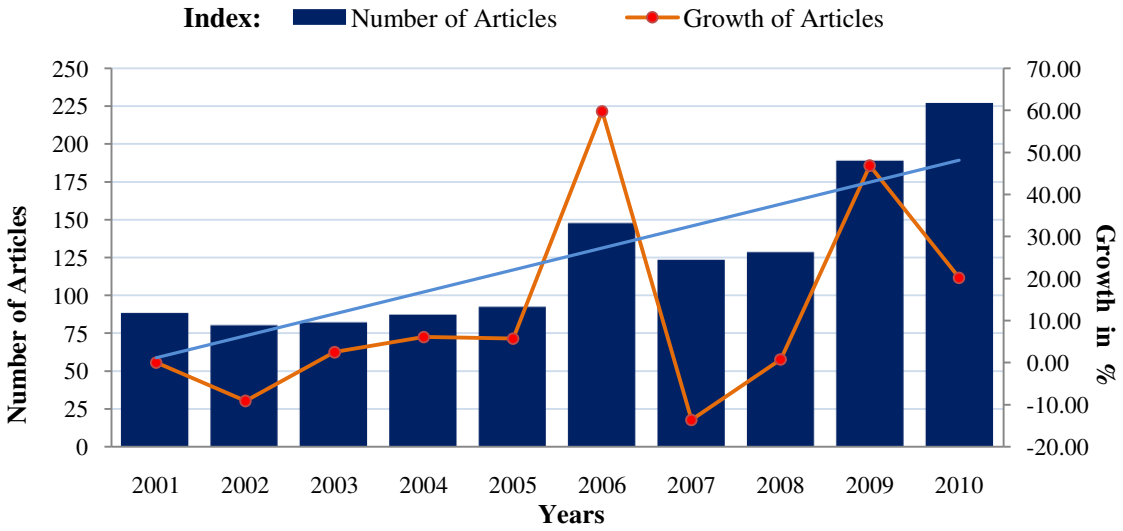

Figure 5.3.1: Articles groth in Scientometrics (2001-2010)

Data Source: *Primary data*

5.3.1.2 Authorship Pattern

The authorship data related to *Scientometrics* are presented in Table 5.3.2. The data have been analysed to understand the contribution of a single authored article and multi authored articles. It can be observed from Table 5.3.2 that most of the articles were contributed by more than one authors during different time segments of the period 2001-2010. In all, approximately 70% of the articles were written by more than one author, and the single author contributions were only 30%.

Table 5.3.2: Authorship pattern in *Scientometrics*

Author	Articles							
	2001-2004		2005-2007		2008-2010		2001-2010	
	No.	%	No.	%	No.	%	No.	%
Single Author	119	36.84	107	29.56	152	28.04	378	30.46
Two Authors	114	35.29	101	27.90	188	34.69	403	32.47
Three Authors	64	19.81	86	23.76	117	21.59	267	21.51
Four Authors	26	8.05	44	12.15	47	8.67	117	9.43
≥ Five Authors	14	4.34	24	6.63	38	7.01	76	6.13
Total	337	100	362	100	542	100	1241	100

Data Source: *Primary data*

Table 5.3.2 also reveals that in the period 2001-2004 and 2005-2007, the number of single authored article roused up slightly in comparison to two authored articles. However, it declined in the period 2008-2010. Overall, the table shows the number of two authored articles is 403 (32.47%) which is higher than single authored articles that is 378 (30.46%) during the period 2001-2010.

A close view of Figure 5.3.2 reveals that during the period 2001-2010 the highest numbers of articles are contributed by two authors followed by single authored and three authored articles. The rest 193 (15.56%) articles were written by more than three authors. Out of multiple authored articles, 117 (9.43%) articles, 76 (3.95%) articles, 13 (1.05%) articles and 14 (1.13%) articles contributed by four authors, five and more than five authors respectively. One of the articles has been contributed by 23 authors in 2005; it is an article during the time span that has the highest number of author. The title of the article is "*Science and technology in the region: The output of regional science and technology, its strengths and its leading institutions*".

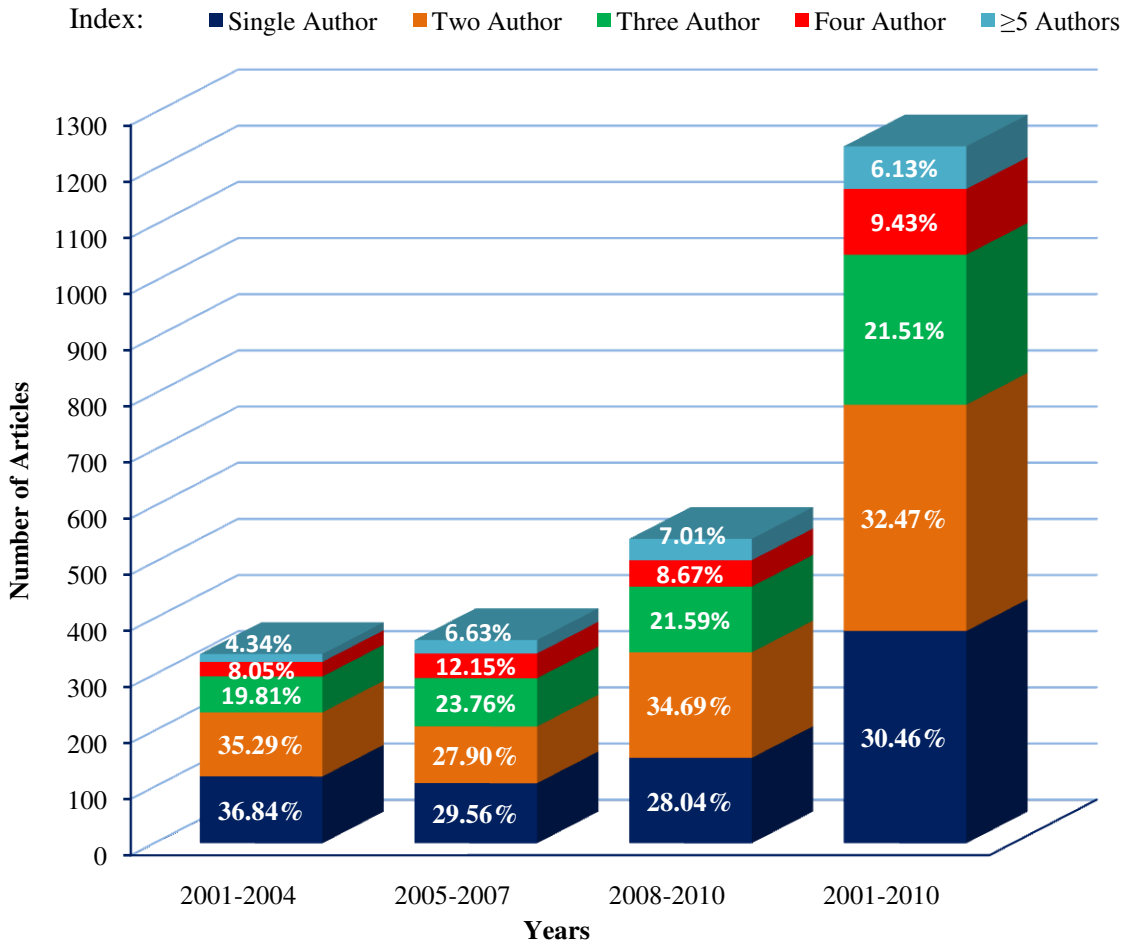

Figure 5.3.2: Authorship pattern in *Scientometrics* (2001-2010)

Data Source: *Primary data*

5.3.1.3 Degree of Collaboration Index

Table 5.3.3 represents collaboration index of *Scientometrics* journal for the period 2001-2010. Collaboration index calculates the average number of authors per co-authored article (see page no. 14 section 1.3.4.3) in a given period.

Table 5.3.3: Degree of collaboration index in *Scientometrics*

Periods(in year)	Articles	Co- Authored Articles		Co-authors		Collaboration Index (CI)
		No.	%*	No.	%**	
2001-2004	337	218	64.69	607	83.72	2.78
2005-2007	362	255	70.44	788	88.24	3.09
2008-2010	542	390	71.96	1134	88.39	2.91
Overall (2001-2010)	1241	863	69.54	2529	86.97	2.90

Data Source: *Primary data*

*$(No.of\ Co-authored\ Article\ in\ a\ period/Total\ articles\ in\ a\ period) * 100$

**$(No.of\ Co-authors\ \ in\ a\ period/Total\ \ Authors\ \ in\ a\ period) * 100$

Table 5.3.3 shows that the number of co-authored articles and number of co-author both increased consistently during the year 2001-2010. The collaboration index ranges between 2.7 and 3.08. The value of collaboration index of the year 2005-2007 is the highest and the lowest value has been seen during the period 2001-2004. Overall, during the period 2001-2010, The Collaboration Index value is 2.90 which indicates that the most of the research team (a group of authors) in *Scientometrics* has 2 to 3 authors only.

5.3.1.4 Collaboration Strength between Authors

Data pertaining to collaboration strength among authors and author per article of *Scientometrics* journal are tabulated in Table 5.3.4. Collaboration coefficient is calculated to measure the strength in a particular period. It can be observed from Table 5.3.4 that the number of authors per article during the period 2005-2007 was 2.46 which was slightly higher than the number of author per article for the period 2008-2010. The period 2001-2005 has minimum number authors (2.15) per article. Overall, the average of authors per article is 2.34 for the period 2001-2010.

Table 5.3.4: Mean (μ) of authors and collaboration co-efficient (*Scientometrics)*

Periods (in years)	Author Per Article (Mean)	Collaboration Co-efficient (CC)
2001-2004	2.15	0.36
2005-2007	2.46	0.44
2008-2010	2.38	0.44
Overall (2001-10)	2.34	0.42

Data Source: *Primary data*

Table 5.3.4 also reveals that the value of collaboration co-efficient ranges from 0.36 to 0.44. The period 2005-2007 and 2008-2010 has recorded same value (0.44) for collaboration co-efficient, and authors per article of both periods are approximately equal. The period 2001-2004 has minimum collaboration co-efficient 0.36. Overall, the collaboration co-efficient is noticed 0.42 for the period 2001-2010. The value of collaboration co-efficient should fall between from 0.5 to 0.67 for better collaboration strength among authors (Ajiferuke, 1988). Hence, it should be noted that the collaboration strength among authors of *Scientometrics* journal was better during the year 2005-2007, and 2008-2010.

5.3.1.5 Authors' Collaboration

Table 5.3.5 recorded different types of collaboration which was formed under the umbrella of *Scientometrics* journal during 2001-2010. The table suggests that during the first time segment (2001-2004), 34% article were produced without any collaboration. The rest amount of the articles was written in collaboration. Most of the articles fell under Local collaboration followed by National and International collaboration.

Table 5.3.5: Authors' collaboration in *Scientometrics* (2001-2010)

Periods(in year)	Level of Collaboration							
	Local		National		International		No Collaboration	
	No.	%	No.	%	No.	%	No.	%
2001-2004	110	32.64	61	18.10	50	14.84	116	34.42
2005-2007	118	32.60	75	20.72	62	17.13	107	29.56
2008-2010	171	31.55	122	22.51	97	17.90	152	28.04
Overall (2001-2010)	399	32.15	258	20.79	209	16.84	375	30.22

Data Source: *Primary data*

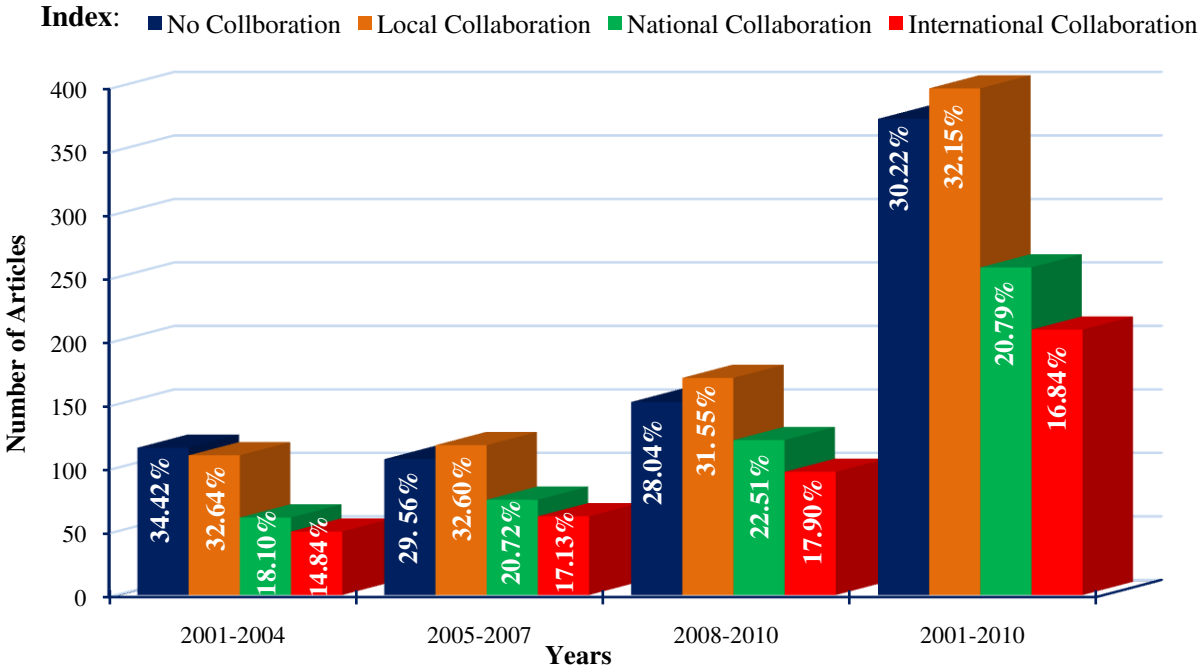

Figure 5.3.3: Authors' collaboration in *Scientometrics* (2001-2010)

Data Source: *Primary data*

During the period 2005-2007, 29% articles emerged without any collaboration with 4.86% decrement. While an increment has been noticed in the articles with National and International collaboration. The period 2008-2010 is an evident of decrease in number of articles with no collaboration (28.04%) and Local collaboration (31.55%). Overall, it can be observed that the journal *Scientometrics* is dominated by Local collaboration.

5.3.1.6 Contribution of Co-authors

Table 5.3.6 presents the data of co-authors of articles published in the journal *Scientometrics*. The table shows that there is constant growth in number of authors who are involved only once in co-authorship. The highest number of authors 783 (84.05%) involved once in co-authorship during the year 2008-2010, that is followed by the year 2005-2007 with 480 (80.00%) authors and year 2001-2004 with 332 (78.12%) authors respectively. The author's involvement frequency in co-authorship of 2008-2010 is higher in comparison to 2001-2004 and 2005-2007.

Table 5.3.6: Co-authors in Collaboration in *Scientometrics* (2001-2010)

Frequency	Article Contributors as Co-authors					
	2001-2004		2005-2007		2008-2010	
	No.	%	No.	%	No.	%
Once	332	78.12	480	80.00	738	84.05
Twice	53	12.47	89	14.83	85	9.68
Thrice	23	5.41	15	2.50	32	3.64
Four Times	5	1.18	7	1.17	10	1.14
five Times	5	1.18	3	0.50	3	0.34
Six Times	2	0.47	3	0.50	3	0.34
More than Six times	5	1.18	3	0.50	7	0.80
Author in Collaboration	425	100.00	600	100.00	878	100.00
Co-authored Articles	218	64.69	255	70.44	390	71.96
Total Articles	337		362		542	

Data Source: *Primary data*

On other hand, during 2001-2004, a total of 93 (21.88%) authors were involved in article publication more than once with others. This figure increased to 120 (20.00%) in 2005-2007 and it reached to 140 authors in the year 2008-2010. However, it was only 15.95% of authors as co-author that was the lowest in comparison to other periods. In general, it can be pointed out that most of the authors appear once as co-authors. There were more authors engaged in collaboration as co-authors in 2008-2010 compared to previous periods.

5.3.1.7 Most Productive Authors of Scientometrics

The study also identifies the most productive authors of *Scientometrics* Journal during the year 2001-2010. There are 1547 unique authors in Scientometrics. The most frequently appeared primary authors are Glanzel, W (*Wolfgang Glänzel, Katholieke University Leuven, Belgium)*

followed by Garfield, E. (*Eugene Garfield, died on 26 Feb. 2017)*, and Leydesdorff, L. *(loet leydesdorff, University of Amsterdam, Netherlands*) and so on (see Table 5.3.7)

Table 5.3.7: Most frequently appeared primary authors in *Scientometrics*

Rank	Name	Frequency
1	Glanzel, W.	25
2	Garfield,.E.	23
3	Leydesdorff, L.	12
4	Egghe, L.	11
5	Moed, H.F.	9
5	Thelwall, M.	9
5	Vanraan, A.F.J.	9
5	Meyer, M.	9
6	Schubert, A.	8
6	Braun, T.	8
7	Narin, F.	7
7	Rousseau, R.	7
7	Small, H.	7
7	Zitt, M.	7
7	Cronin, B.	7

Data Source: *Primary data*

Whereas the most productive co-author is Rousseau, R. (*Ronald Rousseau, Katholieke University Leuven, Belgium*) followed by Glanzel, W. (*Wolfgang Glänzel, Katholieke University Leuven, Belgium)*, Debackere, K (*Koenraad Debackere*, *Katholieke University Leuven, Belgium),* and so on (see Table 5.3.8)

Table 5.3.8: Most frequently appeared co- authors in *Scientometrics*

Rank	Name	Frequency
1	Rousseau, R.	20
2	Glanzel, W.	19
3	Debackere, K.	13
3	Ho, Y.P.	13
3	Thelwall, M.	13
3	Thijs, B.	13
4	Meyer, M.	11
4	Schubert, A.	11
5	Wilson, C.S.	10
6	Daniel, H.D.	8
6	Van Leeuwen, T.N.	8
7	D'Angelo, C.A.	7
7	Leydesdorff, L.	7
7	Markpin, T.	7
7	Moed, H.F.	7

Data Source: *Primary data*

5.3.2 D-Lib Magazine

A total of 403 articles (see Table 5.3.9) were selected for the study from *D-Lib Magazine*. These articles had 706 unique authors. These authors occurred 1042 times as primary authors and co-authors in these articles during the year 2001-2010.

5.3.2.1 Distribution of Articles

Table 5.3.9 presents year wise distribution of articles published in *D-Lib Magazine*. The data of Table 5.3.9 reveals that the lowest number of articles that is 29 (7.20%) published in the last year 2010 and the highest number of paper that is 54 (13.40%) published in the year 2005. After year 2005, the volume of articles published in *D-Lib Magazine* decreased consistently

Table 5.3.9: Distribution of articles of *D-Lib Magazine* (2001-2010)

Years	Articles	
	No.	%
2001	45	11.17
2002	48	11.91
2003	51	12.66
2004	40	9.93
2005	54	13.40
2006	45	11.17
2007	33	8.19
2008	27	6.70
2009	31	7.69
2010	29	7.20
Overall (2001-2010)	403	100

Data Source: *Primary data*

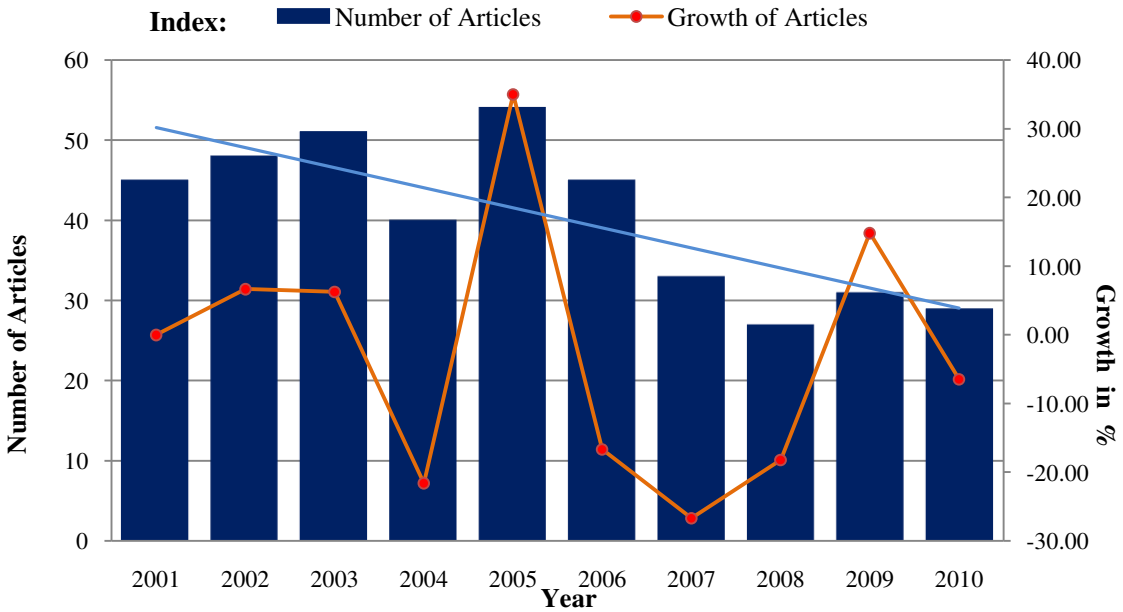

Figure 5.3.4: Articles growth in *D-Lib Magazine* (2001-2010)

Data Source: *Primary data*

from 2001 to 2005 (see Figure 5.3.4), excluding the year 2004. In the year 2004, growth declined to -21%. An evidence of highest growth (32%) was found in the year 2006 (see Figure 5.3.4). After 2005, the growth of articles decreased continually excluding year 2007 and reached to 29 articles in the year 2010. The downtrend line can be seen in Figure 5.3.4 that shows the average negative growth over the period (2001-2010).

5.3.2.2 Authorship Pattern

The authorship data related to *D-Lib Magazine* are recorded in Table 5.3.10. The data are analysed to understand the role of authorship in the publication of articles in *D-Lib Magazine* during the period 2001-2010. It can be observed from Table 5.3.10 that most of the articles were contributed by multi authors over different time segments of the period 2001-2010. During the year 2001-2010, approximately 67% articles were written by more than one author, and the single author contributions were only 32.75%, it can also be observed from Figure 5.3.5.

Table 5.3.10: Authorship pattern in *D-Lib Magazine* (2001-2010)

Authorship	Articles							
	2001-2004		2005-2007		2008-2010		2001-2010	
	No.	%	No.	%	No.	%	No.	%
Single Author	69	37.50	37	28.03	26	29.89	132	32.75
Two Authors	44	23.91	45	34.09	27	31.03	116	28.78
Three Authors	30	16.30	21	15.91	15	17.24	66	16.38
Four Authors	20	10.87	12	9.09	8	9.20	40	9.93
≥ Five Authors	21	11.41	17	12.88	11	12.65	49	12.16
Total	184	100	132	100	87	100	403	100

Data Source: *Primary data*

Table 5.1.10 also reveals that during the period 2005-2007, the number of articles under each type of authorship has decreased excluding authorship of two authors and five authors. While, in the next period (2008-2010), articles in each category of authorship have declined. The reason behind this decline was decreasing number of authors and articles over the periods (see Figure 5.3.4 and Table 5.3.10).

A gradual decrease in the number of authorship and published articles in *D-Lib Magazine* can be observed clearly from the different block of the Figure 5.3.5, over the periods. A close view of Figure 5.3.5 reveals that during the period 2001-2010 the highest numbers of articles 132

(32.75%) are contributed by Single authorship followed by two authorship and three authorship. The rest 49 (22.08%) articles were written by more than three authors. Of multiple authored articles, 40 (9.93%) articles, 49 (12.16%) articles contributed by four authors, five and more than five authors respectively.

