LANDSCAPE OF LIBRARY AND INFORMATION SCIENCE RESEARCH IN INDIA: AN ANALYTICAL STUDY

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The article provides an in-depth information about the publications in the discipline of library and information science (LIS) that have been listed in the Indian Citation Index (ICI) online database during the time period (2014-2018). The study outlines the literature growth patterns, prolific authors, authorship collaboration patterns, major journal outlets, active research areas, productive institutions, etc. The overall growth rate of literature output was found to be negative with decreasing trend in LIS research throughout the study period. The year 2015 emerged as the most productive years in terms of research output with the highest number of publications (494, 25%). The multi-authorship articles (66.5%) were greater than single authorship. The Degree of collaboration and Collaborative Index were 0.664 and 1.9 respectively. The study also found that the researchers in LIS move towards team research rather than solo research. The dominancy of male researchers was very much prominent. The thrust areas of research were ICT and library, followed by bibliometric study. A similar pattern was also seen in the keyword co-occurrence network. DESIDOC Journal of Library & Information Technology was the most preferred journals. The study also revealed scattering of journals through the implementation of Bradford's Law. Additionally, the data set was used to assess the Leimkuhler model's applicability. University of Delhi (0.31%) was the institution with the highest productivity. About 12.43% of the overall output throughout the study period came from the top five most prolific institutions.

Keywords: LIS Research, Indian Citation Index, Collaborative Index, Co-Occurrence of Keywords, Bradford's law, Leimkuhler model.

INTRODUCTION

Research is the fountain of knowledge for the sake of knowledge and an important source of providing guidelines for solving different social problems. Research inculcates scientific and inductive thinking and it promotes the development of logical habits of thinking and organization. (Kothari & Garg, 2016). Research at an advanced level is very essential for the progress/advancement of library and information science (LIS) as a discipline. This is because a research program can sharpen the existing tools and techniques. These research activities/programs train the required

manpower who can take up research work for further advancement (Raju, 2012).

Modern-day library and information science education in India is more than a century old. Most possibly Ranganathan for the first time termed the subject as library science and tried to defend it (Ranganathan, 1957). Though library training classes were started in Baroda in 1911 and at Panjab University (Lahore) in 1915, but systematic training programme to be started in lndia was at Madras University in 1931 under the leadership of Dr SR Ranganathan (Tejomurthy & Kumar, 1998). University of Delhi has also the distinction of starting doctoral studies in library science in India. The beginning of formal research in LIS in India is usually attributed to the work of D B Krishna Rao for his thesis 'Facet Analysis and Depth Classification of Agriculture' under the guidance of Dr S R Ranganathan (Kumar, 1998). Thereafter, other universities in the country introduced facilities for research in library science.

Bibliometrics may be considered as a mean of quantitative studies of socio-cultural evolution through data derived from the bibliographic records. The application of metric indicators in the LIS domain becomes a productive area now-a-days.

REVIEW OF LITERATURE

Several researchers in India as well as in other parts of the World have already carried out a number of works regarding LIS research. Followings are some noteworthy contributions:

Maharana and Das (2020) conducted a bibliometric analysis of 140 papers retrieved from Social Science Citation Index (SSCI) and investigated the productivity and collaboration patterns of Indian LIS researchers. The suitability of Lotka's law of scientific productivity had also been applied. The study undertaken by Barik and Jena (2019) is based on the data retrieved from some selected LIS open access journals indexed in Scopus database for the period of 2001-2015, which describes country-wise, institution-wise research productivity, types of articles and citation quality as well.

Islam, Islam, and Mondal (2018) studied the rate of propensity for the quick expansion and development of research output among information professionals in Bangladesh for the period of 1980-2016. Further the study explored the fundamental components of research patterns like authorship pattern, highly preferred journals, quality of citations, etc. Bhardwaj (2017) surveyed nature of research attitude of LIS professional which describes preferred mode of dissemination of research output, preferred areas of research, and major impediments in carrying out research. Garg and Sharma (2017) discussed the different facets of LIS research in India deriving 2428 papers from Indian citation Index for the period of 2004 - 2015. The study concluded that 2010 was the most productive year and Mysore University was the most prolific institution. Most prolific researchers, high productive journals and mostly preferred areas of research had also been discussed. Vijayakumar and Shankar (2017) analysed 708 articles extracted from Web of Science (WoS) for the period of 1991-2015 and studied the comparative performance of Indian contribution to world's

contribution in the field of LIS research. In addition, the study investigated growth dynamics of research publications, authorship pattern, most prolific authors, highly preferred journals and thrust areas of research.