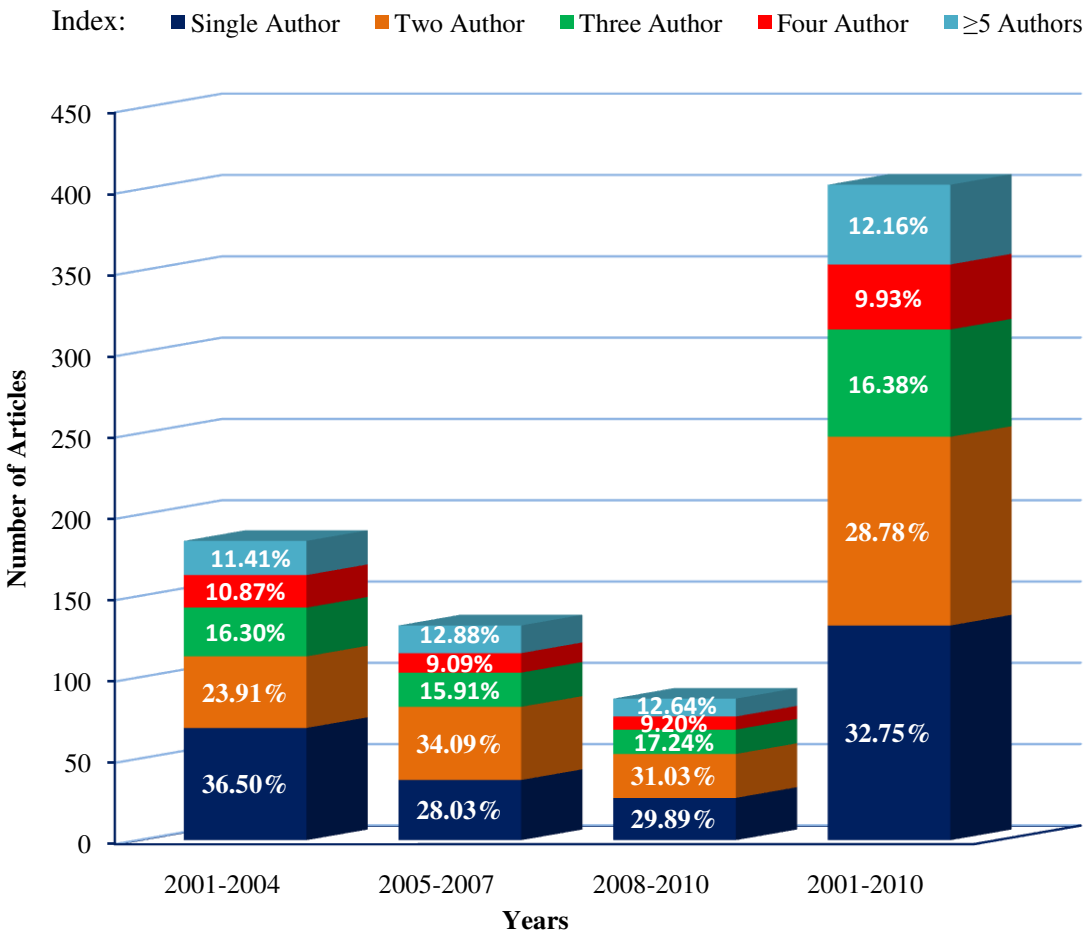

Figure 5.3.5: Authorship pattern in *D-Lib Magazine* (2001-2010)

Data Source: *Primary data*

There are two articles that were written by 13 authors that was the highest number of authors in an article during the period 2001-2010. The first article "Trends in Use of Electronic Journals in Higher Education in the UK - Views of Academic Staff and Students" published in the year 2003 and the second article "The Benefits of Integrating an Information Literacy Skills Game into Academic Coursework: A Preliminary Evaluation" published in the year 2009.

5.3.2.3 Degree of Collaboration Index

Table 5.3.11 represents collaboration index of *D-Lib Magazine* for the period 2001-2010. It can be observed from Table 5.3.11 that the number of co-authored articles and number of co-author decreased consistently during the year 2001-2010.

Here, the value of collaboration index ranges between 3.50 and 3.39. The value of collaboration index of the year 2001-2004 is the highest and the lowest value has been seen during the period 2005-2007. Over the period 2001-2010, The Collaboration Index value was 3.36 which indicate that the most of the research team (group of authors) in *D-Lib Magazine* has grouped into three.

Table 5.3.11: Degree of collaboration index in *D-Lib Magazine* (2001-2010)

Periods (in year)	Articles	Co- Authored Articles		Co-authors		Collaboration Index (CI)
		No.	%*	No.	%**	
2001-2004	184	115	62.50	402	85.35	3.50
2005-2007	132	95	71.97	301	89.05	3.17
2008-2010	87	61	70.11	207	88.84	3.39
Overall (2001-10)	403	271	67.25	910	87.33	3.36

Data Source: *Primary data*

Note: $*(No.of\ Co-authored\ Article\ in\ a\ period/Total\ articles\ in\ a\ period)*100$

$**(No.of\ Co-authors\ \ in\ a\ period/Total\ \ Authors\ \ in\ a\ period)*100$

5.3.2.4 Collaboration Strength between Authors

The data about collaboration strength among authors and author per article of *D-Lib Magazine* are tabulated in Table 5.3.12. The number of authors per article during the period 2005-2007 and 2005-2007 is 2.56, while author per article is 2.68 for the period 2008-210 that is greater than previous periods. In all, the average of authors per article is 2.59 for the period 2001-2010.

Table 5.3.12: Mean (μ) of authors and collaboration co-efficient (CC)

Periods(in Year)	Author Per Article (Mean)	Collaboration Co-efficient (CC)
2001-2004	2.56	0.41
2005-2007	2.56	0.45
2008-2010	2.68	0.45
Overall (2001-10)	2.59	0.43

Data Source: *Primary data*

The Collaboration co-efficient of different time segments can be observed from Table 5.3.12 that provide add to measure collaboration strength among the authors. Table 5.3.12 also reveals the value of collaboration co-efficient that ranges from 0.41 to 0.45. The period 2005-2007 and 2008-2010 has recorded same value (0.45) for collaboration co-efficient. The period 2001-2004 has minimum collaboration co-efficient 0.41. Overall, the collaboration co-efficient was noticed 0.43 for the period 2001-2010. The value of collaboration co-efficient should fall between from 0.5 to 0.67 for better collaboration strength among authors (Ajiferuke, 1988). Hence, it can be

noted that the collaboration strength among authors of *D-Lib Magazine* was better during the year 2005-2007, and 2008-2010 in comparison to 2001-2004. Over the period 2001-2010, it is less than 0.5 which indicates towards week strength.

5.3.2.5 Authors' Collaboration

Table 5.3.13 recorded data of different types of collaboration which was formed under the umbrella of *D-Lib Magazine* during 2001-2010. The table reveals that during the first time segment (2001-2004), 37.5% article was produced without any collaboration that is highest in other time segments. The rest amount of the articles was written in collaboration. Most of the articles fell under local collaboration followed by National and International collaboration.

Table 5.3.13: Authors' collaboration in *D-Lib Magazine* (2001-2010)

Periods(in Year)	Level of Collaboration							
	Local		National		International		No Collaboration	
	No.	%	No.	%	No.	%	No.	%
2001-2004	57	30.98	46	25.00	12	6.52	69	37.50
2005-2007	59	37.82	23	14.74	62	39.74	12	7.69
2008-2010	27	42.86	14	22.22	11	17.46	11	17.46
Overall (2001-2010)	143	35.48	83	20.60	85	21.09	92	22.83

Data Source: *Primary data*

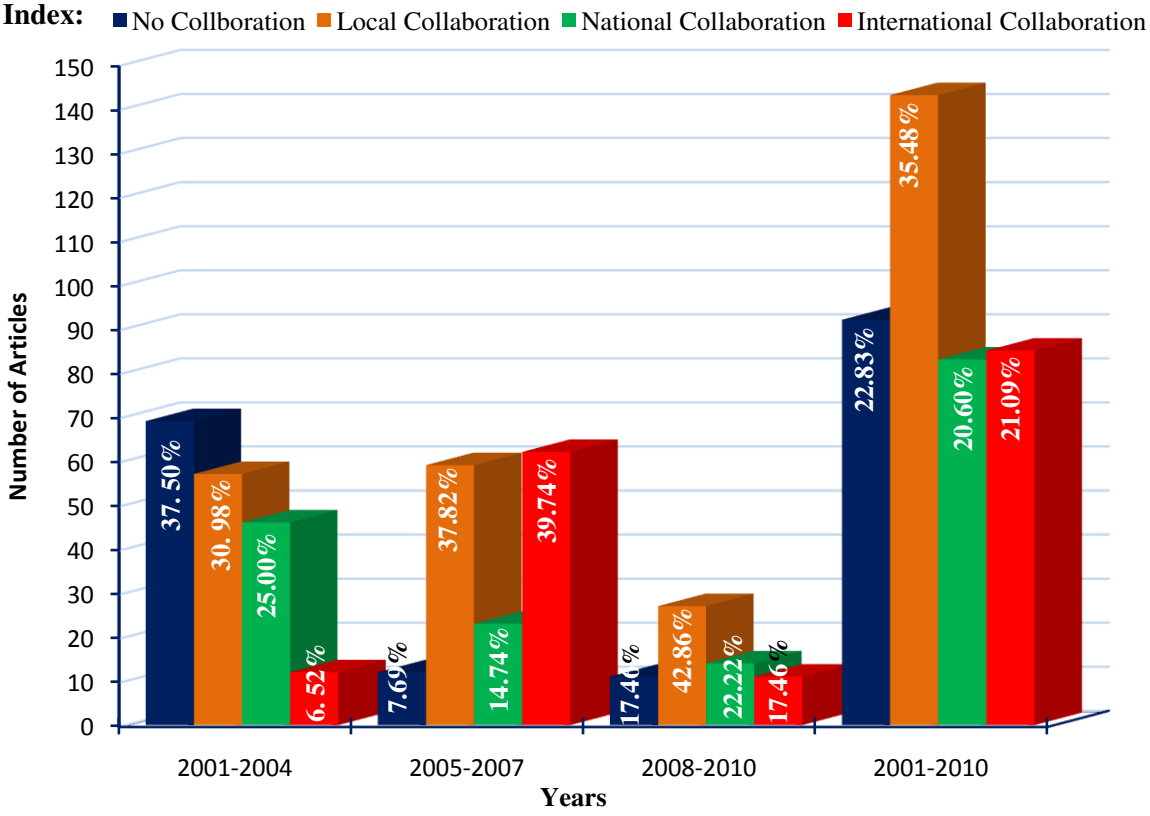

Figure 5.3.6: Authors' collaboration in *D-Lib Magazine* (2001-2010)

Data Source: *Primary data*

During the period 2005-2007, 7.7% articles emerged without any collaboration with 82.60% decrement. An increment with 416.66% has been noticed in the international collaboration and National collaboration has been traced with 3.51% increment. The period 2008-2010 is an evident of declines in growth of articles, in turn the number of articles in different categories of collaboration decreased sharply. Over the period 2001-2010, it can be seen that there is a good number of Local collaboration followed by International and National collaboration in *D-Lib Magazine* (see Figure 5.3.6).

5.3.2.6 Contribution of Co-authors

Table 5.3.13: Co-authors in collaboration in *D-Lib Magazine* (2001-2010)

Frequency	Articles Contributors as Co-author					
	2001-2004		2005-2007		2008-2010	
	No.	%	No.	%	No.	%
Once	284	86.06	220	85.60	185	78.39
Twice	33	10.00	33	12.84	16	6.78
Thrice	9	2.73	2	0.78	32	13.56
Four Times	2	0.61	2	0.78	3	1.27
five Times	1	0.30	0	0.00	0	0.00
Six Times	0	0.00	0	0.00	0	0.00
More than Six times	1	0.30	0	0.00	0	0.00
Author in Collaboration	330	100.00	257	100.00	236	100.00
Co-authored Articles	115	62.50	95	71.97	61	70.11
Total Articles	184		132		87	

Data Source: *Primary data*

Table 5.3.13 shows, the number of authors who involve once in collaboration has been decreased over the period. During 2008-2010, the frequency of authors who appeared thrice increased sharply and reached to thirty-two. The occurrences of authors who appeared more than four times in collaboration turn into zero in this period.

In general, it can be pointed out that most of the authors appear once as co-authors followed by twice and thrice. There were more authors engaged in collaboration as co-authors in 2001-2004 compared to next two periods. The negative growth of articles was responsible for this trend in *D-Lib Magazine*.

5.3.2.7 Most Productive Authors of D-Lib Magazine

The study also identifies the most productive authors of *D-Lib Magazine* during the year 2001-2010. There are 706 unique authors. The most frequently appeared primary author is Van De Sompel, H. (*Herbert Van de Sompel, Belgian librarian*) followed by Arms, W.Y. (*William Y.*

Arms, Cornell University, USA), Zia, L. L. (*Lee L. Zia, Undergraduate Education National Science Foundation, USA*) and so on (see Table 5.3.14; for more see Table D3 of Appendix D).

Table 5.3.14: Most frequently appeared primary authors in *D-Lib Magazine*

Rank	Name	Frequency
1	Van De Sompel, H.	5
2	Arms, W.Y.	4
2	Zia, L.L.	4
3	Bekaert, J.	3
3	Bollen, J.	3
3	Choudhury, G.S.	3
3	Coleman, A.	3
3	Crane, G.	3
3	Hammond, T.	3
3	Holley, R.	3
3	King, D.W.	3
3	Lavoie, B.	3
3	Littman, J.	3
3	Nelson, M.L.	3
3	Paskin, N.	3

Data Source: *Primary data*

Whereas, the most frequently appeared co-authors is Nelson, M. L. (*Michael L. Nelson, Old Dominion University, USA*), followed by Lagoze, C. (*Carl Lagoze, Cornell University, USA*), Van De Sompel, H. (*Herbert Van de Sompel, Belgian librarian*) and so on (see Table 5.3.15; Table D4 of Appendix D).

Table 5.3.15: Most frequently appeared co- authors in *D-Lib Magazine*

Rank	Name	Frequency
1	Nelson, M.L.	7
2	Lagoze, C.	5
2	Van De Sompel, H.	5
3	Fox, E.A.	4
3	King, D.W.	4
4	Brody, T.	3
4	Choudhury, G.S.	3
4	Dempsey, L.	3
4	DiLauro, T.	3
4	Habing, T.G.	3
4	Hannay, T.	3
4	Hickey, T.B.	3
4	Manepalli, G.	3
4	Payette, S.	3
4	Sumner, T.	3

Data Source: *Primary data*

5.4 Institution-wise Publication Distribution and Authors' Affiliations

Counting publications by institutions and their affiliation to authors with respect to journals evaluate the role of institutions. The analysis of the journal *Scientometrics* and *D-Lib Magazine* in the light of objective four is as follows:

5.4.1 Scientometrics (Journal)

There are a total of 716 institutions that provided 2908 affiliations to different authors in 1241 articles published during the year 2001-2010.

5.4.1.1 Institution-wise Distribution of Articles

Table 5.4.1: Contribution of articles of top twenty-five institutions in *Scientometrics*

S. No.	Institutions	Number of Articles			Total Articles 2001-2010
		2001-2004	2004-2007	2008-2010	
1	Katholieke Universiteit Leuven	19	25	30	74
2	Leiden University	14	12	12	38
3	Hungarian Academy of Sciences	12	13	11	36
4	Natl. Institute of Science, Tech. & Devmt. Studs.	20	5	4	29
5	University of Granada	6	15	8	29
6	University of Amsterdam	6	9	5	20
7	University of Wolverhampton	7	5	7	19
8	Spanish National Research Council	3	4	7	14
9	Harbin Institute of Technology	2	6	5	13
10	KHBO- Industrial Sciences & Technology	3	4	6	13
11	University of Hasselt	8	5	10	23
12	University of New South Wales	8	2	2	12
13	University of Sussex	1	8	3	12
14	Beijing university of Aeronautics and Astronautics	2	4	5	11
15	Henan Normal University	6	3	2	11
16	Royal Academy of Arts & Sciences	4	5	2	11
17	King Mongkut's University of Technology Thonburi	3	3	4	10
18	Peking University	1	1	8	10
19	Seoul National University	1	3	6	10
20	University of Western Ontario	4	4	2	10
21	City University	6	3	0	9
22	Fraunhofer Institute for Systems & Innovation Research	2	4	3	9
23	Indiana University	3	2	4	9
24	University of Pretoria	1	4	4	9
25	Bar-Ilan University	1	1	6	8
	Other 691 institution	318	386	487	1191

Data Source: *Primary data*

The analysis of journals' articles brought forward by different institutions throws light on the involvement of institution in research activity. The pertaining data presented in Table 5.4.1 reveals that there are 247 institutions that contributed 337 articles in the year 2001-2004. The National Institute of Science, Technology and Development Studies (India) first with 20 articles followed by Katholieke Universiteit Leuven of Belgium with 19 articles. The Linden University that is native of the journal *Scientometrics* with 14 articles secured third place. The Hungarian Academy of Sciences was ranked 4th with 12 articles; the University of Hasselt and University of New South Wales contributed eight articles each thereby both were placed at 5th rank.

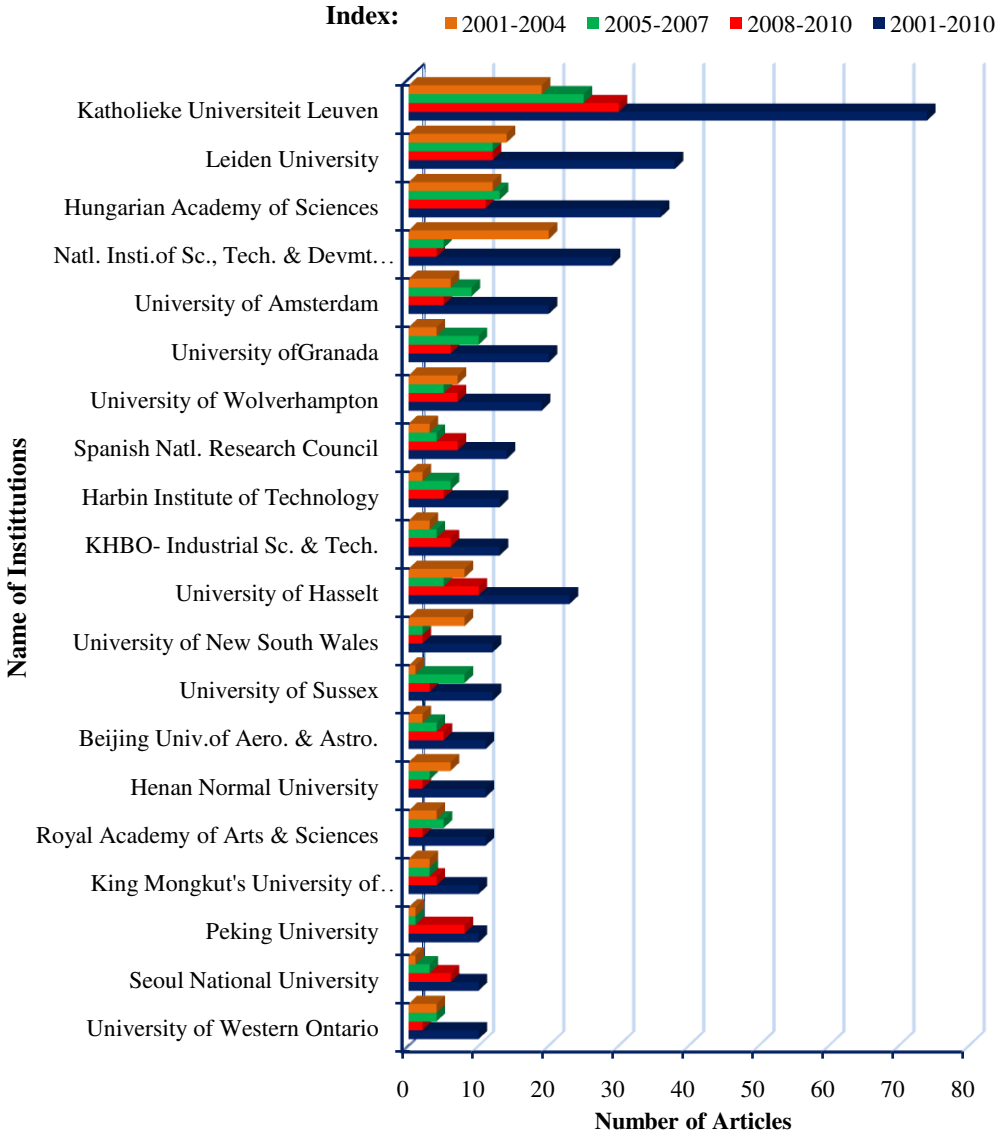

Figure 5.4.1: Contribution of articles of top twenty institutions in *Scientometrics*

Data Source: *Primary data*

The data analysis of the period 2005-2007 from Table 5.4.1 shows a total of 362 articles added by 322 institutions; where 237 institutions were new that did not contribute any article in the

previous period (2001-2005). The contribution of such institutions is 283 articles out of 366 articles. The highest contributor of this period is the K. U. Leuven with 25 articles followed by University of Granada of Spain, Hungarian Academy of Sciences and with 15, and 13 articles respectively. The Leiden University slipped one rank and reached at fourth rank pushing back National Institute of Science, Technology, and Studies (India). The University of Amsterdam produced nine articles and the University of Sussex produced eight articles which brought them 5th and 6th position. The National Institute of Science, Technology, and Studies (India) added only five articles in this period and got 8th position in order of rank.

In the next period (2008-2010), a total of 366 institutes appeared and contributed 562 articles. the Katholieke Universiteit Leuven maintained its position at first rank by contributing 30 articles, While Leiden University stood at second rank placing back Hungarian Academy of Sciences at third rank. The University of Hasselt (Belgium) ordered themselves at fourth place with 10 articles. The University of Granada and Peking University (China) ordered themselves at 5th place by contributing eight articles by each.

The Table 5.4.1 shows that throughout the period 2001-2010, there are only 20 out of 716 institutions whose individual contribution falls under 10-74 articles. There are 664 intuitions that appeared less than five times in *Scientometrics* journal during the period 2001-2010, while 453 Institutions occurred only one time. During this period, the K. U. Leuven contributed 74 articles which placed it at first position (see Tables 5.4.1 and Figure 5.4.2). The second position was secured by the Leiden University by producing 38 articles and third position by Hungarian Academy of Sciences who came up with 36 articles. The National Institution of Science, Technology, and Studies (India) came up with 29 articles, whereas the University of Amsterdam and University of Granada brought forward 20 articles each.

5.4.1.2 Institution and Its Affiliation

Table 5.4.2 presents the types of institutions and their affiliations to the primary authors and co-authors who have contributed articles to *Scientometrics*. It can be traced out from Table 5.4.2 and Figure 5.4.2 that there was an identical trend of institutional affiliation of authors throughout the period of 2001-2010. Most of the authors were affiliated with the academic institution, it can be noticed that approximately 80 to 83% of authors of *Scientometrics* journal belong to academic

institutions within the year 2001-2010. Only 14.5% authors are formally attached to research institutions. While, a small proportion of authors belong to non-academic institutions i.e. 3.78%.

Table 5.4.2: Types of institute and its affiliation in *Scientometrics*

Types of Institute	Number of Affiliations							
	2001-2004		2005-2007		2008-2010		2001-2010	
	No.	%	No.	%	No.	%	No.	%
Research	107	14.94	127	14.27	184	14.39	418	14.49
Academic	587	81.98	734	82.47	1060	81.41	2381	81.87
Non Academic	22	3.07	29	3.26	58	4.53	109	3.78
Total	716	100	890	100	1302	100	2908	100

Data Source: *Primary data*

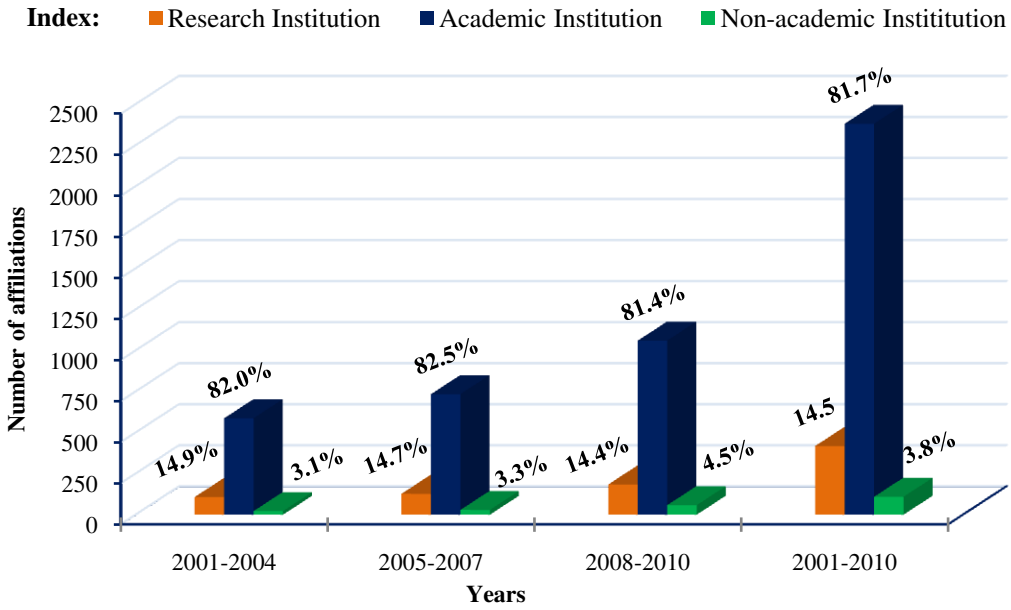

Figure 5.4.2: Type of institutions and its affiliations in *Scientometrics*

Data Source: *Primary data*

Table 5.4.3 comprises of the data that provide details of authors' affiliation of institutions. There are a total of 711 institutions that provided affiliations to 2908 authors who contributed articles to the journal *Scientometrics* in the year 2001-2010. The data confirms that the authors were dispersed in several institutions. It can be observed from Table 5.4.3 that 788 (25%) of authors came from 18 (2.53%) institutions only, whereas rest 1234 authors came from 693 (97.66%) institutions. The biggest subset of authors that is 124 (4.3%) belong to Katholieke Universiteit Leuven (K.U. Leuven) in Belgium followed by Universidad de Granada in Spain with 79 (2.72%) authors and Leiden University in Netherlands with 71 (2.44%). While the highest number of articles (74 articles) was contributed by the K. U. Leuven followed by Leiden University with 38 (3.06%) articles (see Table 5.4.1).

Table 5.4.3: Top twenty-five institutional affiliations of authors in *Scientometrics* (2001-2010)

S. No.	Institutions	Affiliation with				Total Affiliations	
		Primary Authors		Co-Authors			
		No.	%	No.	%	No.	%
1	K. U. Leuven	45	3.63	79	4.74	124	4.27
2	University of Granada	25	2.01	54	3.24	79	2.72
3	Leiden university	30	2.42	41	2.46	71	2.44
4	Hungarian Academy of Sciences	23	1.85	23	1.38	46	1.58
5	Natl. Insti. of Sc.Tech. & Devel. Stud.	23	1.85	21	1.26	44	1.51
6	King Mongkut's Univ.of Tech. Thonburi	8	0.64	34	2.04	42	1.45
7	University of Wolverhampton	14	1.13	27	1.62	41	1.41
8	Spanish Natl. Res. Council	16	1.29	25	1.50	41	1.41
9	Harbin Institute of Technology	13	1.05	20	1.20	33	1.14
10	Peking University	10	0.81	20	1.20	30	1.03
11	Indiana University	8	0.64	20	1.20	28	0.97
12	Wuhan University	6	0.48	22	1.32	28	0.97
13	Univ. Federal do Rio de Janeiro	9	0.73	18	1.08	27	0.93
14	University of Barcelona	7	0.56	19	1.14	26	0.89
15	Universiteit Hasselt	22	1.77	4	0.24	26	0.90
16	Bhabha Atomic Research. Centre	6	0.48	19	1.14	25	0.86
17	University Ddusseldorf	1	0.08	22	1.32	23	0.79
18	University of Amsterdam	16	1.29	7	0.42	23	0.79
19	Inst. of Science. & Tech. Information of China	4	0.32	18	1.08	22	0.76
20	National Taiwan University	7	0.56	15	0.90	22	0.76
21	University of Rome tor Vergata	7	0.56	14	0.84	21	0.72
22	Univ. of New south Wales	8	0.64	12	0.72	20	0.69
23	University of Sussex	9	0.73	11	0.66	20	0.69
24	Universidade de São Paulo	4	0.32	16	0.96	20	0.69
25	Spanish Council for Sci. Research	7	0.56	12	0.72	19	0.65
	Other 691 Institutes	913	73.57	1094	65.63	2007	69.02
	Total	1241	100	1667	100	2908	100

Data Source: *Primary data*

Analysis of primary author from Table 5.4.3 throws light that a total number of 623 (50.20%) primary authors are concentrated in 83 (11.67%) institutions while the rest 50% of primary authors are concentrated over 88% institutions. Examination of individual institution reveals that the highest concentration of primary authors 45 (3.6%) have been seen in the K. U. Leuven University (Belgium), followed by the Leiden university (Netherlands) with 30 (2.41%) authors and the Universidad de Granada (Spain) with 25 (2.0%) authors. The Hungarian Academy of

Sciences (Hungary) and the National Institutes of Science Technology & Development Studies (India) each with 23(1.86%) authors, and the University of Amsterdam (Netherland) with 16 (1.28%) authors secured fourth and fifth rank respectively. Here, it is remarkable to see that the National Institutes of Science Technology & Development Studies, New Delhi (India) has ranked fourth as 1.86% of primary authors of *Scientometrics* journals are formally attached with the institution.

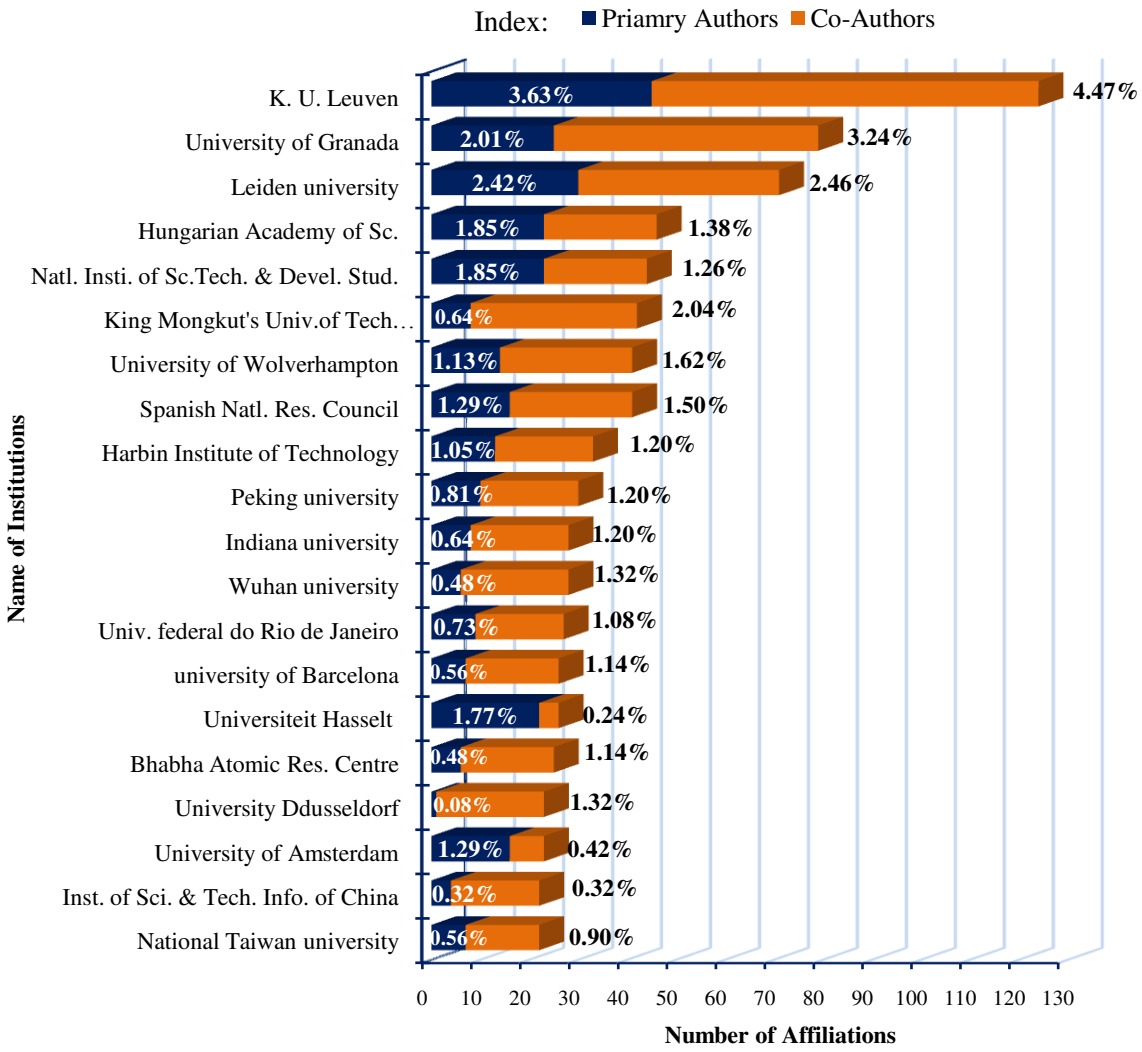

Figure 5.4.3: Top twenty frequently institutional affiliation of authors in *Scientometrics*

Data Source: *Primary data*

The data of co-authors' affiliation from Table 5.4.3 shows that 833 (49.97%) of co-authors are associated with 54 (10.11%) institutions. The rest 834 (49.03%) co-authors belong to 480 (88.0%) institutions. The data shows that a total of 79 (4.74%) co-authors came from the K. U. Leuven thereby it secured first rank, followed by the Universidad de Granada with 54 (3.24%) co-authors, the Leiden University (Netherland) with 41 (2.46%) co-authors and the King

Mongkut's University of Technology (Thailand) with 34 (2.04%) co-authors. The next institutions are the University of Wolverhampton (UK) with 27 (1.62%), and the Spanish National Research council (Spain) with 25 (1.50%) co-authors that has rank 5th and 6th position respectively. The Hungarian Academy of Science (Hungry) provided affiliation to 23(1.3%) co-authors and ranked at the seventh position.

5.4.2 D-Lib Magazine

There are a total of 285 institutions that provided 706 affiliations to different authors in 403 articles published during the year 2001-2010 in *D-Lib Magazine*.

5.4.2.1 Institution-wise Distribution of Articles

Table 5.4.4: Contribution of articles of top twenty-five institution in *D-Lib Magazine*

S. No.	Institutions	Number of Articles			Total Articles
		2001-2004	2005-2007	2008-2010	2001-2010
1	Online Computer Library Center	12	9	3	24
2	Cornell University	11	7	3	21
3	Los Alamos National Laboratory	7	4	3	14
4	Old Dominion University	6	4	2	12
5	University of California	10	2	0	12
6	Chinese academy of science	1	3	5	9
7	University of Michigan	2	5	2	9
8	University of north Carolina	2	5	2	9
9	Corporation for national Research initiatives	3	3	2	8
10	Johns Hopkins university	4	3	0	7
11	University of Colorado	4	2	1	7
12	University of Pittsburgh	6	1	0	7
13	Virginia tech	5	1	1	7
14	Indiana university	2	2	2	6
15	National library of Australia	2	0	4	6
16	National science foundation	3	3	0	6
17	Stanford university	1	4	1	6
18	University of Glasgow	0	3	3	6
19	University of Illinois	2	4	0	6
20	Yale university	2	3	1	6
21	Koninklijke Bibliotheek	1	1	3	5
22	Nature Publishing Group	1	3	1	5
23	Tufts University	1	4	0	5
24	University of Tennessee	3	1	1	5
25	British library	4	0	0	4
	other 261 Institutions	177	118	87	380

Data Source: *Primary data*

The data presented in Table 5.4.4 reveals 160 institutions that contributed articles to *D-Lib Magazine* during the year 2001-2004. The Online Computer Library Center (US) ranked first with 12 articles followed by the Cornell University with 11 articles and the University of California with 10 articles. The Los Alamos National Laboratory secured fourth place. The Old Dominion University and the University of Pittsburgh each contributed six articles thereby both were placed at fifth rank.

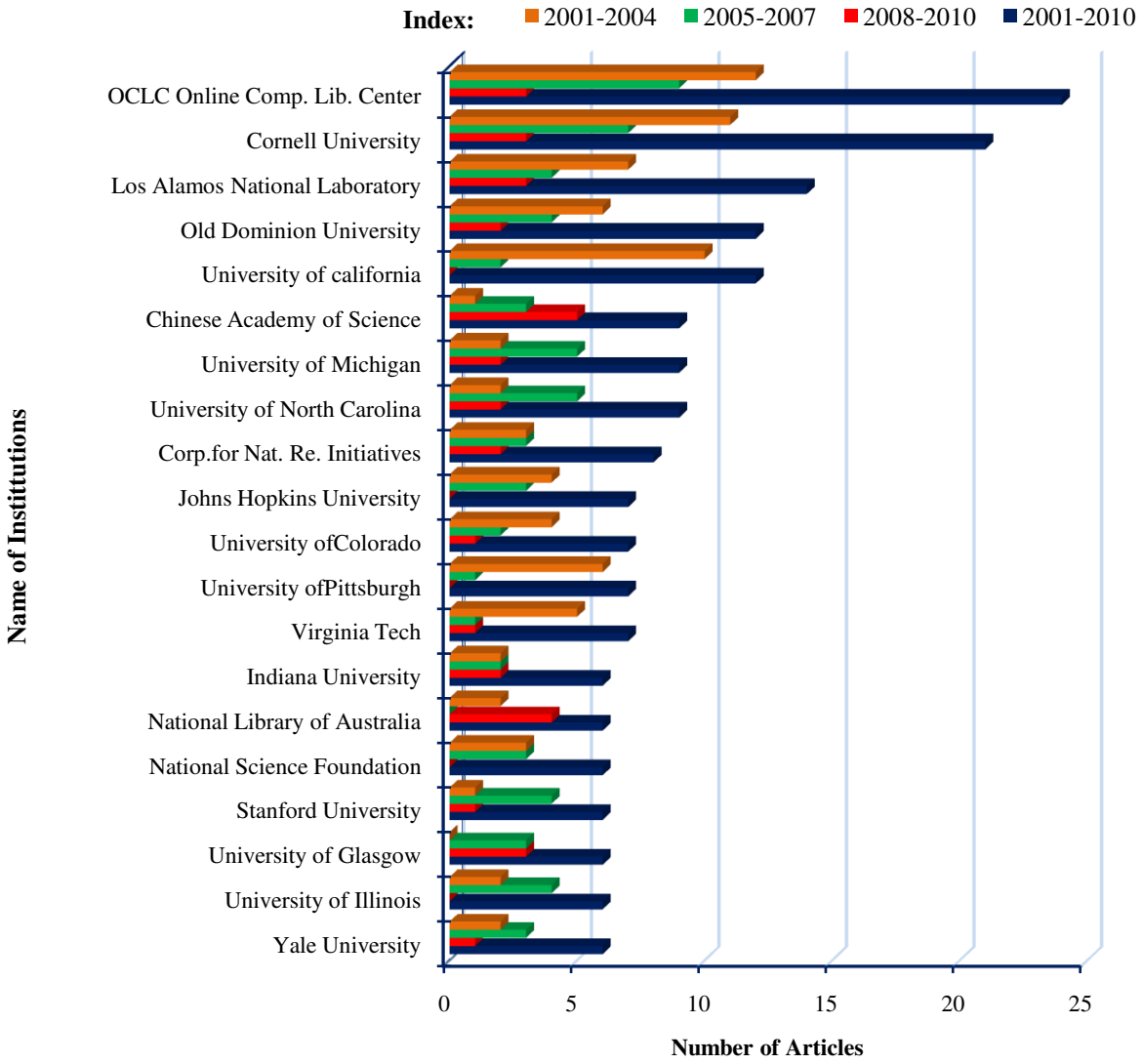

Figure 5.4.4: Contribution of articles of top twenty institutions in *D-Lib Magazine*

Data Source: *Primary data*

The data analysis of the period 2005-2007 from Table 5.4.4 shows that there were 115 institutions that participated in article publication in *D-Lib Magazine*; It included 73 new institutions that did not contribute any article in the previous period (2001-2005) such as the University of Glasgow (UK) etc. The share of such institutions was 92 articles. The Online Computer Library Center (Online Comp. Lib. Center, US) was a prolific Institution with nine

articles followed by the Cornell University (USA) with seven articles, the University of Michigan (USA) and the University of North Carolina (USA) each with five articles, of the period 2005-2007.

In the next period (2008-2010), only 91 institutions contributed articles. Out of 91 Institutions, 53 Institution were new that did not contribute any articles in the previous years. The Chinese Academy of Science (China) brought forward five articles that is the largest number of articles from an institution, of the period, followed by the National Library of Australia (Australia) with four articles.

The statistics of the 2001-2010 from Table 5.4.4 shows that there were 286 institutions contributed articles to *D-Lib Magazine*. During the period, the highest number of articles (72 articles) contributed by the Online Computer Library Center and ranked at the first position (see Tables 5.4.5 and Figure 5.4.5). The Second position was taken by the Cornell University by producing 21 articles and third position by the Los Alamos National Laboratory that came up with 14 articles. The Old Dominion University and the University of California each contributed 12 articles. The most of the institution who contribute articles to *D-Lib Magazine* situated in United State of America (USA).

5.4.2.2 Institutions and Its Affiliation

Table 5.4.5 presents the types of institutes and their affiliation of the primary authors and co-authors both who contributed articles to *D-Lib Magazine*. It can be traced from Table 5.4.5 and Figure 5.4.5 that there was an identical trend of institutional affiliation throughout the period 2001-2010. Most of the authors were affiliated with the Academic institution. It can be observed from the table that approximately 69 to 74% of authors of *D-Lib Magazine* belong to academic institutions during the different time segment. Only 10.17% of authors are formally attached to Research institutions. While, approximately 19% authors belonged to Non-academic institutions.

Table 5.4.5: Institutional affiliation of authors in *D-Lib Magazine*

Institutes	No. of Authors Affiliated with Institutions							
	2001-2004		2005-2007		2008-2010		2001-2010	
	No.	%	No.	%	No.	%	No.	%
Research	47	9.98	38	11.24	21	9.01	106	10.17
Academic	322	68.37	251	74.26	162	69.53	735	70.54
Non -Academic	102	21.66	49	14.50	50	21.46	201	19.29
Total	417	100	338	100	233	100	1042	100

Data Source: *Primary data*

Table 5.4.6 consists of the data that provide details of authors' affiliation of institutions. There are a total of 286 institutions that were affiliated to 706 authors who contributed articles to *D-Lib Magazine* in the year 2001-2010. It is clear from Table 5.4.6 that a total of 448 (42.99%) of authors came from 25 (8.74%) institutions only, whereas the rest 594 authors came from 261 (91.26%) institutions. The biggest subset of 56 (5.37%) the authors belong to the Cornell University (USA) followed by the Online Computer Library. Center (USA) with 42 (4.03%) authors and the University of Michigan in the USA with 71 (2.4%) authors. While the highest number of articles 24 (4.08%) added by Online Computer Library Center (USA) followed by the Cornell University (USA) with 21 (3.57%) articles (see Table 5.4.4).

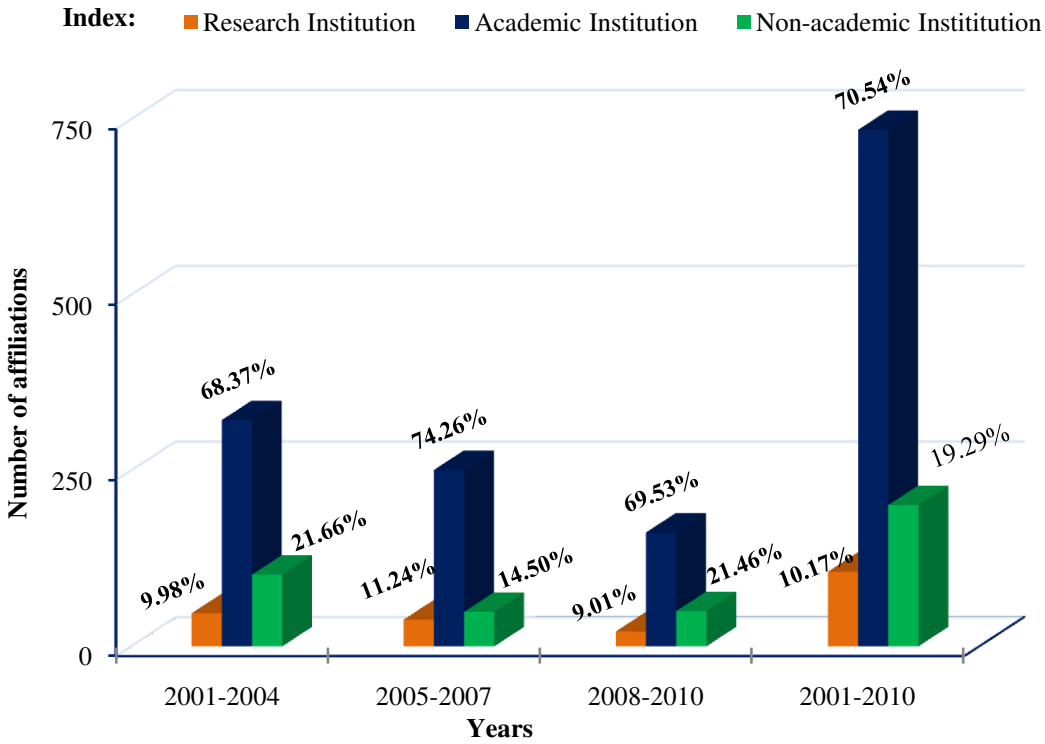

Figure 5.4.5: Type of Institution and its affiliations in *D-Lib Magazine*

Data Source: *Primary data*

Analysis of primary author from Table 5.4.6 shows that there are 403 primary authors who belong to 206 Institutions in *D-Lib Magazine*, during the period 2001-2010. A total of 95 (23.57%) primary authors were dispersed in 25 (12.13%) institutions while the rest approximately 76% of primary authors are concentrated over approximately 88% institutions. Examination of individual institution reveals that the highest concentration of primary authors 56 (4.23%) have been seen in the Online Computer Library Center (USA), followed by the Cornell University (USA) with 16 (3.98%) authors. The University of California and the Los Alamos National Laboratory (USA) each appeared with 10 (2.0%) authors and both secured third rank.

The Old Dominion University (USA) with 23 (1.9%) authors, and Chinese Academy of Science, China with 8 (1.99%) authors secured fourth and fifth rank respectively.

Table 5.4.6: top twenty-five institutional affiliation of authors in *D-Lib Magazine* (2001-2010)

Rank	Institutions	Affiliation with				Total Affiliation	
		Primary Authors		Co-Authors			
		No.	%	No.	%	No.	%
1	Cornell University	16	3.98	40	6.25	56	5.37
2	Online Comp. Lib. Center	17	4.23	25	3.91	42	4.03
3	University of Michigan	7	1.74	30	4.69	37	3.55
4	University of California	10	2.49	20	3.13	30	2.88
5	Old Dominion University	9	2.24	20	3.13	29	2.78
6	Los Alamos Natl. Laboratory	10	2.49	16	2.50	26	2.50
7	Johns Hopkins University	7	1.74	18	2.81	25	2.40
8	Stanford University	6	1.49	13	2.03	19	1.82
9	Virginia Tech.	5	1.24	12	1.88	17	1.63
10	Corp. for Natl. Res. Initiatives	6	1.49	9	1.41	15	1.44
11	University of Illinois	4	1.00	10	1.56	14	1.34
12	University of Colorado	4	1.00	9	1.41	13	1.25
13	University of North Carolina	6	1.49	6	0.94	12	1.15
14	University of Tennessee	3	0.75	9	1.41	12	1.15
15	National Library of Australia	6	1.49	5	0.78	11	1.06
16	Nature Publishing Group	4	1.00	7	1.09	11	1.06
17	University of Southampton	3	0.75	8	1.25	11	1.06
18	Chinese Academy of Science	8	1.99	2	0.31	10	0.96
19	Harvard University	2	0.50	8	1.25	10	0.96
20	Indiana University	4	1.00	6	0.94	10	0.96
21	Michigan State University	2	0.50	8	1.25	10	0.96
22	Montana State University	2	0.50	8	1.25	10	0.96
23	Aberystwyth University	0	0.00	10	1.56	10	0.96
24	Carleton College	3	0.75	6	0.94	9	0.86
25	National Science Foundation	5	1.24	4	0.63	9	0.86
	other 261 Institutions	254	62.94	330	51.72	584	56.05
	Total	403		639		1042	

Data Source: *Primary data*

The data of co-authors' affiliation of Table 5.4.6 shows that there are total 639 co-authors from 202 institutions. Table 5.4.6 reveals that 309 (48.36%) co-authors belong to 25 (12.38%) institutions and other 331 (50.64%) co-authors belong to 614 (87.62%) institutions. Analysis of each institution shows that a total of 40 (5.2%) co-authors came from the Cornell University

which secured the first rank in this phenomenon, followed by the University of Michigan (USA) with 30 (4.69%) authors, the Online Computer Library Center (USA) with 25 (3.91%) authors. The next institutions are the University of California (USA) and the Old Dominion University each came with 20 (3.13%) authors and Johns Hopkins University (USA) with 23(1.5%) authors that have been ranked fifth and sixth position respectively.