Ali and Richardson (2016) investigated 150 LIS research scholar in order to ascertain the general volume and calibre of publication among LIS professionals in Pakistan and especially discussed collaborative authorship pattern and strength of citation metrics. Kawalec (2013) tried to establish pattern of LIS research in Spain between 2000 and 2010 on the basis of publications derived from two renowned database namely Exit - Directory of Experts in Information Handling and Dialnet or DoIS and identified the major thrust areas of research like information sources, information use and sociology of information. Mittal (2011) traced the research trends in LIS in India by using indicators like co-word analysis and co-occurrence analysis, based on the data retrieved from Library and Information Science Abstract (LISA) database from 1900 to 2010 and found that user services, cataloguing, user studies, etc. were mostly preferred areas of research. The study also indicated that open access, Web 2.0, Internet, etc. were some most emerging areas of research in the LIS field. Mukherjee (2010) demonstrated the quantitative performance of scholarly LIS research in Asian nations using data published between 2001 and 2007 in journals listed in the Social Science Citation Index. The study revealed that China was the most productive Asian nation and most of the research output was the result of collaborative effort. Ocholla and Ocholla (2007) used journal and author level quantitative indicators in order to study the research performance of LIS professional in South Africa on the basis of data derived from LISA and Web of Science database for the period of 19993-2006.

Patra and Chand (2006) examined the applicability of Bradford's law of scattering and Lotka's law of scientific productivity on a sample of data collected from Library and Information Science Abstracts (LISA) during the period 1967-2004. Further the study propounded that LIS research were mostly solo in nature during the period under study. Some studies aimed to provide an overview and analysis of the doctoral dissertations in the fields of library and information science that have been submitted to several Indian universities (Roy& Dey, 2014; Singh &Babbar, 2014; Satija, 2010; Kumbar & Raju, 2008; Chatterjee, Rath, & Poddar, 1995) and to some foreign universities as well (Calvert & Cullen, 1996; Samdani & Bhatti, 2011). According to the aforementioned studies, just one work used the Indian Citation Index as its source database to examine the state of LIS research in India over a different time period. The analysis of literature also reveal that no studies based on the co-occurrence network of keywords and applicability of Leimkuhler's Model have been conducted. The state and exposure of the LIS research community in India is surveyed in the current study.

SIGNIFICANCE OF THE STUDY

Like every field of knowledge, intellectual communication is crucial to the creation and

distribution of research outcomes in the field of library and information science (LIS). We can only comprehend India's strengths and capacities through an analysis of its contributions to LIS research. The findings of this study will contribute to a better understanding of the crucial success criteria that could help the LIS researchers publish their research more effectively.

OBJECTIVES OF THE STUDY

The major objectives of the present study are:

- To identify year-wise trends in the publications of papers;
- To study the authorship pattern of the papers;
- To observe the pattern of collaboration in the research team;
- To examine the key research area and map the co-occurrence network of keywords;
- To identify the most prolific institutions in the field of LIS research;
- To assess the journal's scattering through the application of Bradford's law and also through the use of the Leimkuhler Model.

METHODOLOGY

For the study, the Indian Citation Index (ICI) online database is selected as data source for the period 2014-2018. Indian Citation Index is a citation database with multidisciplinary contents collected from about 1000 top Indian scholarly journals. In all 1973 papers were retrieved from the said database during the period under study. This period is the most productive period of LIS research in India as per data reflected in the said database. As we know from the study of Garg and Sharma, about 2500 publications were published by the Indian LIS researchers between 2004 and 2015. So, it is obvious that the average numbers of publications are much higher for the present study and it paves the way to carried out this study. The retrieved data was refined and finally put to excel format. Several bibliometric indicators had been used for better analysis. Additionally, to create the network map of items, researchers employed the VosViewer software (Van Eck & Waltman, 2010).