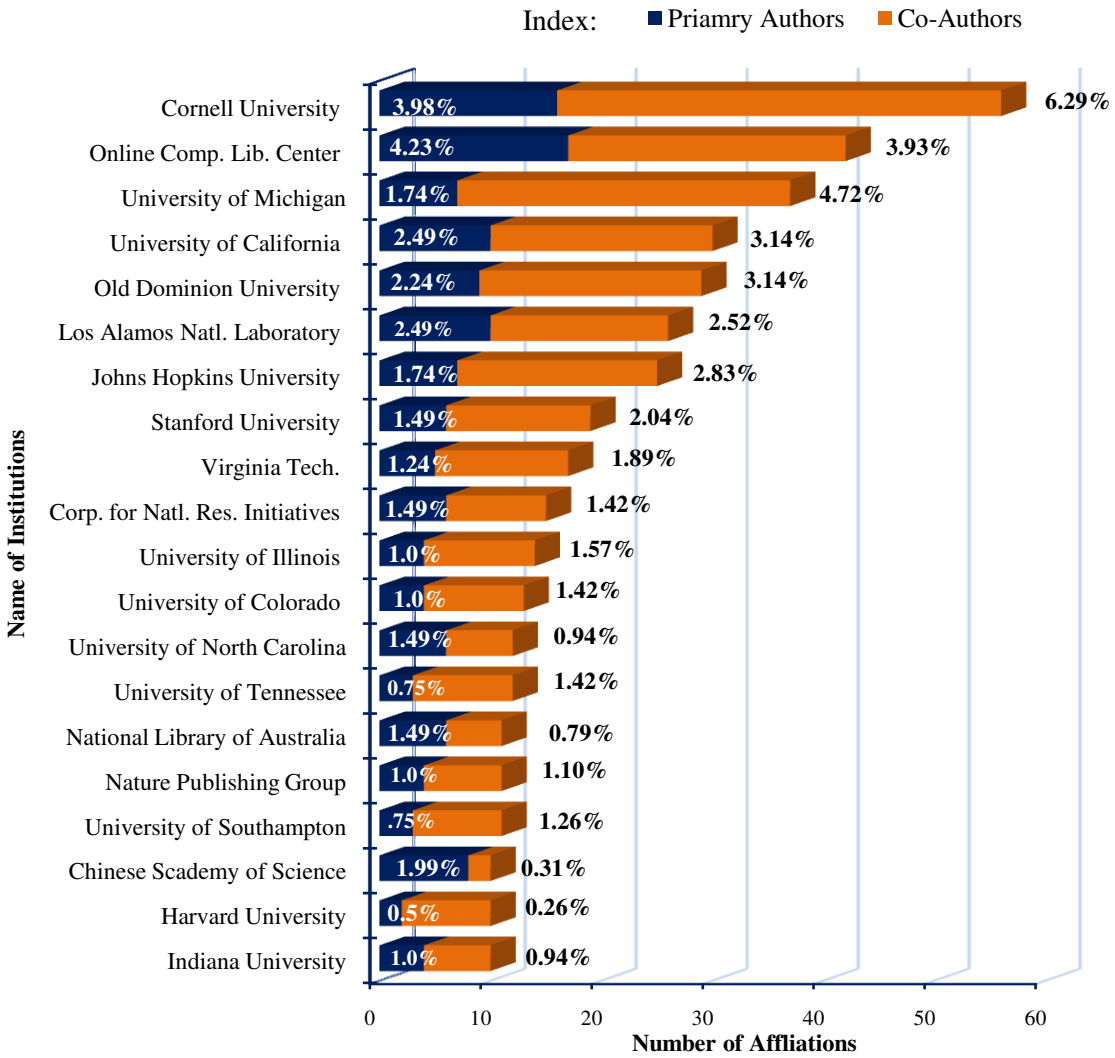

Figure 5.4.6: Top twenty institutional affiliations of authors in *D-Lib Magazine*

Data Source: *Primary data*

In Figure 5.4.6, it is clearly visible that the Cornell University, the Online Computer Library Center, University of Michigan has a great importance and the highest number of primary author belong to Online Computer Library Center and the largest number of co-authors is associated with the Cornell University. Here, it is remarkable that Most of the Institutions that affiliate to primary authors and co-authors situated in the USA that is publishing country of *D-Lib Magazine* also.

5.5 Subject Coverage of Research and Non-research Articles

Evaluation of subject coverage of journals' articles using the parameter of research and non-research articles examine the subject choice of authors involved in articles publications in a discipline.

5.5.1 Scientometrics (Journal)

The data belong to the subject of research and non-research articles published in *Scientometrics* present the choice of the subject of scholars engaged in publication during the period 2001-2010 in Scientometrics discipline have been discussed in this section. There are a total of 22 subjects has been identified under which all articles are grouped into three time-segments as shown in Table 5.5.2.

5.5.1.1 Distribution of Research and Non-Research Articles

The distribution of research and non-research articles of *Scientometrics* journal of the studied period (year 2001-2010) are presented in Table 5.5.1. There are a total of 1165 (93.90%) research articles and 76 (6.12%) non-research articles.

Table 5.5.1: Distribution of research and non-research articles of S*cientometrics*

Years	Journal's Articles				Total Articles
	Research		Non-Research		
	No.	%	No.	%	
2001	73	82.95	15	17.05	88
2002	75	93.75	5	6.25	80
2003	77	93.90	5	6.10	82
2004	81	93.10	6	6.90	87
2005	84	91.30	8	8.70	92
2006	140	95.24	7	4.76	147
2007	117	95.12	6	4.88	123
2008	122	95.31	6	4.69	128
2009	177	94.15	11	5.85	188
2010	219	96.90	7	3.10	226
Overall (2001-2010)	1165	93.90	76	6.10	1241

Data Source: *Primary data*

A big gap has been found in the number of Research and non-research articles in *Scientometrics* journal. In context of research articles, a steep uptrend line can be seen in Figure 5.5.1 which indicates the constant growth of research articles during the period. While a slight downtrend line for non-research articles can be observed in Figure 5.5.1. The largest number of non-research articles published in 2001 is 15 (17.05%) articles. After that, the publication share of non-research articles shrank and reached to 3.10%.

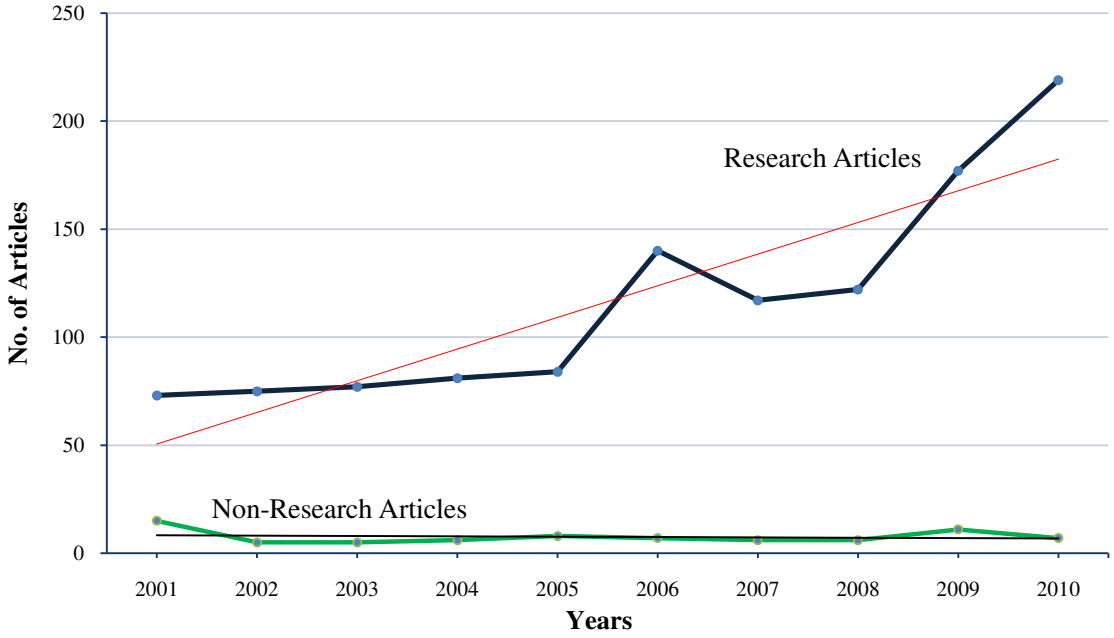

Figure 5.5.1: Distribution of research and non-research articles of *Scientometrics*

Data Source: *Primary data*

5.5.1.2 Subject–wise Distribution of Research Articles

Table 5.5.2: Distribution of research articles of *Scientometrics* by subject

S. No.	Subjects	Research Articles in							
		2001-2004		2005-2007		2008-2010		2001-2010	
		No.	%	No.	%	No.	%	No.	%
1	Academic Ranking	0	0.00	2	0.59	8	1.54	10	0.86
2	Authorship Analysis	19	6.21	11	3.23	18	3.47	48	4.12
3	Bibliometric Study	38	12.42	55	16.13	83	16.02	176	15.11
4	Citation Analysis	72	23.53	65	19.06	86	16.60	223	19.14
5	Collaboration Analysis	29	9.48	18	5.28	41	7.92	88	7.55
6	Demographic Study	5	1.63	3	0.88	14	2.70	22	1.89
7	Impact Factor	8	2.61	12	3.52	20	3.86	40	3.43
8	Informetrics	3	0.98	3	0.88	0	0.00	6	0.52
9	Innovation system	1	0.33	3	0.88	1	0.19	5	0.43
10	Journal Evaluation	3	0.98	2	0.59	5	0.97	10	0.86
11	Mapping of Science	2	0.65	3	0.88	8	1.54	13	1.12
12	Model	8	2.61	5	1.47	3	0.58	16	1.37
13	Network Analysis	7	2.29	9	2.64	17	3.28	33	2.83
14	Patent Analysis	10	3.27	20	5.87	24	4.63	54	4.64
15	Research Assessment	6	1.96	14	4.11	19	3.67	39	3.35
16	Research Output	23	7.52	29	8.50	48	9.27	100	8.58
17	Scholarly Publication	12	3.92	11	3.23	27	5.21	50	4.29
18	Scientometrics	15	4.90	23	6.74	25	4.83	63	5.41
19	Statistics	6	1.96	1	0.29	3	0.58	10	0.86
20	Text mining	4	1.31	15	4.40	25	4.83	44	3.78
21	Triple helix	2	0.65	2	0.59	3	0.58	7	0.60
22	Webometrics	17	5.56	10	2.93	19	3.67	46	3.95
	Miscellaneous	16	5.23	25	7.33	21	4.05	62	5.32
	Total	306	100	341	100	518	100	1165	100

Data Source: *Primary data*

The Subject-wise distribution of research articles published in *Scientometrics* are tabulated in Table 5.5.2. The table reveals the largest number of articles that is 72 (23.5%) articles were published on the subject Citation analysis during the year 2001-2004, followed by Bibliometric study with 38 (12.4%) articles and Collaboration analysis with 29 (9.5%) articles. The other subject major subjects which cover 167 (41%) research articles are Research output with 23 (7.5%) articles, Authorship analysis with 19 (6.2%) articles and Webometrics with 17 (5.7%) articles, Scientometrics with 15 (4.9%) articles and Scholarly publication with 12 (3.9%) articles.

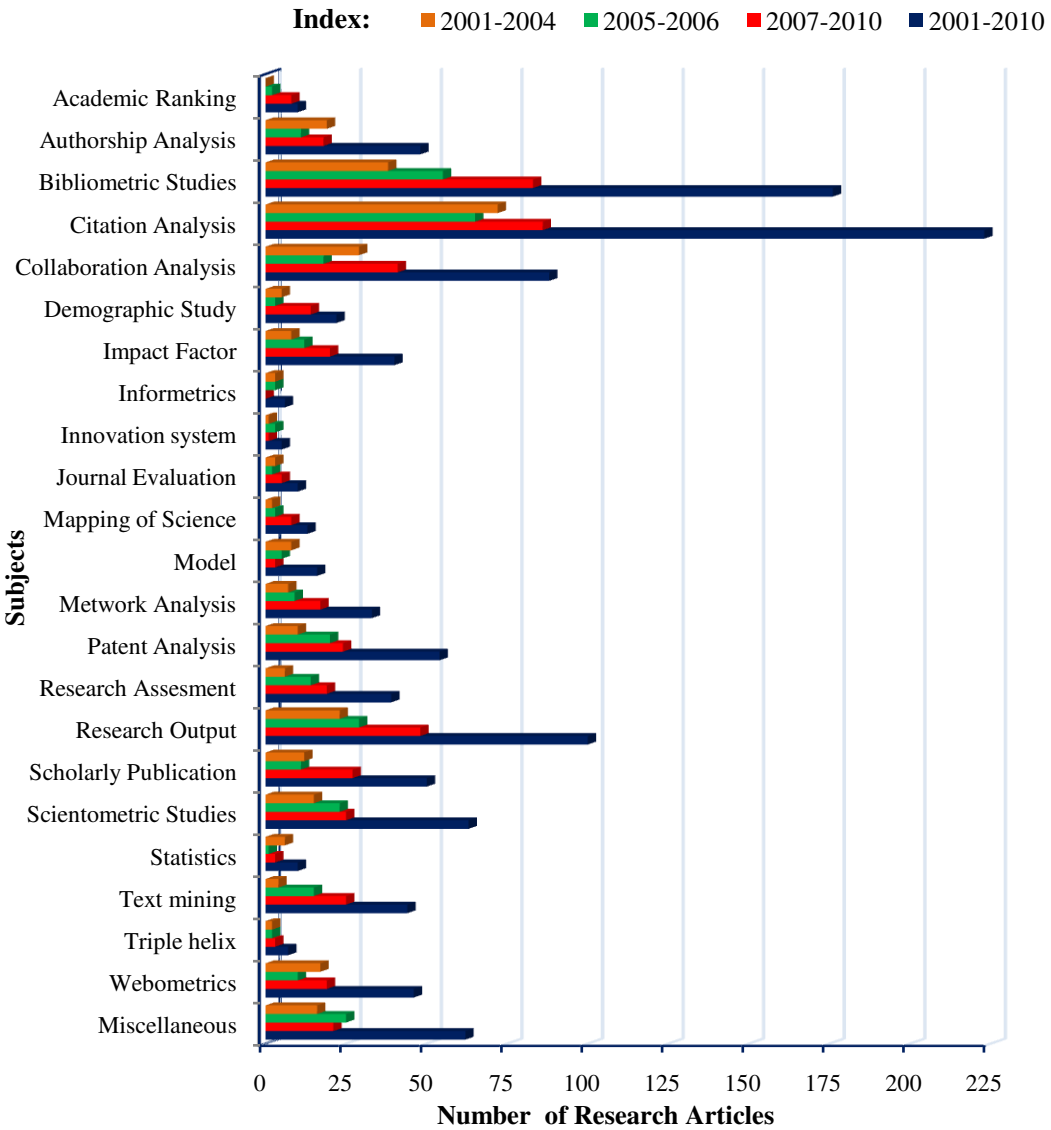

Figure 5.5.2: Distribution of ressearch articles of *Scientometrics* by subject

Data Source: *Primary data*

Table 5.5.2 shows that a total number of 65 (19.1%) research articles were contributed on the subject Citation analysis during 2005-2007 that is highest number of articles to a subject but lesser in comparison to the number of research articles published in 2001-2004 and 2007-2010. The subject Text Mining with 11 articles, Patent analysis with 10 articles, Scientometrics with 8

articles and Research output with 6 articles got more coverage. While the subject Collaboration analysis, Authorship analysis, Webometrics did not cover the number of research articles as well as covered in previous period (2001-2005). In the period 2007-2010, most of the subject attracted good number of research articles in comparison to previous period.

Overall, It could be noticed during the period 2001-2010, the subject Citation analysis become the most popular subject for the contributors of *Scientometrics* journal where it covered 19.1% of the total research articles. It was also found the subject Bibliometric study covered 15.1% of total research followed by Collaboration analysis (7.6%) and Scientometrics (5.4%). The subject patent analysis, Scholarly publication, Authorship analysis and Webometrics received equal attention and contributed 198 (17.00%) articles. It also can be observed, the subjects listed in Table 5.5.2 gain more articles gradually over the period.

5.5.1.3 Subject–wise Distribution of Non-research Articles

Table 5.5.3: Distribution of non-research articles of *Scientometrics* by subject

S. No.	Subjects	Non-research Articles in							
		2001-2004		2005-2007		2008-2010		2001-2010	
		No.	%	No.	%	No.	%	No.	%
1	Academic Ranking	0	0.00	0	0.00	0	0.00	0	0.00
2	Authorship Analysis	1	3.33	0	0.00	0	0.00	1	1.33
3	Bibliometric Study	2	6.67	8	38.10	7	29.17	17	22.67
4	Citation Analysis	2	6.67	1	4.76	1	4.17	4	5.33
5	Collaboration Analysis	2	6.67	0	0.00	0	0.00	2	2.67
6	Demographic analysis	1	3.33	0	0.00	0	0.00	0	0.00
7	Impact Factor	2	6.67	1	4.76	1	4.17	4	5.33
8	Informetrics	1	3.33	1	4.76	0	0.00	2	2.67
9	Innovation System	0	0.00	1	4.76	0	0.00	1	1.33
10	Journal Evaluation	0	0.00	0	0.00	0	0.00	0	0.00
11	Mapping of Science	1	3.33	0	0.00	0	0.00	1	1.33
12	Model	1	3.33	1	4.76	0	0.00	2	2.67
13	Network Analysis	0	0.00	0	0.00	0	0.00	0	0.00
14	Patent Analysis	4	13.33	3	14.29	5	20.83	12	16.00
15	Research Assessment	1	3.33	2	9.52	2	8.33	5	6.67
16	Research Output	0	0.00	1	4.76	1	4.17	2	2.67
17	Scholarly Publication	2	6.67	0	0.00	0	0.00	2	2.67
18	Scientometrics	1	3.33	0	0.00	4	16.67	5	6.67
19	Statistics	7	23.33	1	4.76	1	4.17	9	12.00
20	Text Mining	0	0.00	1	4.76	0	0.00	1	1.33
21	Triple Helix	1	3.33	0	0.00	2	8.33	3	4.00
22	Webometrics	0	0.00	0	0.00	0	0.00	0	0.00
	Miscellaneous	2	6.67	0	0.00	0	0.00	2	2.67
	Total	31	100	21	100	24	100	76	100

Data Source: *Primary data*

Table 5.5.3 shows the subject coverage of non-research articles. It reveals that there are only 30 articles in the period 2001-2004, out of which 11 (36.9%) articles were published on Patent analysis, and Statistical analysis. The rest 19 (63.1%) articles fell under twelve subjects.

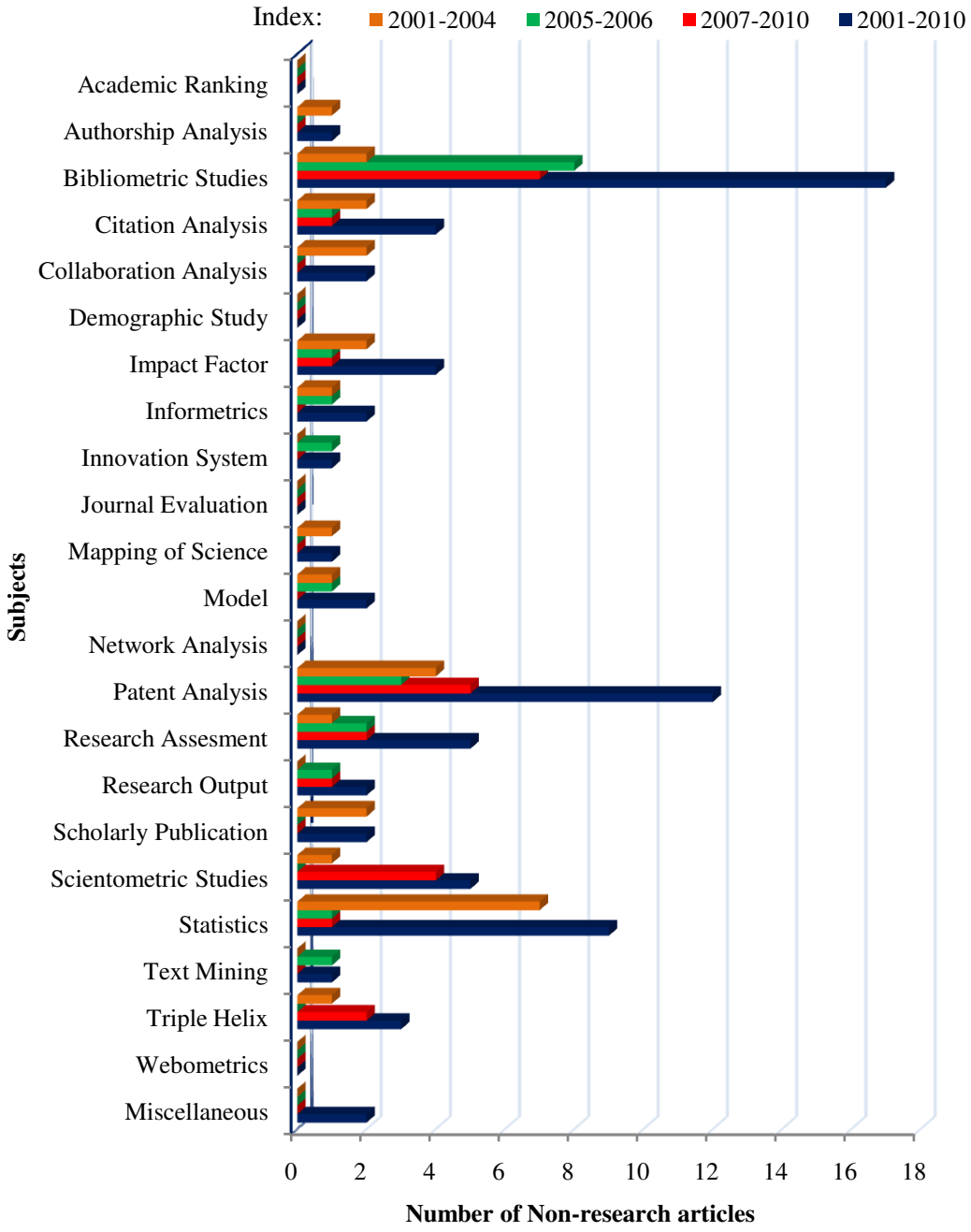

Figure 5.5.3: Distribution of non-research articles of *Scientometrics* by subject

Data Source: *Primary data*

In the period 2005-2007, the number of non-research articles decreased to 21 articles. In this period the attention of scholar were Bibliometrics, and Patent analysis which contributed 8 (38.1%) and 3 (14.3%) articles respectively. The remaining 9 (47.6%) articles fell in the nine subjects listed in the Table 5.5.3.

During the next period 2007-2010, 16 (66.7%) out of 24 articles were published on Bibliometric Study (seven articles), Patent Analysis (five articles) and Scientometrics (four articles). Other 8 (33.3%) articles were written on six subjects and they are Triple Helix, Research Assessment, Research Output, Statistics, Impact Factor and Citation Analysis. It can be observed from Figure 5.5.2 that the subject Academic Ranking, Webometrics, Network Analysis and Research Evaluation did not attract attention of scholars for non-research article.

It could also be noticed that the subject group Bibliometrics Studies, Patent Analysis and Statistics were the first choice of the scholars for non-research articles throughout the period (2001-2010). However, Citation studies, research assessment and Impact factor were also among the subject that gained non-research article during studied period.

5.5.2 D-Lib Magazine

This section analysed the subject coverage of research and non-research articles published in *D-Lib Magazine*. All the articles selected for study have been classified under 22 subjects (see Table 2).

5.5.2.1 Distribution of Research and Non-Research Articles

The distributions of research and non-research articles of *D-Lib Magazine* of the period 2001-2010, are presented in the Table 5.5.4. There are 190 (47.15%) articles are research articles and 213 (52.85%) articles are non-research articles.

During the year 2001-2005, the share of Non-research article was larger than the share of research article. However, the share of research article increased and become larger than the share of non-research, during the year 2006-2009. Over all the share of non-research articles was larger than research articles.

Table 5.5.4: Distribution of research and non research articles of *D-Lib Magazine*

Years	Journal's Articles				Total Articles
	Research		Non-Research		
	No.	%	No.	%	
2001	18	40.00	27	60.00	45
2002	17	35.42	31	64.58	48
2003	24	47.06	27	52.94	51
2004	22	55.00	18	45.00	40
2005	25	46.30	29	53.70	54
2006	23	51.11	22	48.89	45
2007	21	63.64	12	36.36	33
2008	16	59.26	11	40.74	27
2009	17	54.84	14	45.16	31
2010	7	24.14	22	75.86	29
Overall (2001-2010)	190	47.15	213	52.85	403

Data Source: *Primary data*

Research articles and Non-research articles both has a steep downtrend line that can be seen in Figure 5.5.4 which indicates the constant negative growth of research articles and non-research articles during the period.

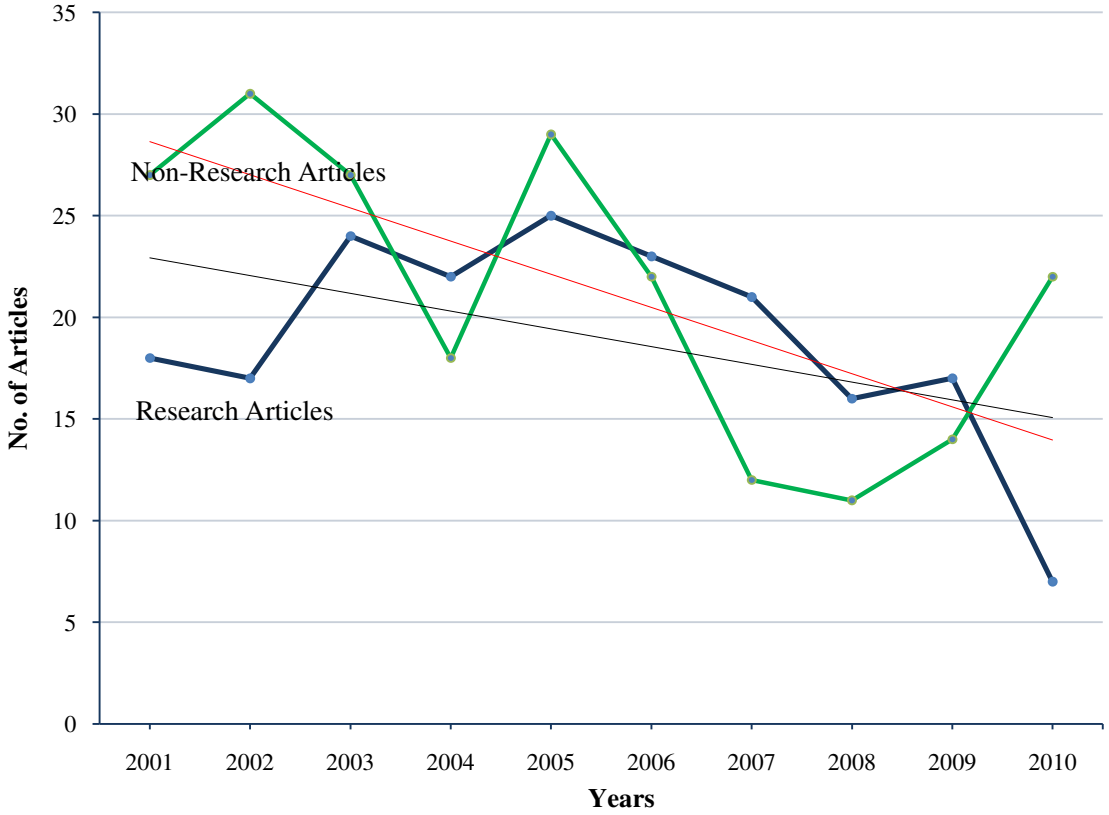

Figure 5.5.4: Distributions research and non-research articles of *D-Lib Magazine*

Data Source: *Primary data*

The curve (see Figure 5.5.4) of non-research articles is below to research article's curve since 2004 to 2010 excluding 2005 and 2010, which indicates larger share of research articles during the period.

5.5.2.2 Subject wise Distribution of Research Articles

The Subject-wise distribution of research articles published in *D-Lib Magazine* tabulated in Table 5.5.5 reveals that the highest number of articles that is 14 (14.81%) were published on the subject Digital library during the year 2001-2004, followed by E-resource with 9 (11.11%) articles and Bibliometric study with 9 (11.11%) articles. The other seven major subjects that covered 34 (41.97%) research articles were Library Management with 8 (9.88%) articles, Metadata with 5 (6.17%) articles, Digital reference service with 5 (6.17%) articles, Information retrievals with 4 (4.94%) articles, Archives with 4 (4.94%) articles, Preservation with 4 (4.94%) articles, and Database with 4 (4.94%) articles.

Table 5.5.5: Distribution of research articles by *D-Lib Magazine* subject

S. No.	Subjects	Research articles in 2001-2004		2005-2007		2008-2010		2001-2010	
		No.	%	No.	%	No.	%	No.	%
1	Digital Library	12	14.81	10	14.49	5	12.50	27	14.21
2	Repository	0	0.00	13	18.84	6	15.00	19	10.00
3	Bibliometric study	9	11.11	3	4.35	5	12.50	17	8.95
4	Archives	4	4.94	10	14.49	1	2.50	15	7.89
5	E-Resource	9	11.11	3	4.35	2	5.00	14	7.37
6	Library Management	8	9.88	4	5.80	2	5.00	14	7.37
7	Internet	3	3.70	3	4.35	3	7.50	9	4.74
8	Information Retrieval	4	4.94	2	2.90	3	7.50	9	4.74
9	Metadata	5	6.17	2	2.90	1	2.50	8	4.21
10	Preservation	4	4.94	1	1.45	2	5.00	7	3.68
11	Database	4	4.94	2	2.90	0	0.00	6	3.16
12	Digital Reference Service	5	6.17	1	1.45	0	0.00	6	3.16
13	Search engine	2	2.47	1	1.45	2	5.00	5	2.63
14	Digitalisation	0	0.00	1	1.45	3	7.50	4	2.11
15	Open URL	2	2.47	1	1.45	1	2.50	4	2.11
16	Social Networking	0	0.00	2	2.90	2	5.00	4	2.11
17	Computer Science	1	1.23	2	2.90	0	0.00	3	1.58
18	Interoperability	0	0.00	3	4.35	0	0.00	3	1.58
19	Intellectual Property Right	0	0.00	2	2.90	1	2.50	3	1.58
20	Digital Image	2	2.47	0	0.00	0	0.00	2	1.05
21	Digital Right Management System	1	1.23	1	1.45	0	0.00	2	1.05
22	Digital Inclusion	0	0.00	0	0.00	0	0.00	0	0.00
23	Digital Objet Identifier	0	0.00	0	0.00	0	0.00	0	0.00
	Miscellaneous	6	7.41	2	2.90	1	2.50	9	4.74
	Total	81	100	69	100	40	100	190	100

Data Source: *Primary data*

In reference to the period 2005-2007, Table 5.5.5 shows that a total number of 13 (18.8%) articles were contributed on the subject Repository that acquired the highest number of article in the year. The other important subjects which achieved more attention of scholars are Archives and Digital library, both subject appeared with 10 (14.5%) articles each, but the digital library bagged lesser article in comparison to previous period. The subject Internet, and Interoperability appeared with 3 (4.3%) articles each, Social networking, and Intellectual property rights with 2 (2.9%) articles each, got better coverage in this period. While subjects like Bibliometric stduy, Library Management, Metadata, and Information Retrieval did not cover the numbers of articles as much as covered in previous period 2001-2004.

The Data of the period 2008-2010 from Table 5.5.5 clearly indicates that all listed subjects in the table, unable to contribute a good number of research articles in comparison to previous years 2005-2007. The subject Repository studies contributed maximum number of articles 6(15.0%) followed by the Digital Library, and Bibliometric study each with 5 (12.5%) articles. The topic Digitalisation, Internet, Information retrieval each contributed 3 (7.5%) articles consequently.

Overall, the observation of the period 2001-2010, It could be remarked that subjects Digital library 27 (14.2%), Repository 19 (10.0%), Bibliometric study 17(8.9) and Archives 15 (7.9%) was the major area for research articles. However, the subject such as like E-Resources, and Library management received equal attention and each contributed 14 (7.4%) articles.

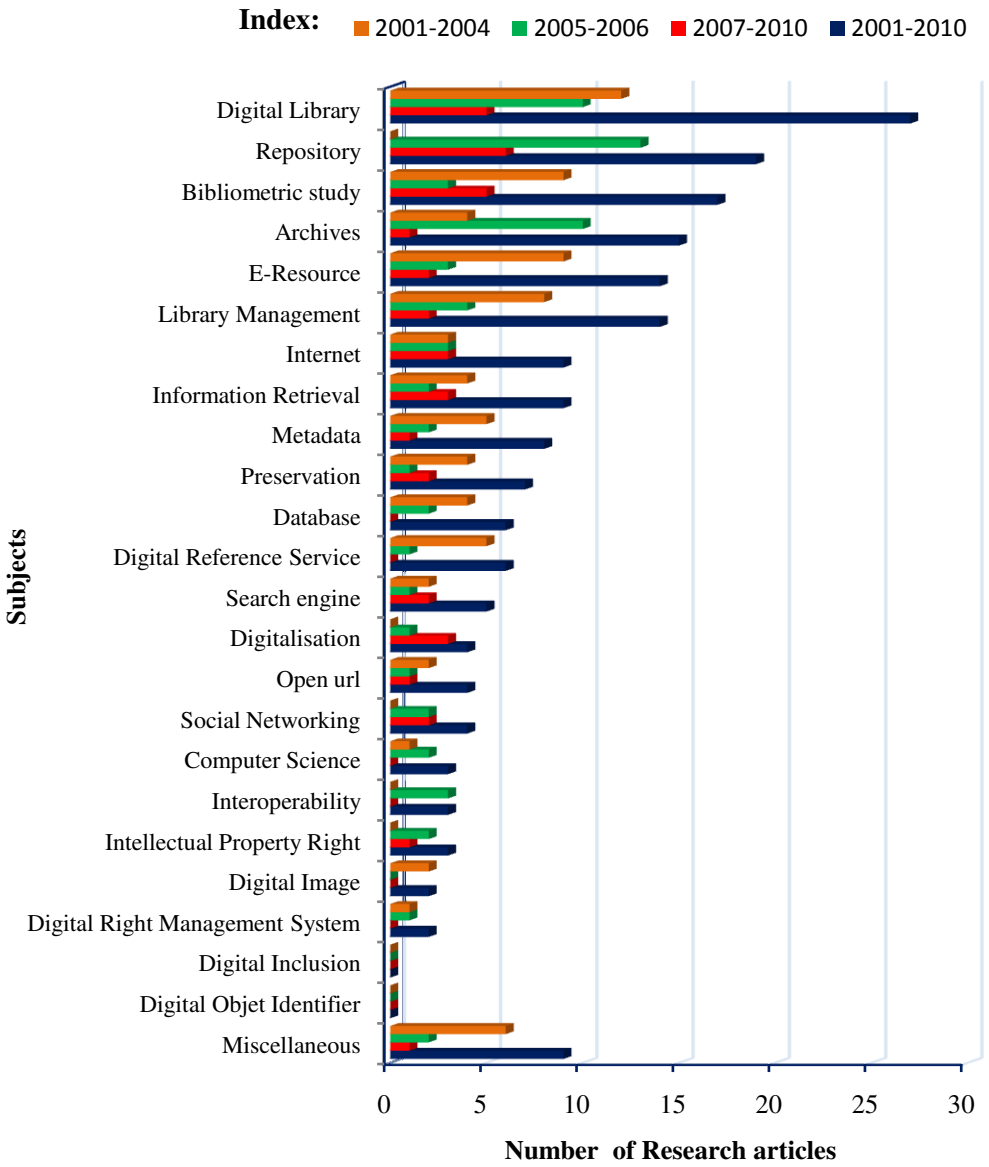

Figure 5.5.5: Distribution of research articles of *D-Lib Magazine* by subject

Data Source: *Primary data*

5.5.2.3 Subject wise Distribution of Non-research Articles

Table 5.5.6 shows the subject coverage of non-research articles. It reveals that 103 non-research articles were published during the period 2001-2004. It included 15 (14.6%) articles on Library Management, 14 articles (13.6%) on Interoperability, 10 articles (9.7%) on Digital right management system, 8 articles (7.8%) on Digital Library, and 7 articles (6.8%) on Database.

Table 5.5.6: Distribution of non-research articles of *D-Lib Magazine* by subject

S. No.	Subjects	Non-Research Articles in							
		2001-2004		2005-2007		2008-2010		2001-2010	
		No.	%	No.	%	No.	%	No.	%
1	Digital Library	8	7.77	3	4.76	2	4.26	13	6.10
2	Repository	1	0.97	1	1.59	3	6.38	5	2.35
3	Bibliometric study	2	1.94	1	1.59	0	0.00	3	1.41
4	Archives	2	1.94	0	0.00	2	4.26	4	1.88
5	E-Resource	4	3.88	1	1.59	0	0.00	5	2.35
6	Library Management	15	14.56	14	22.22	7	14.89	36	16.90
7	Internet	4	3.88	1	1.59	0	0.00	5	2.35
8	Information Retrieval	6	5.83	0	0.00	0	0.00	6	2.82
9	Metadata	6	5.83	3	4.76	3	6.38	12	5.63
10	Preservation	3	2.91	0	0.00	0	0.00	3	1.41
11	Database	7	6.80	5	7.94	5	10.64	17	7.98
12	Digital Reference Service	3	2.91	3	4.76	0	0.00	6	2.82
13	Search engine	1	0.97	3	4.76	0	0.00	4	1.88
14	Digitalization	1	0.97	1	1.59	1	2.13	3	1.41
15	Open URL	1	0.97	2	3.17	1	2.13	4	1.88
16	Social Networking	4	3.88	2	3.17	4	8.51	10	4.69
17	Computer Science	0	0.00	1	1.59	0	0.00	1	0.47
18	Interoperability	14	13.59	1	1.59	4	8.51	19	8.92
19	Intellectual Property Right	2	1.94	1	1.59	0	0.00	3	1.41
20	Digital Image	2	1.94	4	6.35	2	4.26	8	3.76
21	Digital Right Management System	10	9.71	8	12.70	2	4.26	20	9.39
22	Digital Inclusion	6	5.83	7	11.11	7	14.89	20	9.39
23	Digital Objet Identifier	1	0.97	0	0.00	2	4.26	3	1.41
	Miscellaneous	0	0.00	1	1.59	2	4.26	3	1.41
	Total	103	100	63	100	47	100	213	100

Data Source: *Primary data*

The rest 49 (47.5%) articles were contributed by the eighteen subjects listed in Table 5.5.6. In the period 2005-2007, the number of non-research articles decreased to 63 articles. In this period, the scholar paid attention on the topics Library management with 14 (22.2%), Digital right management system with 8 (12.7%), Digital inclusion with 7 (11.1%) and Database with 5 (7.9%) articles. Together these four subjects produced 53.9% of total non-research articles. The rest 29 (46.1 %) articles fall in the eighteen subjects.

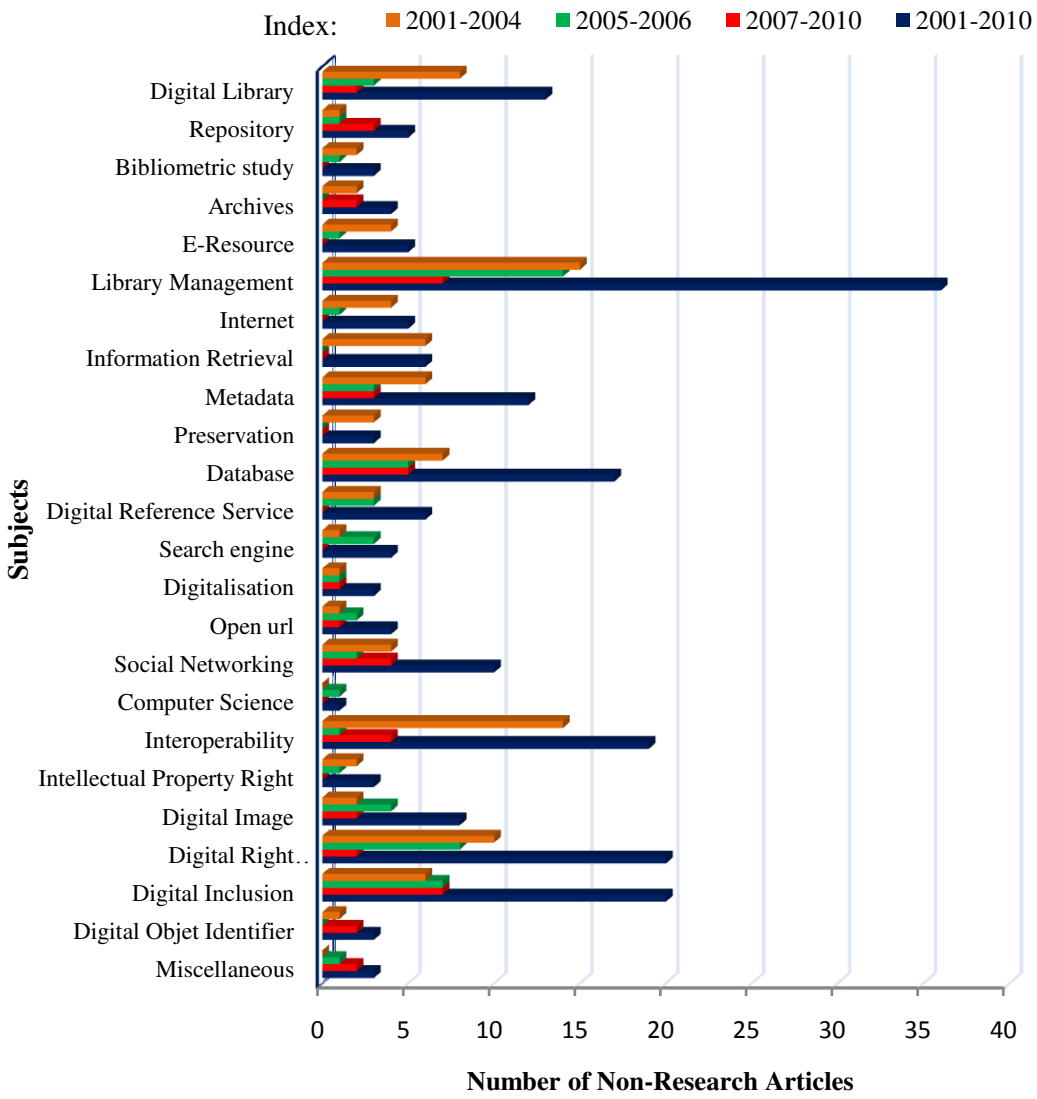

Figure 5.5.6: Distribution of non-research articles of *D-Lib Magazine* by subject

Data Source: *Primary data*

During the next period (2008-2010), only 47 non-research articles were published. The large proportion of the articles covered by the subjects Library management with 7 (14.9%) articles, Digital inclusion with 7 (14.9%) articles, and Database with 5 (10.6%) articles. Some subjects such as User study, E-resource, Internet, Information retrieval, Preservation, Digital reference service, Search engine, Computer science, and Intellectual property right did not attract the attention of scholars for non–research articles.

It could be noticed from Figure 5.5.6 that the subject Library management, Digital inclusion, Digital right management system, Interoperability and Database were the first choice of the scholars for non-research articles throughout the period (year 2001-2010). However, Digital library, Metadata, Social networking and Digital image were also among the subject that gained non-research article during the studied period (2001-2010).

5.6 Testing of Hypotheses

This study has two hypotheses that have been tested under this section with appropriate data and statistical tool.

5.6.1 Hypothesis-one

H_0 There is no significant variation in the pattern of level of collaboration among authors over the time segments of the study period .

Above mentioned hypothesis has been tested using χ^2 (chi Square) statistical tool for both journals (*Scientometrics* and *D-Lib magazine*):

χ^2 Test

5.6.1.1 Scientometrics (Journal)

Table H1.1.1: Observed value of collaboration in *Scientometrics*
(see Table 5.3.5)

Time Segments (Yrs)	Level of Collaboration				Total (%)
	Local	National	International	No Collaboration	
	No. (%)	No. (%)	No. (%)	No. (%)	
2001-2004	110 (32.64)	61 (18.10)	50 (14.84)	116 *(34.42)*	337(100)
2005-2007	118 *(32.59)*	75 (20.71)	62 (17.13)	107 (29.55)	362(100)
2008-2010	171 *(31.55)*	122 (22.50)	97 (17.89)	152 (28.04)	542(100)
Total	399	258	209	375	1241

Table H1.1.2: Expected value of variables

Time Segments (Yrs)	Level of Collaboration			
	Local	National	International	No Collaboration
	Value	Value	Value	Value
2001-2004	108.351	70.061	56.755	101.833
2005-2007	116.388	75.259	60.965	109.388
2008-2010	174.261	112.680	91.280	163.779

Table H1.1.3: (Observed value − Expected value)^2/Expected value

Time Segments (Yrs)	Level of Collaboration			
	Local	National	International	No Collaboration
	Value	Value	Value	Value
2001-2004	0.025	1.172	0.804	1.971
2005-2007	0.022	0.001	0.018	0.052
2008-2010	0.061	0.771	0.358	0.847

$$\boldsymbol{\chi^2} = \sum_{i=1}^{n} (\mathrm{O}_i - \mathrm{E}_i)^2/\mathrm{E}_i$$

Here, 'O' is Observed value.

'E' is Expected value.

Sample size is 1241.

Expected value of each cell (E) $= (row\ total * Column\ total)/Saple\ size$

Degree of freedom (*df*) $= (no.of\ row - 1)/(no.of\ column - 1)$

Significant level $(\alpha) = 0.05$

Critical value of at 6 *df* and at 0.05 significant level (α) is 12.5

So,

$$\boldsymbol{\chi^2} = 0.025 + 1.172 + 0.804 + 1.971 + 0.022 + 0.001 + 0.018 + 0.052 + 0.061 + 0.771 + 0.358 + 0.847$$

$$= \mathbf{6.102}$$

P-value at *6.102* $\boldsymbol{\chi^2}$ with *df 6* at α level *0.05* is 0.412

P-value=0.412

Thus,

P-value > α *and*

χ^2 Value is less than critical value (6.102<12.5)

So, the null hypothesis has been accepted.

5.6.1.2 D-Lib Magazine

Table H1.2.1: Observed value of collaboration in *D-Lib Magazine*

(see Table 5.3.13)

Time Segments (Yrs)	Level of Collaboration				Total (%)
	Local	National	International	No Collaboration	
	No. (%)	No. (%)	No. (%)	No. (%)	
2001-2004	57 (30.98)	46 (25.00)	12 (06.52)	69 ***(37.50)***	184 (100)
2005-2007	59 ***(37.82)***	23 (14.74)	62 (39.74)	12 (07.69)	156 (100)
2008-2010	27 ***(42.86)***	14 (22.22)	11 (17.46)	11 (17.46)	63 (100)
Total	143	83	85	92	403

Table H1.2.2: Expected value of variables

Time Segments (Yrs)	Level of Collaboration			
	Local	National	International	No Collaboration
	Value	Value	Value	Value
2001-2004	65.290	37.896	38.809	42.005
2005-2007	55.355	32.129	32.903	35.613
2008-2010	22.355	12.975	13.288	14.382

Table H1.2.3: (Observed value − Expected value)^2 /Expected value

Time Segments (Yrs)	Level of Collaboration			
	Local	National	International	No Collaboration
	Value	Value	Value	Value
2001-2004	1.053	1.733	18.519	17.349
2005-2007	0.240	2.594	25.731	15.656
2008-2010	0.965	0.081	0.394	0.795

Here,

Sample size is 403.

Expected value of each cell (E) $= (row\ total * Column\ total)/Saple\ size$

Degree of freedom (*df*) $= (no.of\ row - 1)/(no.of\ column - 1)$

Significant level $(\alpha) = .05$

Critical value of at 6 *df* and at 0.05 significant level (α)= 12.5

So,

$$\boldsymbol{\chi^2} = 1.053 + 1.733 + 18.519 + 17.349 + 0.240 + 2.594 + 25.731 + 15.656 + 0.965 + 0.081 + 0.394 + 0.795$$

$$= \mathbf{85.110}$$

P-value at *85.110* $\boldsymbol{\chi^2}$with *df 6* at α level *0.05* is less than *0.0001*

P-value*<0.001*

Thus ,

P-value $< \alpha$ *and*

χ^2 Value is greater than critical value (85.110>12.5)

So, the null hypothesis has been rejected.