ANALYSIS AND INTERPRETATION

Year-wise Trend of Distribution of publications

In table 1, details of the number of papers from 2014-2018 are tabulated. As can be seen from the table that highest number of papers was published in the year 2015 which is 494 i.e., 25% of the total number of papers. The lowest number of papers was published in the year 2018, which is 278 (14%) of the total number of papers.

Table 1: Year-wise distribution of paper

Year	Frequency	% of contribution
2014	384	19.47
2015	494	25.03
2016	430	21.8
2017	387	19.61
2018	278	14.09
Total	1973	100

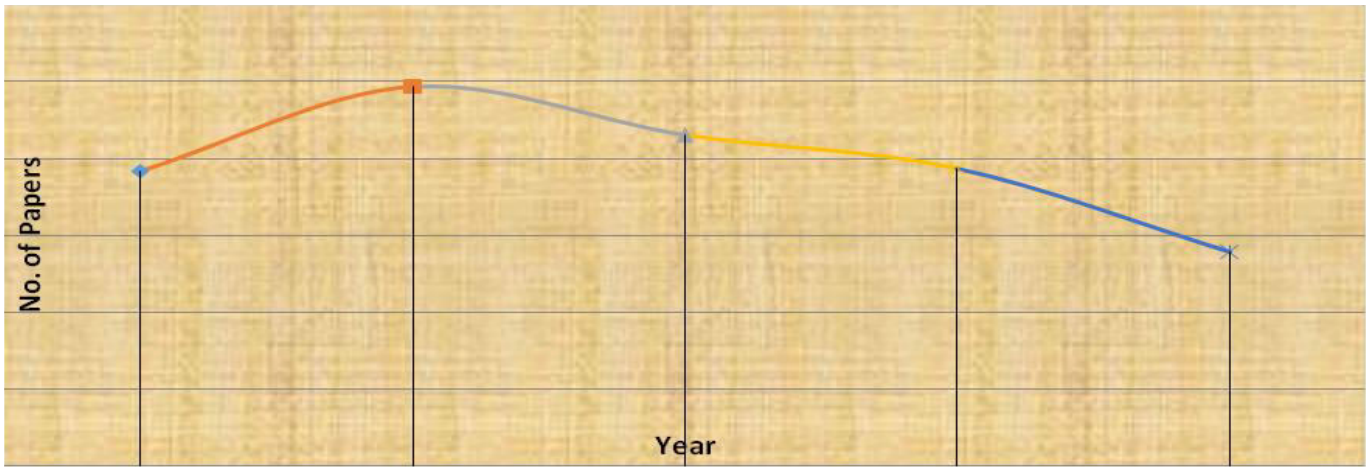

Figure 1: Year wise distribution of paper

The publication growth rate is decreasing over the periods (fig.1). This may be due to ICI only considering the journals that are originated in India.

Authorship Pattern

Table 2 shows trend of authorship pattern. Out of 1973 papers, 661 papers (33.5%) are single authored and 1312 papers (66.5%) are multi-authored. Individually, two authored papers have more contributions (48.3%) followed by single authored (33.5%) and three authored (14.03%) papers respectively. Only 4 percent papers are multi-authored. A negligible percentage of papers are mega-authored i.e. contributed by more than five authors as well.

Table 2: Authorship pattern

Authorship	Frequency	% of contribution
Single	661	33.5
Two	953	48.3
Three	277	14.03
Multi-authored (4 &5)	79	4
Mega-authored (> 5 authors)	3	0.15
Total	1973	100

So, the result provides a definite indicator that collaborative research is more prevalent in case of LIS research during the period under study.

State of Collaboration among Authors

The Collaborative Index and Degree of Collaboration were calculated based on input of data.

According to Subramanyam's method (1983), the degree of collaboration is calculated by the following formula:

$$DC = \frac{NM}{NM+NS}$$

[where, NS= number of single authored papers; NM= number of multi-authored papers]

The overall Degree of Collaboration in LIS domain is 0.664.

The following is one of the early measures of degree of collaboration derived by Lawani (1986).

$$\textbf{Collaborative Index (CI)} = \frac{\sum_{j=1}^{A} jfi}{N}$$

Where, f1, f2, f3……= number of authors; N = Number of publications in that year

The Collaborative Index (CI) for this study is 1.9.