Thus, the test finds that the null hypothesis 'There is no significant variation among author has been accepted in case of t Journal *Scientometrics* and has been rejected in case of *D-Lib Magazine*

5.6.2 Hypothesis-Two

H_0 There is no significant difference in the frequency of keywords occurred during 2001-2005 and 2005-2010.

The above mentioned hypothesis has been tested with **t −Test** statistical tool for both journals (*Scientometrics* and *D-Lib Magazine*):

t −Test

5.6.2.1 Scientometrics (Journal)

Table H2.1.1: Descriptive statistics of keywords (*Scientometrics*)

S. No.	Keywords	Frequency		Difference (X-Y)	Square of D
		1st period (2001-2005)	2nd Period (2006-2010)		
		X	Y	D	D^2
1	Academic Patent	107	27	80	6400
2	Academic Rank	21	103	-82	6724
3	ANOVA	16	75	-59	3481
4	ARWU	0	89	-89	7921
5	Author Co-citation analysis	14	102	-88	7744
6	Author Productivity	18	26	-8	64
7	Author Rank	0	21	-17	289
8	Authorship	345	535	-190	36100
9	Authorship Pattern	17	20	-3	9
10	Back link	0	48	-48	2304
11	Bayesian Analysis	5	14	-9	81
12	Betweeness-centrality	22	154	-132	17424
13	Bibliography	190	257	-67	4489
14	Bibliographic Coupling	111	146	-35	1225
15	Bibliography Database	50	36	14	196
16	Bibliometric Analysis	831	1155	-324	104976
17	Bibliometric Approach	16	46	-30	900
18	Bibliometric Data	52	93	-41	1681
19	Bibliometric Evaluation	0	23	-18	324
20	Bibliometric Indicator	157	319	-162	26244
21	Bibliometric Law	16	7	9	81
22	Bibliometric Map	26	58	-32	1024
23	Bibliometric Rank	0	20	-18	324
24	Bibliometric tool	0	20	-13	169
25	Bradford Law	56	24	32	1024
26	Case Study	154	202	-48	2304
27	Centrality	475	1100	-625	390625
28	Citation Age	11	10	1	1
29	Citation Analysis	181	449	-268	71824

30	Citation Count	283	678	-395	156025
31	Citation Curve	11	44	-33	1089
32	Citation Distribution	163	138	25	625
33	Citation Environment	40	32	8	64
34	Citation Frequency	96	161	-65	4225
35	Citation Impact	220	500	-280	78400
36	Citation Index	448	706	-258	66564
37	Citation Indicator	68	144	-76	5776
38	Citation link	40	39	1	1
39	Citation Network	59	144	-85	7225
40	Citation Pattern	87	161	-74	5476
41	Citation Rank	21	55	-34	1156
42	Citation Rate	160	360	-200	40000
43	Citation Score	59	49	10	100
44	Citation Trend	0	10	-9	81
45	Citation Window	89	220	-131	17161
46	Citing Behavior	0	26	-21	441
47	Citing Half Life	99	144	-45	2025
48	Citing Journal	111	141	-30	900
49	Citing Paper	398	677	-279	77841
50	Citing Pattern	28	15	13	169
51	Cited Source	22	34	-12	144
52	Cluster Analysis	1186	1171	15	225
53	Co-author Analysis	642	1231	-589	346921
54	Co-authorship Link	11	27	-16	256
55	Co-authorship Network	45	169	-124	15376
56	Co-authorship Relation	12	6	6	36
57	Co-citation Analysis	230	437	-207	42849
58	Co-citation Cluster	678	1163	-485	235225
59	Co-citation Count	10	21	-11	121
60	Co-citation Link	0	18	-10	100
61	Co-citation Map	0	19	-13	169
62	Co-efficient	409	620	-211	44521
63	Co-in Link	5	101	-96	9216
64	Co-link Analysis	118	265	-147	21609
65	Collaboration Activity	25	50	-25	625
66	Collaboration Network	47	233	-186	34596
67	Collaboration Pattern	66	113	-47	2209
68	Collaboration Relationship	0	34	-30	900
69	Collaboration Research	30	106	-76	5776
70	Compare Analysis	23	47	-24	576
71	Complex Network	10	35	-25	625
72	Composite Indicator	14	45	-31	961
73	Content Analysis	50	83	-33	1089

74	Co-occurrence Analysis	91	192	-101	10201
75	Co-operation Network	0	19	-13	169
76-243	Other 165 keywords	12394	24503	-12109	Null
	Total:	21672	40587	-18721	10230009

Formulas for t-score

$$\boldsymbol{t} = \frac{(\Sigma D)/N}{\sqrt{\frac{\Sigma D^2 - ((\Sigma \mathrm{D})^2/N)}{(N-1)*N}}}$$

Where,

'D' is differences of frequencies, and

'N' is number of keywords.

Sample size (number of keywords) is 243.

Degree of freedom (*df*) $= (no.of\ row - 1)$

$$= (243 - 1)$$

$$= 242$$

Significant level $(\alpha) = .05$

$$\boldsymbol{t} = \frac{(-18271)/243}{\sqrt{\frac{10230009 - ((-18271)^2/243)}{(243-1)*243}}}$$

$$= \frac{-77.840}{\sqrt{\frac{10230009 - (337777225/243)}{58806}}}$$

$$= \frac{-78.004}{\sqrt{\frac{10230009 - 147234.259}{(243-1)*243}}}$$

$$= \frac{-78.004}{\sqrt{\frac{8757674.741}{58806}}}$$

$$= \frac{-78.004}{\sqrt{148.925}}$$

$$= \frac{-78.004}{12.203}$$

$$= -6.378$$

P-value at *-6.378* $\boldsymbol{t}$ **score** with *df 242* at α level *0.05* is less than *0.0001*

P-value*<0.001*

Thus,

P-value $< \alpha$

Hence, the result is significant at p<0.05, so the test concludes that the 2nd null hypothesis in reference to *Scientometrics* journal has been rejected.

5.6.2.2 D-Lib Magazine

Table H2.2.1: Descriptive statistics of keywords (*D-Lib Magazine*)

S. No.	Keywords	Frequency		Difference (X-Y)	Square of D
		1st period (2001-2005)	2nd Period (2006-2010)		
		X	Y	D	D^2
1	Add-ons	0	55	-55	3025
2	Advertisements	54	23	31	961
3	Aggregators	261	298	-37	1369
4	Analog	83	38	45	2025
5	Annotation	91	382	-291	84681
6	Art Museums	25	14	11	121
7	Automation	282	154	128	16384
8	Bibliographical Records	47	26	21	441
9	Bibliography	57	31	26	676
10	Blog	34	80	-46	2116
11	Bookmarks	115	35	80	6400
12	Catalogue	534	214	320	102400
13	Citation	347	238	109	11881
14	Classification	212	108	104	10816
15	Clustering	150	110	40	1600
16	Collection Management	83	63	20	400
17	Conservation	36	19	17	289
18	Consortium	166	68	98	9604
19	Content Management	20	19	1	1
20	Conversion	217	130	87	7569
21	Co-occurrence	12	11	1	1
22	Copyright	346	650	-304	92416
23	Cross Reference	101	11	90	8100
24	Cultural Heritage	65	84	-19	361
25	Data Mining	31	40	-9	81
26	DCMI	199	35	164	26896
27	Digital Archive	50	75	-25	625
28	Digital Collections	110	149	-39	1521
29	Digital Curation	17	10	7	49
30	Digital Formats	43	18	25	625
31	Digital Image	46	30	16	256
32	Digital Information	47	24	23	529
33	Digital Library Federation	15	12	3	9

34	Digital Library Service	27	17	10	100
35	Digital Material	113	36	77	5929
36	Digital Museums	18	12	6	36
37	Digital Newspapers	18	16	2	4
38	Digital Object	499	413	86	7396
39	Digital Preservation	333	130	203	41209
40	Digital Repository	64	169	-105	11025
41	Digital Resource	95	99	-4	16
42	Digital Right	54	10	44	1936
43	Digital Technology	37	17	20	400
44	Document Delivery	16	21	-5	25
45	DOI	262	58	204	41616
46	DSpace	288	293	-5	25
47	Dublin Core	404	134	270	72900
48	E -Book	416	20	396	156816
49	E -Commerce	19	10	9	81
50	E -Content	17	22	-5	25
51	E - Journal	250	25	225	50625
52	E -Learning	14	22	-8	64
53	E- Resources	111	67	44	1936
54	Educational Resource	56	33	23	529
55	End User	124	142	-18	324
56	Engineering	325	172	153	23409
57	E-print	278	76	202	40804
58	Exhibitions	55	67	-12	144
59	Federated Search	35	15	20	400
60	FEDORA	106	85	21	441
61	File Format	72	53	19	361
62	Forum	92	43	49	2401
63	Gateway	168	25	143	20449
64	Geographical System	181	54	127	16129
65	Google	212	227	-15	225
66	Google Scholar	28	14	14	196
67	Greenstone	231	19	212	44944
68	Handle System	35	42	-7	49
69	HTML	209	103	106	11236
70	Hyperlinks	49	10	39	1521
71	Index	579	254	325	105625
72	Information Dissemination	17	21	-4	16
73	Information Literacy	36	23	13	169
74	Information Management	35	40	-5	25
75	Information Objects	81	23	58	3364
76-412	other 337 keywords	17455	11836	5619	Null
	Total:	27410	18222	9188	2308774

Formulas for t-score

$$\boldsymbol{t} = \frac{(\Sigma D)/N}{\sqrt{\frac{\Sigma D^2 - ((\Sigma \mathrm{D})^2/N)}{(N-1)*N}}}$$

Where,

'D' is differences of frequencies, and

'N' is number of keywords.

Sample size (number of keywords) is 412.

Degree of freedom (*df*) $= (no.of\ row - 1)$

$= (412 - 1)$

$= 411$

Significant level $(\alpha) = .05$

$$\boldsymbol{t} = \frac{9188/412}{\sqrt{\frac{2308774 - ((9188)^2/412)}{(412-1)*412}}}$$

$$= \frac{22.301}{\sqrt{\frac{2308774 - (84419344/412)}{411*412}}}$$

$$= \frac{22.301}{\sqrt{\frac{2308774 - 204901.320}{169332}}}$$

$$= \frac{22.301}{\sqrt{\frac{2103872.680}{16332}}}$$

$$= \frac{22.301}{\sqrt{12.425}}$$

$$= \frac{22.301}{3.525}$$

$$= 6.237$$

P-value at *6.237* $\boldsymbol{t}$ **score**with *df 411* at α level *0.05* is less than *0.0001*

P-value*<0.001*

Thus,

P-value $< \alpha$

Hence, the result is significant at p<0.05, so the test concludes that the 2nd null Hypothesis in reference *D-Lib Magazine* has been rejected.

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Chapter 6

Findings, Conclusion and Suggestions

Every analysis leads to findings, conclusion and suggestions which is the principal outcome of a research. Findings and suggestions of a research vary accordingly methodology and data set. It may establish a new fact or give a new meaning to the accepted concept or discard old concept in the light of acquired facts and knowledge of research. Findings give shape to the conclusion which is the ultimate objective of a research. The study of scholar going through different stages of scientific research leads to findings and conclusion of the study.

6.1 Findings

The chapter five (Analysis of Data and Interpretation) at its best results in numbers of findings that are very crucial part of the study. The findings are given as following in different section according to objectives of the study.

6.1.1 Intellectual Structure

The study comes across following findings to fulfill the objective one (to identify the intellectual structure of existing journals).

6.1.1.1 Scientometrics (Journal)

1) During the year 2001-2005, the keywords Co-authorship, Network analysis, Co-citation analysis, Lotka law, Impact factor, Self citation, Citation half life, University patent, Domestic collaboration, Collaboration network, Web link analysis, Patent analysis, Text analysis, Co-occurrence analysis, Information retrievals, Scientometrics analysis, Cluster analysis are the important research topics which have robust link with other keywords.

2) In the year 2006-2010, the topics Bibliometric Indicator, Bibliometric analysis, Patent analysis, Scientific output, Academic ranking, Co-citation analysis, citation Index, Lotka law, H-Index, Web citation, Patent citation, Network analysis, Infometrcis, Web link analysis, Network structure, Scientometrics analysis, Scientific collaboration, Bibliographic coupling Author co-citation, International Collaboration, Webometrics became the main topics for research having many co-occurrences with other keywords.

3) The study finds that the topics Bibliometric law, Bibliometric characteristics, Co-authorship relation, Quantitative content analysis, and Inventor author did not occur in the second phase (2006-2010) of the study period (see Table B2 of Appendix B).

4) Some consistent topics that appeared in both phases of the period (2001-2005 and 2006-2010) with good link strength and frequency are Co-citation analysis, Network analysis, web link analysis, Lotka law, Collaboration network, Patent analysis

5) Some topics that appeared with less importance (with no or less link and less frequency) in the second phase of the period (2006-2010) are Cluster analysis, Content analysis, Self citation, University patent, Bradford law, Zip law and so on (see Table B5 of Appendix B).

6) It also identifies 52 new emerged topics (see Table B4 of Appendix B) that did not appear during the previous period (2001-2005). Some new emerged topics that appeared with good frequency and link are H-indicator, ARWU (Academic World Ranking of Universities), Back-link, Knowledge mapping, Web co-link analysis, Trend analysis, Intra-regional collaboration, Co-citation link, Distributional model, H(2)index, and Citation performance, during the period 2006-2010.

6.1.1.2 D-Lib Magazine

1) The study finds some robust and Important research topics of the period 2001-2005, the topics are Information technology, Library services, Strategic planning, Literature, Information literacy, Digital preservation, Cultural heritage, Digital references, Aggregators, E-commerce, E-resources, Index, Vocabulary, Retrieval system, Information retrieval, Search engine, Search service, Network, Infrastructure, Microfilm, Public domain, Internet, Web services, Web crawler, Web preservation, Web page, Web sites, HTML (Hyper-Text Mark Up Language), Protocol, MARC (Machine Readable catalogue), DCMI (Dublin core Metadata Initiative), Metadata harvesting, Metadata standard, Metadata initiative, Interoperability, Open archives, Museum, Semantic analysis, Photographs, Periodical, Bound journal, and Intellectual property.

2) In the year 2006-2010, the topics Open source, Network, Automation, Ontology, Retrieval system, Semantic analysis, Semantic integration, Protocol, Information system,

E-book, Collection management, Website, Strategic plan, Search engine, Research institute, University library, End user, Interoperability, Multimedia, Index, Digital news paper, Quality control, Digital information, Digital repository, Librarianship, Digital collections, HTML, DOI, Onix, ISBN, Cultural heritage, Social tagging, Dublin Core, Interoperability, Metadata standard, Restoration, Digital library software, Digital curation, Digital image, Digital preservation, Digital right, Digital library, Archives, and Security are the focused topic that has a good strength of link and frequency.

3) The study reveals 156 topics (see Table B8 of Appendix B) that did not occur in the second phase of the period (2006-2010). Some of them are Web crawler, digital references, Fair use, E format, Virtual library, Noosphere system, Renardus, Risk management, Virtual spine, Digital media, Direct query language, Subject gateway, Hypermedia, Information Visualisation.

4) Some consistent topics that appeared in both phase of the period with good link strength and frequency relatively are Retrieval system, website Network, Digital object, Interoperability, Librarianship, citation, copyright, Periodicals, HTML, Protocal Search engine, Strategic planning, Metadata harvest, automation and open source, metadata initiative.

5) Some topics that appear with less importance in the second phase of the period (2006-2010) are Semantic analysis, Cross reference, Bookmarks, Digital preservation, E-print, Intellectual property, Gateway, E-book, Hyperlink, MPEG21, OhioLink, Preprints, Self archiving and User interface, Open-URL framework, DCMI and others (see Table B11 of Appendix B).

6) This study identifies 53 new emerged topics (see table B 9 of appendix B) that did not appear during the previous period (2001-2005). Some of them appeared with good frequency and link are H-indicator, ARWU(Academic World Ranking of Universities), Back-link, Knowledge mapping, web Co-link analysis, trend analysis, Intra-regional collaboration, co-citation link and Distributional model, H(2)index, Citation performance, Open-URL framework

6.1.2 Citation Pattern

The analysis of citation pattern of *Scientometrics* and *D-Lib Magazine* reached at following findings to fulfill the objective two (to identify the citation patter of existing in serials).

6.1.2.1 Scientometrics (Journal)

1) The study finds that there were approximately 97% of the total cited resources were Print Resource while 3% of the total resources were Electronic Resources.

2) The highly cited form of resources are Journals and Books. These forms of resources together produced approximately 85% of the total cited resources.

3) The highly concentration of each form of cited resources finds in Six subjects that are Bibliometric studies, Citation analysis, Scholarly publication, Bibliometric index, Scientometrics, and Webometrics.

4) This study found that the scattering pattern of cited journals in *Scientometrics* did not follow the Bradford's Law of Journals' Scattering pattern.

5) This study make known that there were two core journals (*Scientometrics*, and *Journal of the American Society for Information Science and Technology*) that produced 35.68% citation to research under the umbrella of *Scientometrics* journal.

6) The largest share of cited resources (27.19%) belong to itself *Scientometrics* journal and 8.49% of the share of cited resources come from the *Journal of the American Society for Information Science and Technology*).

7) In term of authorship pattern of cited resources, the study identifies that approximately 46% cited resources are written by single author followed by two authors (26.94%) and three authors (12.26%) and so on. Overall, there is dominance of multi authored papers.

8) There are a total of 11388 unique authors consist of primary authors, co-authors, and corporate bodies who have contributed 16602 citations.

9) The study finds out the most cited primary author in *Scientometrics* journal over the period (2001-2010) is Glanzel, W. (*Wolfgang Glänzel, Katholieke University Leuven,*

Belgium) followed by Garfield, E. (*Eugene Garfield, died on 26 Feb. 2017*), Leydesdorff, L. *(loet leydesdorff, University of Amsterdam, Netherlands*) and so on.

10) The study also found the most frequently cited secondary author (Co-author) in *Scientometrics* is Rousseau, R. **(***Ronald Rousseau, Katholieke University Leuven, Belgium***)** followed by Schubert, A. (*András Schubert, Hungarian Academy of Sciences, Hungary*), Glanzel, W. (*Wolfgang Glänzel, Katholieke University Leuven, Belgium)*, Moed, H. F. *(Henk F. Moed, Sapienza University Rome, Italy*) and so on.

11) In respect of Citation age, the study identified that the highest share of cited resources (approximately 44%) are 1-5 years old. The age of cited resources varies between <1 to 167 year.

12) The study brought forth the facts that most of cited resources of *Scientometric*s journal published form United State of America followed by Netherlands, United Kingdom. These countries published 84% cited resources of *Scientometrics* journal.

13) In term of languages of cited resources, the study finds that 96% of cited resources are in English language, 1% in Spanish, 1% in German and so on.

6.1.2.2 D-Lib Magazine

1) This study reveals that there are approximately 60% of cited resources that are Electronic Resources while 40% resources are Print Resources.

2) The study finds that Web resource, Journal, and Proceeding are the major forms of cited resources and these resources cumulatively account for approximately 83% of total cited resources.

3) In term of the subject of cited resources, the high concentration of cited resources are found in six subjects that are Digital library, Internet, Library science, Digital archive & preservation, Electronic publication, Metadata. These subjects aggregately cover the proportion of 62% of total cited resources.

4) This study reveals that the scattering pattern of cited journals in the field of Digital library does not fit to Bradford's Law of Journals' scattering pattern.

5) This study finds that in the field of Digital library, there are two journals (*D-Lib Magazine, and Journal of the American Society for Information Science and Technology*) in the core zone that covers 33.64% of cited resources in this phenomena.

6) The highest share of cited journal (32.42%) belongs to *D-Lib Magazine* itself and 3.33% share come from a journal *D-Lib Magazine*

7) In term of authorship pattern of cited resources, the study finds that approximately 35% cited resources are written by single author followed by two authors (15.31%) and three authors (7.20%) and so on. This journal also had dominance of multiple authored papers during the period (2001-2010).

8) There are a total of 4732 unique authors consist of primary authors, co-authors, and corporate bodies who contributed 5437citations.

9) The study reveals the most frequently cited primary author in *D-Lib Magazine* over the period (2001-2010) is Van De Sompel, Herbert (*Herbert Van de Sompel, Belgian librarian*) followed by Lagoze, C. (*Carl Lagoze, University of Michigan, USA*), Tenopir, C. (*Carol Tenopir, University of Tennessee, USA*), Lynch, C. (*Clifford Lynch, University of California, USA*) and so on.

10) The study also find the highest cited secondary author (Co-author) is Van De Sompel, Herbert (*Herbert Van de Sompel, Belgian librarian*) followed by King, D. W. (*Donald W. King, University of Pittsburgh*), Lagoze, C. (*Carl Lagoze, Cornell University, USA*), Hochstenbach, P. (*Patrick Hochstenbach, Ghent University, Belgium*) and so on.

11) In respect of Citation age, the study identifies the highest share of cited resources (approximately 49%) are 1-5 years old, and approximately 13% of total citation <1 year old. The age of cited resources varies between <1 to 194 years.

12) The study finds that most of the cited resources of *D-Lib magazine* published from United State of America (USA) followed by United Kingdom (UK), and Germany. These countries published approx. 80% cited resources of *D-Lib Magazine*.

13) In term of languages of cited resources, the study reveals that 99% of cited resources are in English language, 0.26% in Spanish, 0.15% in Dutch and so on.

6.1.3 Authorship Pattern and Collaborative Trend

The analysis of data related to the author who published papers in journal *Scientometrics*, and *D-Lib Magazine* during the period 2001-2010 has drawn up following findings to fulfill third objective (*To identify the authorship and collaborative among the authors*):

6.1.3.1 Scientometrics (Journal)

1) It is found that there was a constant growth in the number of *Scientometrics* journal during the period 2001-2010 and articles reach to 226 (in the year 2010) from 88 articles (in the year 2001).

2) The study reveals that there are 1241 articles which are equipped with the idea of 1547 unique authors over the years (2001-2010).

3) In term of Authorship pattern, the largest share of articles is written in collaboration with two authors in comparison to single authors (i.e. 30%) and others.

4) This study identifies the value of collaboration index among authors which vary between 2.78 to 3.09.

5) The value of collaboration co-efficient for the period 2001-2010 was found 0.42, which indicates moderate good collaboration among authors.

6) In term of types of collaboration, this study observed an identical trend over the period. The largest share (32.15%) of published articles was the result of local collaboration. And 30% of articles were written without any collaboration.

7) The share and numbers of authors who appeared in collaboration once increased and the share of authors who appeared twice, thrice, and more declined over the period (2001-2010).

8) The most prolific primary author of the period is Glanzel, W (*Wolfgang Glänzel, Katholieke University Leuven, Belgium*) followed by Garfield, E. (*Eugene Garfield, died on 26 Feb. 2017*), and Leydesdorff, L (*loet leydesdorff, University of Amsterdam, Netherlands*), and so on.

9) The most prolific secondary author (Co-authors) of the period is Rousseau, R. (*Ronald Rousseau, Katholieke University Leuven, Belgium*), followed by Glanzel, W. (*Wolfgang*

Glänzel, Katholieke University Leuven, Belgium), Debackere, K (*Koenraad Debackere*, *Katholieke University Leuven, Belgium),* and so on.

6.1.3.2 D-Lib Magazine

1) In terms of publication growth, the study found a sharp downtrend line in the phenomena of publication of articles in *D-Lib Magazine* which indicates a negative growth in publication over the study period

2) The study finds that there are 403 articles which are equipped with the idea of 794 unique authors over the period (2001-2010).

3) In term of Authorship pattern, the largest share of articles was written by single author (i.e. 33%) during the year 2001-2010, but the number of papers by single authors declined over different phases of the period. Aggregately, there is a dominance of multiple of authors.

4) This study identifies the value of collaboration index among authors which vary from 3.15 to 3.50.

5) The value of collaboration co-efficient found between 0.41-0.45 over the period of this study which indicates moderate good collaboration among authors.

6) In term of types of collaboration, this study observes the largest share (35.5%) of published articles is the result of local collaboration. Only 28.2% of articles were published without any collaboration. It also found that the number of articles in local collaboration decreased while the number of articles in International collaboration increased, over the period.

7) There is the largest proportion of co-authors who appeared in collaboration once but the number and share of such authors decreased over the period. The share of authors who appeared twice, and more declined but the number of authors who appeared thrice increased over the period (2001-2010).

8) The most prolific primary author of the period (2001-2010) is Van De Sompel, H. (*Herbert Van de Sompel, Belgian librarian*) followed by Arms, W.Y. (*William Y. Arms,*

Cornell University, USA), Zia, L. L. (*Lee L. Zia, Undergraduate Education National Science Foundation, USA*) and so on.

9) The most prolific secondary author of the period (2001-2010) is Nelson, M. L. (*Michael L. Nelson, Old Dominion University, USA*) followed by Lagoze, C. (*Carl Lagoze, Cornell University, USA*), Van De Sompel, H. (*Herbert Van de Sompel, Belgian librarian*) and so on.

6.1.4 Institution wise publication and institutional Affiliation of Authors

The study presents following findings for both journals to fulfill the fourth objective (*To identify institution wise publication and institutional affiliation to authors*):

6.1.4 .1 Scientometrics (Journal)

1) In term of institutional output towards *Scientometrics,* There are 711 institutions over the year that contributed articles to *Scientometrics*. Katholieke Universiteit Leuven, Belgium has been ranked first in the order by contributing 74 articles. The Leiden University, Netherland was placed second; Hungarian Academy of Sciences, Hungry placed third, and Natl. Institute of Science, Tech. & Devmt. Studs. (National Institute of Science, Technology & Development Studies, India) is ranked fourth in the order.

2) In reference to Institutional affiliation to authors, Katholieke Universiteit Leuven (Belgium) ranked first in the order. University of Granada (Spain) is placed second followed by Leiden University, Hungarian Academy of Sciences, Hungry, and Natl. Insti. of Sc.Tech. & Devel. Stud. (National Institute of Science, Technology & Development Studies, India) and so on.

3) This study identifies that approximately 82% authors belong to Academic Instructions over the year.

6.2.4 .2 D-Lib Magazine

1) In term of institutional output towards *D-Lib Magazine*, There are 285 institutions over the studied period that contributed articles to *D-Lib Magazine*. The Online Computer Library Center (USA) is ranked first in the order by contributing 24 articles. The Cornell University (USA) is placed second; The Los Alamos National Laboratory (USA) is

placed third; University of California (USA) and Old Dominion University (USA) both were ranked fourth in the order and so on.

2) In reference to Institutional affiliation of authors, The Cornell University (USA) is ranked first in order. In that order, the Online Computer Library Center (USA) is placed second followed by University of Michigan (USA), University of California (USA), Old Dominion University (USA), and so on.

3) This study also reveals that largest share (approximately 71%) of author belong to Academic Institutions over the period (2001-2010).

6.1.5 Subject Coverage of Research and Non-research Articles

The analysis of data related to research and non-research articles give forth following findings to fulfill the last objective (To identify subject coverage of research and non-research articles):

6.1.5.1 Scientometrics (Journal)

1) It is found that since the year 2001, the number of research articles was constantly growing and the proportion was reached to approximately 94% (in the year 2010) from 83% (in the year 2001) of total articles published.

2) The growth of non-research articles declined since 2001 and it reached to 6 % (in the year 2010) from 17% (in the year 2001) of total published articles.

3) In term of subject coverage of articles, it is found that 49% of the research articles concentrated on only five subjects (Bibliometric study, Citation studies, Collaboration analysis, Research output, Scientometrics).

4) It is found that approximately 65% of non-research articles fall under the five subjects that are Bibliometrics study, Patent analysis, Statistics, Research assessment, and Scientometrics.

6.1.5.2 D-Lib Magazine

1) In the term of research articles publication in *D-Lib Magazine*, the study reveals a downtrend line which indicates a negative growth over the period (2001-2010). The proportion of research articles always became smaller to non-research articles during the studied period.

2) In case of non-research articles, the study identifies a downtrend line ,which indicate negative growth during the period 2001-2010. However, the proportion non-research articles larger to research articles.

3) In term of subject coverage of articles, it is found that approximately 56% of the research articles concentrated on only five subjects that are Digital Library, Repository, Library Research, Archives, E-Resource and library science.

4) The study finds that approximately 59% of non-research articles fall under the six subjects that are Digital right management system, Digital Inclusion, Digital library, Interoperability, Database, and Library science.

6.2 Discussion

This study identifies the topics on which scholars bring forward their ideas through Journals' articles in the field of Scientometrics and Digital library during a decade of the period 2001-2010. It analysed Bibliometrics attributes of the made communications in the journals. This study finds co-word analysis as an important tool to identify the themes of communication with the help of linkage and association of different topics through the analysis of co-occurrences and frequencies of keywords and phrases. As we know, increasing frequency of keywords not only measures the topics' importance but also its association with different keywords provide a detailed structure through which subject trend and formed pattern of publication can be identified. This study discovers the core, marginal and obsolete topics of Scientometrics, and Digital library using the contents of the *Scientometrics* journal, and *D-Lib Magazine*.

The study illustrates the communication pattern of scholars' ideas made through the journals (*Scientometrics* and *D-Lib Magazine*) by studying the attributes of appended references in the articles. The scholars' attitude towards citing resources is to cite recent articles form reputed journals when they wrote their articles for *Scientometrics* and *D-Lib Magazines*. This study tested Bradford's Law and explores the core journals of the subjects but the scattering pattern of cited journals is not fit to Bradford's scattering pattern of journals. It also recognizes the role of age, language, and country of cited resources.

The findings from several Bibliometrics indicators reveal that *Scientometrics* is a mature journal and shows the healthy signs of scholarship. In reference to *D-Lib Magazine*, the number of articles has been declined over the period that is a subject of further study. The study reveals authorship characteristics of articles and subject coverage of research and non-research articles of journals and role of institution in author's affiliations. It discovers that a large proportion of the articles published in both journals are written by multiple authors. It also explored that *Scientometrics* journal has articles from not only its publishing country but also has worldwide coverage. On the contrary, a large proportion of the *D-Lib Magazine* came for the publishing country.

For the study 'R' software have been used that is a very sophisticated statistical analysis open source software, as the TM packages (Text Mining Package) of the software helps us to find out the frequency and a program (developed by the research scholar) compatible to 'R' software have been used to recognize the co-occurrences of keywords from a document in a corpus. It has been used for MDS plotting, creation of network among keywords and calculating its different characteristics.

6.3 Conclusion

Co-word analysis is a powerful tool to identify the linkage and association between different topics and analysing co-occurrence of the keywords and phrases of a subject. It is used for the better understanding and to communicate the development of scientific field (Borner et. al. 2003). The findings show that the structure of subject cluster in the field of Scientometrics and Digital Library, and the relationships between these clusters, have changed over the time, and have dynamic changes over the period. The study finds core, marginal, obsolete and newly emerging topics in the both subject, which can allow for a better understanding of the intellectual structure of Scientometrics and Digital library.

The bibliometric analysis of the articles published in both journals provides an overall picture of its base, devolvement and evaluation. The citation used by the source authors in both subject reveals the availability and importance of different form of information resource in the field. Increasing number of multiple authored publications in both journals confirmed team based

research activity in both fields. The *Scientometrics* journal sustained constant positive growth rate while *D-Lib Magazine* is on contrary during the period (2001-2010). English language, and affiliations to authors by USA's institutions and organisations are in dominating role. However, it is believed that the methods adopted for this study would be useful for a wide range of scholar, notably scientists, researchers and library science professionals to determine the intellectual structure (subject structure) and development of subject's trend in any domain of knowledge.

6.4 Suggestions

On the basis of the study's findings and discussions following suggestions can be deduced and its implementation will lead to the betterment of the both subject areas and journals:

1) The Journal *Scientometrics* has a standard citation style but it did not follow strictly. So, the study suggests to follow the standard strictly and avoid negligence of punctuation marks between the different component of citation and spelling mistake of journal's name and author's name of articles.

2) The *D-Lib Magazine* does not follow any standard format of citation style. So the study suggests to follow a standard format of citation style which will save the time of scholars in further study.

3) The Journals should include the information related to designation and department of authors in author section of articles. So that intra-subject and the inter-subject relationship of articles would be identified as, the study has confirmed the dominance of multi authored papers.

4) The journals should bring out some special issues on identified marginal subject under the study. It will give space to authors to write on specific subject.

5) The number of articles declined over the period (2001-2010) in the *D-Lib magazine*. The study suggests to the concerned society or publishers to tie up with some notable institutions and organization in the field of Digital library, so that the minimum numbers of publication can be ensured for an issue.

6) The dominance of multiple authored articles in both journals and multiple authored citations indicates the emergence of team based output in research activity. Hence, the team based research must be encouraged by Institutions and Organizations.

7) Approximately 97% use of print resources as citation in *Scientometrics* journal shows that the concerned scholars are not comfortable with e-resources in the present electronic age. So, they must be provided training, and workshop should be organized on the use of electronic and web resource by their Institutions and Organizations.

8) A large proportion (70%) of cited resource in *Scientometrics* is journals. It shows the unavailability of information related to Scientometrics in other form of resources. So, the study suggests that the Seminars, Conferences and workshops must be organized and different aspect of Scientometrics should be incorporated at micro level in the syllabus of Library and information science at different stage.

9) Most of the articles of journals written in local collaboration. Hence, the study suggests to the journals' publishers, and the institutions to motivate their scholars to have National and International collaboration. It will encourage the share of knowledge and it will increase the coverage of journals.

10) Citation form Indian journals and of Indian author almost in both journals is very less. So, the study suggests to the stakeholder of this field of India to start some journals in this filed with quality and Indian authors should approach to journals with good impact factor for their articles publication.

6.5 Scope for Further Research

The present study covered only two journals '*Scientometrics*', and '*D-Lib Magazine*' in the field Scientometrics and Digital library respectively. Future work would be extended this study by studying some other reputed journals of above mentioned both fields and other fields also, and identifying common topics carried by studied resources. This work has covered the period 2001 to 2010 only, so next decade can be studies and a comparative study can be made between two decades. This type of study in other domains will enrich the methodology of mapping Intellectual structure (subject structure) of a discipline.

APPENDICES

Appendix A

Co-occurrence matrix from the Document term matrix

Input-

	v1	v2	v3
doc2	0	1	0
doc3	2	3	4
doc4	1	0	0
doc5	1	0	0
doc6	0	3	1

```
A<-read.table("DTM_1",header=T,sep=",")
A<-A[,-1]
nc<- length(A[1,])
nr<-length(A[,1])
B<-matrix(0,nc,nc)
for(k in 1:(nc-1))
             {
               for(j in 1:(nc-1))
                {
                   for(i in 1:nr)
                     {
                      if(A[i,k]>=A[i,j+1])
                         B[k,j+1]<- B[k,j+1]+A[i,j+1]
                      else
                         B[k,j+1]<- B[k,j+1]+A[i,k]}}}

B<-as.matrix(B)

diag(B)<-0
for(i in 2:nc)
          {
            B[i,1]<-B[1,i]
          }

for(j in 2:nc)
          {
            B[nc,j]<-B[j,nc]
          }
  B
```

Output- B

	v1	v2	v3
v1	0	2	2
v2	2	0	4
v3	2	4	0

Appendix B

Table B1: Top 100 most frequently occurred keywords during 2001-2005 (*Scientometrics*)

S. No.	Keywords	Frequency	S. No.	Keywords	Frequency
1	Cluster analysis	1186	51	Power law	116
2	Self citation	958	52	Recall	116
3	Bibliometric analysis	831	53	Non patent reference	114
4	Co-citation cluster	678	54	Cite journal	111
5	Co-author analysis	642	55	Bibliographic coupling analysis	111
6	Patent application	515	56	Academic patent	107
7	Scientific output	489	57	Fraction count	106
8	Centrality	475	58	Cited half-life	99
9	H-index	472	59	Citation frequency	96
10	Web page	456	60	International co-authorship	96
11	Citation index	448	61	Total citation	95
12	Coefficient	409	62	Web citation	92
13	Website	399	63	Co-occurrence analysis	91
14	Cited paper	398	64	Multidimensional scale	90
15	Scientometrics analysis	384	65	Citation window	89
16	Internet	372	66	hyperlink	88
17	Authorship	345	67	Citation pattern	87
18	International collaboration	339	68	Immediacy index	83
19	Editor	322	69	Page-rank	83
20	Citation count	283	70	Shanghai rank	80
21	Key-word analysis	261	71	Co-word analysis	75
22	Precision	255	72	Social network analysis	74
23	Publication delay	233	73	Gini index	72
24	Co-citation analysis	230	74	Geographical distribution	72
25	Publication output	228	75	Co-publication	71
26	Citation impact	220	76	Lotka law	69
27	Research output	213	77	Citation Indicator	68
28	URL	213	78	Information retrieval	67
29	Self citation rate	210	79	Collaboration pattern	66
30	Bibliography	190	80	Search strategy	62
31	Correlation coefficient	190	81	Network analysis	61
32	Patent citation	188	82	Citation network	59
33	Interdisciplinary research	188	83	Citation score	59
34	Citation analysis	181	84	Patent reference	59
35	Patent activity	177	85	International patent	58
36	Journal impact factor	171	86	Bradford law	56
37	Gender	164	87	Webometrics	56
38	Citation distribution	163	88	Factor analysis	55
39	Patent analysis	162	89	Statistical analysis	53
40	Questionnaire	161	90	Scientific collaboration	53
41	Citation rate	160	91	High-cited research	52
42	Research article	158	92	Bibliometric data	52
43	Bibliometric indicator	157	93	Publication pattern	52
44	Editorial board	154	94	Content analysis	50
45	Case study	154	95	Bibliographical database	50
46	Editorial	147	96	Inventor author	49
47	University patent	146	97	University rank	49
48	Informetrics	146	98	Publication count	49
49	Research collaboration	136	99	Multi-variation analysis	49
50	Co-link analysis	118	100	Internal link	47

Table B2: List of keywords which were not noticed during the year 2001-2005 but appeared during the year 2006-2010 (*Scientometrics*)

S. No.	Keywords	S. No.	Keywords
1	ARWU (Academic Ranking of World University)	27	Intra-region collaboration
2	Author rank	28	Journal mapping
3	Back link	29	Knowledge mapping
4	Bayesian analysis	30	Knowledge network
5	Bibliometric characteristics	31	Lorenz curve
6	Bibliometric evaluation	32	Lotka distribution
7	Bibliometric rank	33	National collaboration
8	Bibliometric tool	34	Non-patent citation
9	Chi square test	35	Partial correlation
10	Citation performance	36	Patent citation count
11	Citation trend	37	Publication growth
12	Cited behavior	38	Publication quality
13	Co-citation link	39	Qualitative analysis
14	Co-citation map	40	Qualitative evaluation
15	Co-in link	41	Quantitative content analysis
16	Collaborative relationship	42	Quantitative research
17	Co-operation network	43	Rank distribution
18	Co-word mapping	44	Reference per paper
19	Descriptor analysis	45	Research trend
20	Distribution model	46	Spearman rank correlation coefficient
21	Exploratory analysis	47	Stochastic model
22	Garfield impact factor	48	Trend analysis
23	H(2)index	49	Trend indicator
24	H-score	50	Weak tie
25	H-indicator	51	Web co-link
26	Individual product	52	Web source

Table B3: List of keywords which were noticed during the year 2001-2005 but did not appear during the year 2006-2010 (*Scientometrics*)

S. No.	Keywords	S. No.	Keywords
1	Bibliometric characteristics	7	Individual product
2	Bibliometric law	8	Inventor author
3	Chi square test	9	Quantitative content analysis
4	Cluster quality	10	Spearman correlation coefficient
5	Co-authorship relation	11	Spearman correlation coefficient
6	Dense network	12	Website quality

Table B4: Top 100 most frequently occurred keyword during the year 2005-2010 (*Scientometrics*)

S. No.	Keywords	Frequency	S. No.	Keywords	Frequency
1	Cluster analysis	1186	51	Power law	202
2	Self citation	958	52	Case study	202
3	Bibliometric analysis	831	53	Co-occurrence analysis	192
4	Co-citation cluster	678	54	H-score	181
5	Co-author analysis	642	55	Editorial board	177
6	Patent application	515	56	Co-authorship network	169
7	Scientific output	489	57	Web citation	168
8	Centrality	475	58	Research article	168
9	H-index	472	59	Co-word analysis	163
10	Web page	456	60	Citation frequency	161
11	Citation index	448	61	Citation pattern	161
12	Coefficient	409	62	Publication count	160
13	Website	399	63	Co-publication	159
14	Cited paper	398	64	Fraction count	155
15	Scientometric analysis	384	65	Betweeness centrality	154
16	Internet	372	66	Shanghai rank	153
17	Authorship	345	67	Information retrieval	147
18	International collaboration	339	68	Bibliographical coupling analysis	146
19	Editor	322	69	Citation Indicator	144
20	Citation count	283	70	Citation network	144
21	Key-word analysis	261	71	Cited half-life	144
22	Precision	255	72	Cited journal	141
23	Publication delay	233	73	Scientometrics indicator	139
24	Co-citation analysis	230	74	Citation distribution	138
25	Publication output	228	75	Recall	131
26	Citation impact	220	76	International co-publication	128
27	Research output	213	77	Hyperlink	123
28	URL	213	78	Network structure	122
29	Self citation rate	210	79	Webometrics	118
30	Bibliography	190	80	Publication delay	116
31	Correlation coefficient	190	81	Knowledge diffusion	116
32	Patent citatation	188	82	Questionnaire	115
33	Interdisciplinary research	188	83	Self citation rate	113
34	Citation analysis	181	84	University patent	113
35	Patent activity	177	85	Collaboration pattern	113
36	Journal impact factor	171	86	Patent quality	108
37	Gender	164	87	Collaboration research	106
38	Citation distribution	163	88	Patent activity	104
39	Patent analysis	162	89	Academic rank	103
40	Questionnaire	161	90	Author co-citation analysis	102
41	Citation rate	160	91	Web-resource	101
42	Research article	158	92	Co-in-link	101
43	Bibliometric indicator	157	93	Knowledge map	96
44	Editorial board	154	94	Knowledge network	95
45	Case study	154	95	Journal rank	95
46	Editorial	147	96	Regression analysis	95
47	University patent	146	97	Bibliometric data	93
48	Informetrics	146	98	Scientific impact	93
49	Research collaboration	136	99	Hypertext	91
50	Co-link analysis	118	100	ARWU	89

Table B5: List of keywords which appeared with decreased frequency during the year 2006-2010 (*Scientometrics*)

S. No.	Keywords	Yrs 2001-2005	Yrs 2006-2010	Decrement	Decrement
		Frequency (X)	Frequency (Y)	(X-Y)	in %
1	Non-patent reference	114	26	88	78
2	Academic patent	107	27	80	75
3	Zipf law	40	12	28	70
4	Patent reference	59	23	36	62
5	Geographical distribution	72	30	42	59
6	Bradford law	56	24	32	58
7	Network mapping	25	12	13	52
8	Publication delay	233	116	117	51
9	Citation pattern	28	15	13	47
10	Self citation rate	210	113	97	47
11	Correspondence analysis	24	13	11	46
12	Innovative indic	19	11	8	43
13	Patent activity	177	104	73	42
14	Web-link analysis	39	23	16	42
15	Jacquard index	34	22	12	36
16	Source publication	20	13	7	35
17	International co authorship	96	64	32	34
18	Patent and license	24	16	8	34
19	Out degree	31	21	10	33
20	Patent application	515	349	166	33
21	Page rank	83	58	25	31
22	Questionnaire	161	115	46	29
23	Bibliographic database	50	36	14	28
24	Patent portfolio	25	18	7	28
25	Lotkaian informetrics	13	10	3	24
26	Publication frequency	22	17	5	23
27	University patent	146	113	33	23
28	Citation environment	40	32	8	20
29	Citation score	59	49	10	17
30	Immediacy index	83	70	13	16
31	Citation distribution	163	138	25	16
32	International patent	58	52	6	11
33	Citation age	11	10	1	10
34	Inter-citation	25	23	2	8
35	Publication pattern	52	48	4	8
36	Publication index	20	19	1	5
37	National patent	41	39	2	5
38	Impact measure	21	20	1	5
39	Spearman correlation coefficient	21	20	1	5
40	Citation link	40	39	1	3
41	Cluster analysis	1186	1171	15	2

Table B6: Top 100 most frequently occurred keyword during the year 2001-2005 (*D-Lib Magazine*)

S. No.	Keywords	Frequency	S. No.	Keywords	Frequency
1	Web site	637	51	Literature	169
2	Index	579	52	Newspaper	169
3	Network	574	53	Gateway	168
4	Retrieval system	546	54	Monitoring	167
5	Catalogue	534	55	Consortium	166
6	Digital object	499	56	MARC	164
7	Internet	465	57	Clustering	150
8	Interoperability	443	58	Music	149
9	Museum	423	59	Workflow	142
10	Protocol	417	60	OCLC	137
11	E book	416	61	Multimedia	135
12	Dublin core	404	62	Information system	132
13	Librarianship	396	63	Self archiving	127
14	Strategic planning	356	64	User interface	126
15	Citation	347	65	End user	124
16	Copyright	346	66	Security	120
17	Digital preservation	333	67	Preprints	119
18	Engineering	325	68	Digital reference	118
19	Periodicals	304	69	Lockss system	116
20	Infrastructure	292	70	Bookmarks	115
21	Dspace	288	71	Digital material	113
22	Automation	282	72	Intellectual property	112
23	Licenses	282	73	E resources	111
24	E-print	278	74	Digital collections	110
25	NSDL	264	75	Innovation	108
26	DOI	262	76	FEDORA	106
27	Aggregators	261	77	University Library	106
28	Workshops	261	78	Java	105
29	E journal	250	79	Crossref	101
30	Visualization	244	80	Metadata standard	96
31	Open URL	241	81	Digital resource	95
32	Vocabulary	239	82	Forum	92
33	Search engine	232	83	Annotation	91
34	Greenstone	231	84	SciElo (online library)	88
35	Video	223	85	Reference service	85
36	Conversion	217	86	Web service	84
37	Subscriptions	213	87	Analog	83
38	Classification	212	88	Collection management	83
39	Google	212	89	Information objects	81
40	RSS	210	90	Web resources	81
41	Service providers	210	91	Fair use	80
42	HTML	209	92	NISO	79
43	DCMI	199	93	Information resources	78
44	Web page	198	94	Worldcat	77
45	Mpeg21	188	95	Ohio link	76
46	Open source	188	96	Metadata harvesting	75
47	Semantic analysis	183	97	Search service	75
48	Geographic	181	98	Medline	73
49	Scientific publishing	180	99	Open archives initiative	73
50	Statistics	172	100	File format	72

Table B7: List of keywords which are not noticed during the year 2001-2005 (*D-Lib Magazine*)

S. No.	Keywords	S. No.	Keywords
1	Change management	51	Mass digitization
2	Add-ons	52	Metadata management
3	Antiquities	53	NeoNote
4	Archival materials	54	Nuclear astrophysics
5	Archival services	55	O A network
6	Artificial intelligence	56	OAIster
7	Bibliobouts (game)	57	Online survey
8	Bibliometrics	58	Oral history
9	Bibtip (opac)	59	Organizational structure
10	Broadband	60	Professional education
11	Computer network	61	Qualitative analysis
12	Content recruitment	62	Reading patterns
13	Contextual design	63	Recommender system
14	Control access	64	Repository content
15	Control systems	65	Resource federations
16	CORDRA	66	Resources management
17	Crowd sourcing	67	Scientific literature
18	Development strategy	68	Scientists
19	Digital audio	69	Service model
20	Digital book	70	Site design
21	Digital copying	71	Social engagement
22	Digital divided	72	Social software
23	Digital librarian	73	Social tagging
24	Digital library software	74	Software failures
25	Distance education	75	Sound archives
26	Distributed systems	76	State government
27	Document management	77	Subject repositories
28	E Government	78	Technological innovation
29	Educational metadata	79	Text correction
30	Facebook	80	Text encoding
31	FEDCOR	81	Thumbshots
32	Geographic distribution	82	Transaction log analysis
33	Google book search	83	UKWaC
34	Government information	84	Universal access
35	Grey literature	85	University archives
36	Human computer interfaces	86	User behavior
37	Hybrid library	87	Virtual campus
38	Image databases	88	Virtual journal
39	Image processing	89	Web curator
40	Information communication	90	WikiD
41	Information processing	91	YouTube
42	Information sharing	92	Zwolle group
43	Information society		
44	Library automation		
45	Library materials		
46	Library portal		
47	Library reference service		
48	Library research		
49	License agreements		
50	Machine translation		