Prolific Researchers

Table 3 lists the researchers who have published in LIS field most frequently over the period under study. The most productive researchers are B. M. Gupta, CSIR, who authored or co-authored 31 papers, followed by Ritu Gupta, Sri Venkateswara University (27 papers), and S. M. Dhawan, CSIR (18 papers) respectively. The raw data presented here are the results of what has come to be known as the 'straight' method of counting.

Table 3: Prolific Researchers

Author	Affiliation	Frequency	Rank	Times cited	CPP
Gupta B M	Council of Scientific and Industrial Research India, New Delhi (CSIR)	31	1	4	0.12
Gupta Ritu	Sri Venkateswara University, Andhra Pradesh	27	2	6	0.22
Dhawan S M	CSIR	18	3	3	0.16
Kaushik Anna	University of Kota, Rajasthan	16	4	10	0.62
Madhusudan M	University of Delhi, New Delhi	16	5	6	0.37
Singh Jagjit	Guru Nanak Dev University, Punjab	14	6	2	0.14
Verma Manoj Kumar	Mizoram University, Mizoram	13	7	7	0.53
Garg K C	CSIR	13	8	15	1.15
Singh K P	University of Delhi, New Delhi	13	9	11	0.84
Ramesh L S R C V	Professor Jayashankar Telangana State Agricultural University, Hyderabad	12	10	00	00

As can be seen from the above table, K. C. Garg, CSIR become the most prolific researcher according to average citations per paper, followed by K. P. Singh, University of Delhi (CPP = 0.84) and Anna Kaushik of University of Kota (CPP = 0.62) respectively.

Active Research Area

The primary aim of this analysis is to know the sub-disciplines of the subject 'Library and Information Science'. Because it informs us about the present thrust area of research. Table 4 displays key research areas which are preferred by the LIS professionals.

Table 4: Key Research areas

Rank	Subject category	Frequency	Percentage
1	Library and ICT	479	24.27
2	Bibliometric study	377	17.97
3	Library resources	220	11.15
4	User study	173	8.76
5	Library services	101	5.11
6	Library administration and management	83	4.21
7	Academic Library	68	3.44
8	LIS Education	56	2.83
9	Information Literacy	54	2.73
10	Public library	46	2.33

As can be seen from the above table, highest 479 papers (24.27%) is in the area of 'Library and ICT' which covers library automation, digital libraries and information technology application. 'Bibliometric study' which includes scientometric, informetric, and webometric study with 377 papers (17.97%) occupies the second place, followed by 'Library resources' which encompasses e-resources with 220 papers (11.15%) and 'User study' with 173 papers (8.76%) as well.

Co-occurrence Network of Keywords

In the present study, keywords of the 1973 published documents have been used to create the clustering map. We get totally 4264 keywords on the basis of the fraction counting methodology. Based on the relevance score, the most relevant

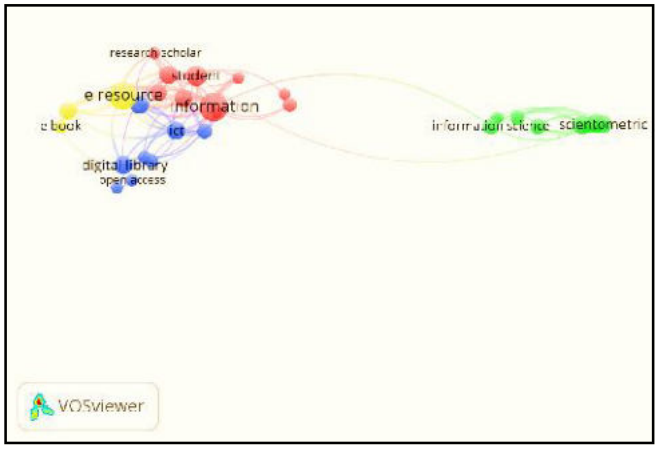

Figure 2: Co-occurrence network of keywords

terms have been selected. Here "minimum number of occurrences" of a term is set to be at least 25 times, so only 49 keywords meet the threshold.