Table B8: List of keywords which are not noticed in the year 2006-2010 (*D-Lib Magazine*)

S. No.	Keywords	S. No.	Keywords	S. No.	Keywords
1	Change management	46	Evaluation studies	91	LOCKOSS system
2	Antiquities	47	Fair use	92	Machine learning
3	Archival services	48	Fiction e book	93	Markup language
4	ARKive	49	Folksonomies	94	Mass digitization
5	Artificial intelligence	50	Geographic distribution	95	Mathematics tool
6	Bibshare	51	Georeferencing	96	Natural history
7	Bound journals	52	Google answers	97	Natural resource
8	Broadband	53	Government information	98	Network environment
9	Citation index	54	Grey literature	99	Noosphere system
10	Computer games	55	Human computer interfaces	100	OAIS model
11	Computer model	56	Human resource	101	Online collection
12	Computer Network	57	Hybrid library	102	Online games
13	Content recruitment	58	Hypermedia	103	OPLIN
14	Contetnt analysis	59	Image processing	104	Organizational structure
15	Continuing education	60	Impact factor	105	Peer review
16	Control systems	61	Indigenous cultural	106	Physicists
17	Cost effectiveness	62	Indigenous peoples	107	Plants
18	Current awareness services	63	Information content	108	Print format
19	Deep web	64	Information infrastructure	109	Print journal
20	Developing countries	65	Information networks	110	Print materials
21	Digital copying	66	Information processing	111	Professional education
22	Digital cultural content	67	Information professionals	112	Programming languages
23	Digital divided	68	Information sharing	113	Question negotiation
24	Digital information objects	69	Information visualization	114	Question point
25	Digital learning	70	Integrated library system	115	Readership surveys
26	Digital license	71	International conferences	116	Reading patterns
27	Digital media	72	Internet searching	117	Reference desk
28	Digital reference	73	iVia	118	Reference interviews
29	Digital sanborn map	74	Knowledge management	119	Reference librarian
30	Directed query engines	75	Learning community	120	Reference library
31	Distance education	76	Learning materials	121	Reference resource
32	Distributed systems	77	Library automation	122	Reference service
33	DL-Harvest	78	Library management	123	Renardus (metadata)
34	Document management	79	Library materials	124	Repository architecture
35	Domain names	80	Library of congress subject headings	125	Risk management
36	Dynamic disseminations	81	Library portal	126	SciELO
37	E entertainment	82	Library reference service	127	Scientific literature
38	E format	83	Library resources	128	Search strategies
39	E information	84	Library science	129	Search system
40	E record	85	Library users	130	Serial publications
41	Educational materials	86	Library web page	131	Sheet music
42	Educational metadata	87	Linked systems	132	Site design
43	Educational program	88	Linking service	133	Social scientists
44	Electronic library	89	Literacy	134	Software failures
45	ERPANET	90	Literature reviews	135	Sound archives
136	State government	143	User satisfaction	150	Web accessibility
137	Subject gateway	144	User services	151	Web crawler
138	Teaching methods	145	Video game	152	Web portal
139	Technological innovation	146	Virtual lab	153	Web preservation
140	Universal access	147	Virtual library	154	Web standard
141	University archives	148	Virtual spine	155	Word processing
142	User behavior	149	VxInsight	156	X-past

Table B9: List of new keywords noticed in the year 2006–2010 (*D-lib Magazine*)

S. No.	Keywords	S. No.	Keywords
1	Add-ons	51	Wikid
2	Archival materials	52	YouTube
3	Bibliobouts (game)	53	Zwolle group
4	Bibliometrics		
5	BibTip (OPAC)		
6	Contextual design		
7	Control access		
8	CORDRA		
9	Crowd sourcing		
10	Development strategy		
11	Digital audio		
12	Digital book		
13	Digital librarian		
14	Digital library software		
15	E government		
16	Face book		
17	FeDCOR		
18	Google book search		
19	Image databases		
20	Information communication		
21	Information society		
22	Library research		
23	License agreements		
24	Machine translation		
25	Metadata management		
26	Neonote		
27	Nuclear astrophysics		
28	OA network		
29	OAIster		
30	Online survey		
31	Oral history		
32	Qualitative analysis		
33	Recommender system		
34	Repository content		
35	Resource federations		
36	Resources management		
37	Scientists		
38	Service model		
39	Social engagement		
40	Social software		
41	Social tagging		
42	Subject repositories		
43	Text correction		
44	Text encoding		
45	Thumbshots		
46	Transaction log analysis		
47	UKWaC		
48	Virtual campus		
49	Virtual journal		
50	Web curator		

Table B10: Top 100 frequently occurred keyword during the year 2006-2010 (*D-Lib Magazine*)

S. No.	Keywords	Frequency	S. No.	Keywords	Frequency
1	Copyright	650	51	Clustering	110
2	Web site	439	52	Classification	108
3	Digital object	413	53	HTML	103
4	PREMIS	405	54	Web page	102
5	Annotation	382	55	Video	101
6	Interoperability	331	56	Digital resource	99
7	Aggregators	298	57	Scientific publishing	97
8	D space	293	58	Scientists	92
9	Network	283	59	Innovation	91
10	Retrieval system	278	60	Fedora	85
11	Librarianship	273	61	Cultural heritage	84
12	Vocabulary	271	62	Blog	80
13	Index	254	63	Metadata standard	78
14	Periodicals	253	64	CORDRA	77
15	Citation	238	65	User interface	77
16	Strategic planning	233	66	E-print	76
17	Google	227	67	MARC	76
18	Workflow	221	68	Music	76
19	Open URL	218	69	Digital archive	75
20	Catalogue	214	70	Visualization	75
21	Statistics	208	71	Information science	72
22	Infrastructure	204	72	TIFF	71
23	Museum	203	73	Consortium	68
24	Semantic analysis	196	74	E resources	67
25	Licenses	194	75	Exhibitions	67
26	Protocol	182	76	Worldcat	66
27	Newspaper	180	77	Workshops	65
28	Literature	176	78	Face book	64
29	Engineering	172	79	Bibliobouts (game)	63
30	Digital repository	169	80	Collection management	63
31	Photographs	169	81	Monitoring	63
32	Jpeg	159	82	OCLC	63
33	Web service	159	83	Yahoo	63
34	Internet	156	84	Information retrieval	62
35	Automation	154	85	Scholarly communication	62
36	Digital collections	149	86	Subscriptions	62
37	Search engine	148	87	Information system	61
38	Wikipedia	146	88	DOI	58
39	End user	142	89	Robots	58
40	Dublin core	134	90	Online survey	57
41	Conversion	130	91	Library services	56
42	Digital preservation	130	92	RSS	56
43	Subject repositories	128	93	Add-ons	55
44	Thumbnails	127	94	NSDL	55
45	Security	125	95	OA network	55
46	Open source	123	96	Web server	55
47	Zwolle group	122	97	Geographic	54
48	Ontology	120	98	License agreements	54
49	Service providers	118	99	University Library	54
50	Restoration	111	100	YouTube	54

Table B11: Top 50 keywords which appeared with decreased frequency in the year 2006-2010 (*D-Lib Magazine*)

S. No.	Keywords	yrs 2001-2005 Frequency (X)	yrs 2006-2010 Frequency (y)	Decrement (X-Y)	Decrement in %
1	E-book	416	20	396	95.19
2	Index	579	254	325	56.13
3	Catalogue	534	214	320	59.93
4	Internet	465	156	309	66.45
5	Network	574	283	291	50.70
6	Dublin core	404	134	270	66.83
7	Retrieval system	546	278	268	49.08
8	Protocol	417	182	235	56.35
9	E-journal	250	25	225	90.00
10	Museum	423	203	220	52.01
11	Greenstone	231	19	212	91.77
12	NSDL	264	55	209	79.17
13	DOI	262	58	204	77.86
14	Digital preservation	333	130	203	60.96
15	E-print	278	76	202	72.66
16	Web site	637	439	198	31.08
17	Workshops	261	65	196	75.10
18	MPEG21	188	17	171	90.96
19	Visualization	244	75	169	69.26
20	DCMI	199	35	164	82.41
21	RSS	210	56	154	73.33
22	Engineering	325	172	153	47.08
23	Subscriptions	213	62	151	70.89
24	Gateway	168	25	143	85.12
25	Automation	282	154	128	45.39
26	Geographic	181	54	127	70.17
27	Librarianship	396	273	123	31.06
28	Strategic planning	356	233	123	34.55
29	Video	223	101	122	54.71
30	Digital reference	118	2	116	98.31
31	Interoperability	443	331	112	25.28
32	Lockss system	116	5	111	95.69
33	Citation	347	238	109	31.41
34	HTML	209	103	106	50.72
35	Classification	212	108	104	49.06
36	Monitoring	167	63	104	62.28
37	Consortium	166	68	98	59.04
38	Web page	198	102	96	48.48
39	Service providers	210	118	92	43.81
40	Crossref	101	11	90	89.11
41	Infrastructure	292	204	88	30.14
42	Licenses	282	194	88	31.21
43	Marc	164	76	88	53.66
44	SciELO	88	0	88	100.00
45	Conversion	217	130	87	40.09
46	Digital object	499	413	86	17.23
47	Search engine	232	148	84	36.21
48	Self archiving	127	43	84	66.14
49	Intellectual property	112	29	83	74.11
50	Scientific publishing	180	97	83	46.11

Appendix C

Table C1: List of top 100 cited journals in Scientometrics (2001-2010)

S. No.	Journals' Tile	No. of Citation	Rank
1	Scientometrics	3161	1
2	journal of the American Society for Information Science and Technology	987	2
3	Research Policy	595	3
4	Science	343	4
5	Nature	285	5
6	Journal of Documentation	221	6
7	Journal of Information Science	195	7
8	Information Processing And Management	178	8
9	Research Evaluation	174	9
10	Social Studies of Science	163	10
11	Journal of Informetrcis	113	11
12	American Sociological Review	80	12
13	Annual Review of Information Science and Technology	64	13
14	Cybermetrics: International Journal of Scientometrics Informetrics and Bibliometrics	56	14
15	Higher Education	56	14
16	Management Science	55	15
17	Physical Review	52	16
18	Science and Public Policy	50	17
19	Current Science	48	18
20	Technological Forecasting and Social Change	47	19
21	Journal of Technology Transfer	42	20
22	American Economic Review	40	21
23	American Journal Of Sociology	40	21
24	American Psychologist	39	22
25	Library Trends	38	23
26	Journal of Nanoparticle Research	36	24
27	Minerva	36	25
28	College & Research Libraries	34	26
29	Online Information Review	34	26
30	Social Networks	34	26
31	British Medical Journal	33	27
32	Psychological Bulletin	32	28
33	Research In Higher Education	32	28
34	Interciencia Journal	31	29
35	Libri	31	29
36	The Review of Economics and Statistics	30	30
37	Science Studies	30	30
38	European Journal of Operational Research	28	31
39	World Patent Information	28	31
40	Library And Information Science Research	27	32
41	Trends in Ecology & Evolution	26	33
42	D-Lib Magazine	25	34
43	Journal of Economic Literature	25	34
44	Science, Technology & Human Values	25	34
45	Strategic Management Journal	25	34
46	Higher Education In Europe	24	35
47	American Journal of Psychology	23	36
48	The Information Society	22	37
49	Science Communication	22	37

50	Social Science Information	22	38
51	Academy of Management Journal	21	39
52	Administrative Science Quarterly	21	39
53	Economic Journal	21	39
54	Economics Of Innovation And New Technology	21	39
55	Information Research	21	39
56	Journal of Information	21	39
57	Journal of Political Economy	21	39
58	Technovation	21	39
59	Aslib Proceedings	19	40
60	Chinese Science Bulletin	19	40
61	Ethics In Science And Environmental Politics	19	40
62	The Library Quarterly	19	40
63	Nanotechnology	19	40
64	Journal of The Washington Academy of Science	18	41
65	Psychological Review	18	41
66	R&D Management	18	41
67	Czechoslovak Journal of Physics	17	42
68	Industrial and Corporate Change	17	42
69	Journal of the ACM	17	42
70	Technology Analysis & Strategic Management	17	42
71	Behavioral and Brain Sciences	16	43
72	Journal of the Operational Research Society	16	43
73	Journal of the American Medical Association	16	43
74	PNAS	16	43
75	The RAND Journal of Economics	16	43
76	Social Forces	16	43
77	The BMJ	15	44
78	Canadian Medical Association Journal	15	44
79	Econometrica	15	44
80	Information Processing Letters	15	44
81	International Journal of Clinical and Health Psychology	15	44
82	Journal of Econometrics	15	44
83	Journal of Economic Perspectives	15	44
84	Journal of The Royal Statistical Society	15	44
85	Sociology of Education	15	44
86	Europe-Asia Studies	14	45
87	Journal of Higher Education	14	45
88	Journal of the American Statistical Association	14	45
89	The Lancet	14	45
90	Physica A	14	45
91	Revista Española De Documentación Científica	14	45
92	South African Journal of Science	14	45
93	Economics of Education Review	13	46
94	Quarterly Journal of Economics	13	46
95	Biometrika	12	47
96	BioScience	12	47
97	Engineering	12	47
98	European Economic Review	12	47
99	Lacent	12	47
100	Learned Publishing	12	47

Table C2: List of top 100 cited journals in *D-Lib Magazine* (2001-2010)

S. No.	Journals' Tile	No. of Citation	Rank
1	D-Lib Magazine	448	1
2	Journal of the American Society for Information Science and Technology	70	2
3	Library Hi Tech.	25	3
4	Communications of the ACM	46	4
5	College & Research Libraries	23	5
6	Library Trends	23	5
7	First Monday	18	6
8	Information Processing & Management	17	7
9	Library Journal	17	7
10	International Journal on Digital Libraries	14	8
11	Journal of Information Services & Use	12	9
12	Serials Review	12	9
13	Information Technology and Libraries	11	10
14	Journal of Academic Librarianship	11	10
15	Journal of Digital Information	11	10
16	Practical Assessment Research and Evaluation	11	10
17	Journal of Documentation	9	11
18	Journal of Electronic Publishing,	9	11
19	Nature	9	11
20	Online Information Review	9	11
21	Reference service review	9	11
22	Serials	9	11
23	Journal of the Medical Library Association	8	12
24	Scientometrics	8	12
25	ACM Computing Surveys	7	13
26	Cataloging & Classification Quarterly	7	13
27	Learned Publishing	7	13
28	OCLC Systems & Services	7	13
29	Science & Technology Libraries	7	13
30	Science	7	13
31	Annual Review of Information Science & Technology	6	14
32	IEEE Computer	6	14
33	International Journal of Digital Libraries	6	14
34	Issues in Science & Technology Librarianship	6	14
35	New Review of Information Networking	6	14
36	Reference & User Services Quarterly	6	14
37	Against the Grain	5	15
38	Zarchivariaz	5	15
39	IASSIST Quarterly	5	15
40	Library Quarterly	5	15
41	Portal: Libraries & the Academy	5	15
42	Serials Librarian	5	15
43	ACM Transactions on Computer-Human Interaction	4	16
44	American Archivist	4	16
45	ASLIB Proceedings	4	16
46	The Computer Journal	4	16
47	Computing Systems	4	16
48	Education Policy Analysis Archives	4	16
49	Electronic Library	4	16

50	Journal of Geoscience Education	4	16
51	Library Acquisitions: Practice & Theory	4	16
52	Library Resources & Technical Services	4	16
53	Machine Translation	4	16
54	Online	4	16
55	Scientific American	4	16
56	ACM Interactions	3	17
57	ACM Transactions on Information Systems	3	17
58	Archives and Museum Informatics	3	17
59	British Medical Journal	3	17
60	Bulletin of the American Society for Information Science	3	17
61	Charleston Advisor	3	17
62	Ciência da Informação	3	17
63	Computer Networks & ISDN Systems	3	17
64	Computers & the Geosciences	3	17
65	CT Watch Quarterly	3	17
66	Educause Review	3	17
67	El Profesional de la Información	3	17
68	IEEE Internet Computing	3	17
69	IEEE Multimedia	3	17
70	IEEE Transactions on Pattern Analysis & Machine Intelligence	3	17
71	Information & Management	3	17
72	Information Research	3	17
73	International Journal of Digital Curation	3	17
74	Journal of Educational Technology & Society	3	17
75	Journal of Internet Cataloging	3	17
76	Journal of Librarianship & Information Science	3	17
77	Journal of the Society of Archivists	3	17
78	Library & Information Science Research	3	17
79	Library Management	3	17
80	Libri	3	17
81	Program	3	17
82	RQ	3	17
83	ACM Transactions on Database Systems	2	18
84	Acta Editologica	2	18
85	Annual Review of OCLC Research	2	18
86	Archivaria	2	18
87	Astronomy & Astrophysics Supplement	2	18
88	Canadian Journal of Communication	2	18
89	Computational Linguistics	2	18
90	Computer Networks	2	18
91	Computers & the Humanities	2	18
92	Current Opinion in Immunology	2	18
93	Economic Analysis & Policy	2	18
94	Educational Researcher	2	18
95	Educational Technology & Society	2	18
96	Education Policy Analysis Archives	2	18
97	Education Statistics Quarterly	2	18
98	Abstracts with Programs- Geological Society of America	2	18
99	Government Information Quarterly	2	18
100	High Energy Physics Libraries Webzine	2	18

Appendix D

Table D1: List of top 50 Primary authors frequently appeared in *Scientometrics* (2001-2010)

S. No.	Primary Authors' Name	No. of Paper/s
1	Glanzel, W.	25
2	Egghe, L.	23
3	Yu, G.	12
4	Leydesdorff, L.	11
5	Barcza, K.	9
6	Burrell, Q.L.	9
7	Guan, J.	9
8	Lewison, G.	9
9	Liang, L.	8
10	Meyer, M.	8
11	Abramo, G.	7
12	Bornmann, L.	7
13	Tsay, M.-Y.	7
14	Vaughan, L.	7
15	Vinkler, P.	7
16	Garg, K.C.	6
17	Pouris, A.	6
18	Schubert, A.	6
19	Small, H.	6
20	Sombatsompop, N.	6
21	Thelwall, M.	6
22	Campanario, J.M.	5
23	Gupta, B.M.	5
24	Kim, M.-J.	5
25	Kostoff, R.N.	5
26	Kretschmer, H.	5
27	Lee, Y.-G.	5
28	Leta, J.	5
29	Ortega, J.L.	5
30	Pinto, M.	5
31	Prathap, G.	5
32	Sternitzke, C.	5
33	Van Leeuwen, T.N.	5
34	Van Raan, A.F.J.	5
35	Bailon-Moreno, R.	4
36	Bhattacharya, S.	4
37	Bonaccorsi, A.	4
38	Braun, T.	4
39	He, T.	4
40	Jarneving, B.	4
41	Kademani, B.S.	4
42	Kao, C.	4
43	Nederhof, A.J.	4
44	Park, H.W.	4
45	Persson, O.	4
46	Rey-Rocha, J.	4
47	Robert, C.	4
48	Sooryamoorthy, R.	4
49	Wray, K.B.	4
50	Zhou, P.	4

Table D2: List of top 50 Secondary authors (Co-authors)frequently appeared in *Scientometrics* (2001-2010)

S. No.	Secondary Authors' Name	No. of Paper/s
1	Rousseau, R.	20
2	Glanzel, W.	19
3	Debackere, K.	13
4	Ho, Y.-P.	13
5	Thelwall, M.	13
6	Thijs, B.	13
7	Meyer, M.	11
8	Schubert, A.	11
9	Wilson, C.S.	10
10	Daniel, H.-D.	8
11	Van Leeuwen, T.N.	8
12	Da Costa Patrao, D.	7
13	Leydesdorff, L.	7
14	Markpin, T.	7
15	Moed, H.F.	7
16	Bassecoulard-Zitt, E.	6
17	Bordons, M.	6
18	De Moya-Anegon, F.	6
19	Kumar, V.	6
20	Moya-Anegon, F.	6
21	Premkamolnetr, N.	6
22	Russell, J.M.	6
23	Van Raan, A.F.J.	6
24	Aguillo, I.F.	5
25	Ma, N.	5
26	Ratchatahirun, P.	5
27	Visser, M.S.	5
28	Von Ins, M.	5
29	Yochai, W.	5
30	Zitt, M.	5
31	Arreto, C.-D.	4
32	Courtial, J.P.	4
33	Daraio, C.	4
34	Dhawan, S.M.	4
35	Garzon, B.	4
36	Gaudy, J.-F.	4
37	Gomez-Benito, J.	4
38	Gupta, B.M.	4
39	Herrero-Solana, V.	4
40	Jurado-Alameda, E.	4
41	Kalyane, V.L.	4
42	Kretschmer, H.	4
43	Kumar, S.	4
44	Leta, J.	4
45	Li, Y.-J.	4
46	Martin, M.	4
47	Noyons, E.C.M.	4
48	Ramanana-Rahary, S.	4
49	Ruiz, R.M.	4
50	Schlemmer, B.	4

Table D3: List of top 50 Primary authors frequently appeared in *D-Lib Magazine* (2001-2010)

S. No.	Primary Authors' Name	No. of Paper/s
1	Van De Sompel, H.	5
2	Arms, W.Y.	4
3	Zia, L.L.	4
4	Bekaert, J.	3
5	Bollen, J.	3
6	Coleman, A.	3
7	Crane, G.	3
8	Hammond, T.	3
9	Holley, R.	3
10	King, D.W.	3
11	Lavoie, B.	3
12	Littman, J.	3
13	Nelson, M.L.	3
14	Paskin, N.	3
15	Pinfield, S.	3
16	Smith, J.A.	3
17	Suleman, H.	3
18	Van Veen, T.	3
19	Witten, I.H.	3
20	Adamick, J.	2
21	Arlitsch, K.	2
22	Canós, J.H.	2
23	Choudhury, G.S.	2
24	Dekkers, M.	2
25	DiLauro, T.	2
26	Dobratz, S.	2
27	Erickson, J.S.	2
28	Friedlander, A.	2
29	Heery, R.	2
30	Hirtle, P.B.	2
31	Hitchcock, S.	2
32	Jantz, R.	2
33	Kenney, A.R.	2
34	Kirriemuir, J.	2
35	Lavoie, B.F.	2
36	Manduca, C.A.	2
37	Markey, K.	2
38	Powell, J.E.	2
39	Rosenthal, D.S.H.	2
40	Ross, S.	2
41	Rudner, L.M.	2
42	Tanner, S.	2
43	Tenopir, C.	2
44	Ternier, S.	2
45	Thomas, C.	2
46	Abrams, S.	1
47	Almasy, E.	1
48	Altman, M.	1
49	Anderson, I.G.	1
50	Anderson, R.	1

Table D4: List of top 50 Co-authors frequently appeared in *D-Lib Magazine* (2001-2010)

S. No.	Secondary Authors' Name	No. of Paper/s
1	Nelson, M.L.	7
2	Lagoze, C.	5
3	Van De Sompel, H.	5
4	Fox, E.A.	4
5	King, D.W.	4
6	Brody, T.	3
7	Choudhury, G.S.	3
8	Dempsey, L.	3
9	DiLauro, T.	3
10	Habing, T.G.	3
11	Hannay, T.	3
12	Hickey, T.B.	3
13	Manepalli, G.	3
14	Payette, S.	3
15	Sumner, T.	3
16	Ward, N.	3
17	Young, J.	3
18	Young, J.A.	3
19	Agnew, G.	2
20	Atkins, A.	2
21	Bainbridge, D.	2
22	Beit-Arie, O.	2
23	Castelli, D.	2
24	Chachra, V.	2
25	Chapman, S.	2
26	Collins, L.M.	2
27	Crowder, M.	2
28	Droettboom, M.	2
29	Duval, E.	2
30	Entlich, R.	2
31	Flecker, D.	2
32	Fox, S.	2
33	France, R.K.	2
34	Frost, R.L.	2
35	Fujinaga, I.	2
36	Geisler, G.	2
37	Gonçalves, M.A.	2
38	Green, A.	2
39	Hochstenbach, P.	2
40	Iverson, E.R.	2
41	Jennings, B.J.	2
42	Jones, A.	2
43	Lannom, L.W.	2
44	Lipkis, T.	2
45	Liu, X.	2
46	Luce, R.	2
47	Lund, B.	2
48	Maly, K.	2
49	Massart, D.	2
50	McDonald, R.H.	2

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