In order to obtain a readable map, only 29 terms (almost 60% of the terms in the distribution) have been accounted and thereby we can get 4 clusters, as exhibited in figure 2. The co-word analysis revealed four theoretical nodes such as Information use and user behavior (red) Scientometric analysis (green), ICT application in library (blue) and E-resources (yellow) respectively. The cluster 1 contains 10 items, followed by cluster 2 and cluster 3 with 8 items each. The last cluster with only 3 items as well. Here, we can see that the network consists of 193 links with 865 total links strength.

Institutional Affiliation of Authors

The relative frequencies of occurrence of items of different institutions over the full five-year period are presented in Table 5. By summing the frequencies of occurrence of items, we might conclude that top ten institutions among themselves host the authors of almost one-fifth (18 per cent) of all those items published in Indian Citation Index on LIS whose authors affiliations are recorded.

Table 5: Institutional Outputs

Institution Name	Frequency	Rank	% of contribution
University of Delhi	63	1	3.19
University of Kerala	47	2	2.38
Panjab University	39	3	1.97
Banaras Hindu University	35	4	1.77
University of Calcutta	31	5	1.57
Guru Nanak Dev University	31	6	1.57
Council of Scientific and Industrial Research, India	29	7	1.46
University of Kashmir	27	8	1.36
Mizoram University	26	9	1.31
Karnatak University	26	10	1.31

The table exhibits the most productive institutions; those from which author published 25 or more papers. University of Delhi takes the first place by number of published papers (n = 63, 3.19%), followed by University of Kerala (n = 47, 2.38%) and Panjab University (n = 39, 1.97%) respectively.

Distribution of Journals

Table 6 reflects distribution of core journals. DESIDOC Journal of Library & Information Technology (DJLIT) leads in productivity accounting with 229 papers (11.6%), followed by SRELS Journal of Information Management with 218 papers (11.06%), Pearl: Journal of Library

& Information Science with 193 papers (9.78%) and so on. Among these journals only two journals are indexed in SCOPUS and secured the Q2 category of journals i.e., included among top 25% to 50% group of journals and/or Q3 category of journals i.e., included among top 50% to 75% group of journals. The DJLIT has a CiteScore of 0.9 and SCImago Journal Ranking (SJR) scores that are 0.275, 0.371, 0.392, 0.313, and 0.274, respectively, during the time period under consideration. The corresponding Source Normalized Impact per Paper (SNIP) values are 0.587, 0.662, 0.811, 0.615, and 0.829. While for the period under study, the CiteScore for Annals

Table 6: Distribution of journals

Name of a Journal	Frequency	Cumulative	Rank
DESIDOC Journal of Library & Information Technology	229	229	1
SRELS Journal of Information Management	218	447	2
Pearl: Journal of Library & Information Science	193	640	3
International Journal of Information Dissemination and Technology	166	806	4
Annals of Library and Information Studies	119	925	5
International Journal of Information Sources and Services	112	1037	6
International Journal of Digital Library Services	106	1143	7
Library Herald	97	1240	8
Library Progress (International)	89	1329	9
Kelpro Bulletin	88	1417	10
Collnet Journal of Scientometrics and Information Management	73	1490	11
Indian Journal of Information, Library & Society	73	1563	11
IASLIC Bulletin	71	1634	12
Journal of Information Management	67	1701	13
Gyankosh- The Journal of Library And Information Management	40	1741	14
Journal of Library and Information Technology	38	1779	15
World Digital Libraries	36	1815	16
Indian Journal of Library and Information Science	33	1848	17
International Journal of Information Processing	31	1879	18
International Journal of Advanced Library and Information Science	29	1908	19
Information Studies	25	1933	20
International Journal of Library and Information Management	19	1952	21
Journal of Library And Information Science	13	1965	22
International Library Movement	8	1973	23

of Library and Information Studies is 0.6 and the SJR values are 0.363, 0.463, 0.268, 0.268, and 0.235 respectively. The corresponding SNIP values are 1.121, 0.791, 0.424, 0.798, and 0.731.

Table 7 displays Bradford's Zone for LIS journals during the period under study. In all 24 journals published 1973 papers. For testing verbal formulation of Bradford's law of scattering, 1973 papers are divided equally into three zones i.e. 657 papers in each zone for this study.

Table 7: Application of Bradford's Law of Scattering

Zones	Articles	%	Journal	%
I	640	32.43	3	12.5
II	689	34.92	6	25
III	644	32.64	15	62.5
Total	1973	100	24	100

Here the relationship among each zone is 3 : 6: 15. 3 represent journals in the nucleus. The value of multiplier n is 2.

Thus $1 : n : n^2 :: 3 : 3*2 : 3*4 :: 3 : 6 : 12 = 21$

Error in percentage is=(24-21)/24) *100= 12.5%

The percentage of error found is significantly high. Thus, we can infer that Bradford's law of scattering does not conform with observed data of the present study.

Leimkulher Model

Leimkuhler Model (1967) can be shown as below:

R(r) = alog(1+b*r) where, R(r) is the cumulative number of research paper published by journals with positioned first through r, and 'a' and 'b' are the variables.

In 1990, Egghe calculated the value of 'a' and 'b' and can be shown as follows:

$a = y_0 / \text{Log } k$

$b = k\text{-}1 / r_0$

Where, y_0 = number of items (equal size) in each Bradford zone; r_0 = number of source journals in the nucleus zone and k= Bradford multiplier.

The Bradford multiplier 'k' can be calculated as $k = (e^{\gamma} * Y^m)^{1/P}$

Here, the data set has been divided in 3 zones. So, p=3

e^{γ} =1.781 (Euler constant) and

Y^m = 229 (Y^m = no. of papers in highest productive journal)

Now, $k = (1.781*229)^{1/3} = (407.849)^{1/3} = 7.415$

y_0= A/P, where A is the total number of paper

y_0= 1973/3= 657.66

Using the value of multiplier 'k' different Bradford's group can be found as below:

Nucleus zone or First Zone $r_0 = T (k\text{-}1) / (k^P - 1)$, where T= whole number of source journals in the data set of study.

$r_0 = 24(7.415-1)/ [(7.415)^3 - 1)]$

$r_0 = 153.96/ (407.69-1) = 0.378$

$a = y_0 / \text{Log } k = 657.66/ \text{Log } 7.415$

$= 657.66/0.87 = 755.93$

$b = k-1/ r_0$

$= (7.415-1)/0.378 = 16.97$

Different Bradford's zone can be identified using the qualified value of 'r_0' and 'k'.

Now the nucleus zone or first zone = $r_0 *1 = 0.378*1 = 0.378>>1$

Second zone = $r_0*k = 0.378*7.415 = 2.802>>3$

Third zone = $r_0*k^2 = 0.378*(7.415)^2 = 20.782>>21$

Therefore, the Bradford zone would be as per Leimkuhler's Model:

Table 8: Bradford zone as per Leimkuhler model

Bradford Zone	Journal	Papers	k
I	1	229	-
II	3	577	2.51
III	21	1167	2.02
Total	25	1973	2.26

According to Brookes (1979), the value of multiplier 'k' should be greater than one (k >1) and the size of the articles/citation in each group (y_0) should be almost equal in size. Here, the size of the 'y_0' is not same in all groups; have very high level of fluctuation. The core group / nucleus group's number of journal calculated is 0.378 which cannot be a feasible number for journal. Hence, the Leimkuhler model is also failed to prove the Bradford law of scattering in the present data set.

CONCLUSIONS

The publication growth rate is swinging during the period under study. The most productive year is 2015 (25% papers). The multi-authorship phenomenon (66.5%) is more prevalent than single authorship. The Degree of collaboration and Collaborative Index are 0.664 and 1.9 respectively. An upward trend of collaborative research is found. B. M. Gupta from CSIR, New Delhi is ranked one researcher with 31 papers. The dominancy of male researchers is very much prominent. The subject-wise maximum activity is observed in ICT application in library (24.7%) followed by bibliometric study. The Co-word analysis also reflects subject wise distribution through the creation of network of keywords. The most productive institution was University of Delhi (0.31%). Top five most productive institutions were contributed about 12.43% of total output during the period under study. Desidoc Journal of Library & Information Technology (11.6%) is the most preferred journals. The present data set was evaluated through the implementation of Bradford's Law and further re-examined by Leimkuhler model. It shows that Bradford's law of scattering does not fit with observed data. The Leimkuhler model also does not conform to the present data set. We may

conclude that the application of metric indicators in the analysis of research contributions could give a better understanding about the recent trends of LIS research.

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