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Growth of LIS Research Articles in India seen through Scopus: A bibliometric analysis

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***Abstract:** The present study aims to analyze the growth of Library and Information Science (LIS) research articles in India. It covers a total of 385 article indexed by Scopus database during the period of 2004-2013. In this study the authors have tried to analyze the annual growth of LIS research publications in India and to identify the authorship pattern, authors' productivity and degree of collaboration. Lotka's inverse square law has been applied to identify the productivity of authors and Bradford's law has been applied to identify the scattering of core journals.*

***Keywords:** Bibliometric, Scopus, authorship pattern, author's productivity, Lotka's law and Bradford's law*

1. Introduction:

Bibliometric study is widely used for mapping of scientific research growth, authorship pattern, research collaboration, author's productivity, etc. in any discipline of knowledge. Mainly it is a best instrument in social science research for systematic analysis of publication output of any subject, author, institution and country. Bibliometrics is used to measure the qualitative and quantitative research and to investigate the research trends in a subject.

Library and Information Science is a very practical subject which solve problems related to collection development, information retrieval, systems design, user studies etc. LIS professionals are very vigorous to show performance in disseminating knowledge as well as taking every problem in a collaborative way. So, day by day LIS research is going on to update the LIS professionals with the current trends and build a rich collection of LIS publications. In

this study an attempt have been made to assess the year wise growth of LIS publications, authorship pattern, authors' productivity etc. particularly in between the period of 2004-2014.

2. Literature Review

The investigator have referred so many research papers and articles related to LIS research in India and abroad to have a clear understanding of bibliometric analysis of LIS research growth India and to find out some possible ways to carry out the present study smoothly in a qualitative way. Khan, Ahmed, Munsif and Akhter (1998) in their study present a statistical analysis of the LIS research papers emanated from Bangladesh during 1966-1997. Result showed that, during this period of study, a total number of 308 articles were authored by 116 library professionals. Publications of such papers are highest in Bangladesh with (256, 83.11%) and followed by India with (21, 6.82%). Tiew, Abrizah & Kiran (2002) carried out a bibliometric study of the articles published in Malaysian Journal of Library and Information Science during 1996-2000 and found that the percentage of multi-authored articles was slightly higher than the single authored articles. The most popular subject according to this study was scientific and professional publishing. Mittal & et. al. (2006) stated in their study 'Periodical Literature on Library and Information Science Education: A bibliometric study' that literature growth on the area of LIS has been found to be negative. Most of the papers have been dominated by single author contributions at 72.8% and 72% of literature are published in 72 journals. Patra and Chand (2006) have revealed that Indian research output is less in Global visibility. Less numbers of LIS research papers have published in international journals. Collaboration among researchers is very poor with (25.37%). Ocholla and Ocholla (2007) studied the journal research output in Library and Information Science of South Africa from 1993-2006, using the database LISA, Thompson (ISI) and Web of Science and found that South African LIS researchers largely publish in local journals (46.3%). Among all the contributing journals, South African Journal of Library and Information Science (SAJLIS) have published highest numbers of articles with (25.1%). Another important thing they revealed in their study that, LIS research collaboration is encouraging in South Africa with (69%). Naseer and Mahmood (2009) have revealed in their study "LIS Research in Pakistan: An Analysis of Pakistan Library and Information Science Journal 1998-2007" that Pakistan Library and Information Science Journal is a domestic journal and highly dominated by the Pakistani authors. Again the state of collaboration among authors is

not very encouraging while majority of the authors prefer to work in isolation. But the journal has witnessed the increase of female authors' contribution. Verma (2009) stated in his study 'Analysis of contributions to Defence Science Journal' that most of the contributors prefer to contribute their works with one companion. If, the source journal is a National journal it could spread over 16 foreign countries. Park (2010) revealed a new thing in her study "D-Lib magazine: Its first 13 years" that the source journal is dominated by male authors with 74% of all contributions, and 77% of authors made a single contribution to D-Lib magazine during this study.

Thanuskodi (2010) stated in his study "Bibliometric Analysis of the Journal Library Philosophy and Practice from 2005-2009" that during the period of study highest number of articles published in the subject area are Library and Internet with (21.69%) and about (59.8%) of the contributors are from the University. Journals constituted as the most cited sources of information with (53.03%). Hussain & Fatima (2011) in their study 'A Bibliometric analysis of the Chinese Librarianship: an International Electronic Journal, 2006-2010' tried to find out the main characteristics of the source journal using a bibliometric study. Khaparde (2011) stated in his study "Bibliometric Study of Electronic Journal of Academic and Special Librarianship." that single author contributions have dominated the journal with 47.95% of contributions, and in geographical based distribution of articles India have occupied the top position with 28.41% publications. Kumar and Moorthy (2011) revealed in their study "Bibliometric Analysis of DESIDOC Journal of Library and Information Technology during 2001-2010" that collaboration of authors is less visible as single author and joint author contribution are somewhat equal with 37.6% and 36.9% respectively. As the journal has crossed 32 long years of publications, only after 2006 it could able to increase the numbers of papers substantially. Mittal (2011) discovered in her study a new trends of LIS research being conducted during that time. She found in her study that LIS researchers were interested to carry their research in the areas of open access, web 2.0, www, internet, access to information etc. as these were the current area of research in the field of LIS during that time. Thanuskodi (2011) in his study "Library Herald Journal: A bibliometric study" opined the same thing that 52.17% authors want for single author contribution. Foreign author contribution to this journal is comparatively less with 10.15%. Jena, Swain and Sahoo (2012) revealed in their study "Annals of Library and Information Studies,

2002-2010: A Bibliometric Study" that the contribution of articles to each volume of targeted journal is constantly increasing from year to year. Also the collaborative research is visible in the journal and the two authored articles have ranked top in the journal. Das (2013) revealed in his study " Journal of Informetrics: A bibliometric profile" that most of the contributions in the journals are joint author collaboration. USA has produced highest portion of authors and the impact factor of the journal is highest in the year 2011 with 4.229%. Roy (2013) revealed in his study "Journal of Documentation: A bibliometric study" that the degree of collaboration is 0.51 i.e. majority of the library and information scientists prefer to contribute their papers jointly. About 6.21% citations are self cited by the respective authors. Maharana (2014) conducted a bibliometric analysis of research growth and development of Sambalpur University using SCOPUS database and found that the university's publications range ranges from 38 to 83 papers with an annual average growth percent rate of 11.29 papers. A total of 1152 authors contributed 301 papers out of which 598 authors were affiliated to Sambalpur University. Again it is found that Astrophysics and Space Science is the most favored journal among the researchers of the university with 12 (3.98%) papers.

3. Objectives of the study

The present study deals with the following objectives;

- To know the year wise growth of LIS research articles in India;
- To know the authorship pattern of the articles published;
- To identify the authors' productivity and degree of authors' collaboration;
- To know the subject orientation of articles and their geographical distributions;
- To identify the most productive LIS authors and Journals; and
- To identify the average page length of LIS articles published during 2004-2013

4. Methodology

The data for the study period 2004 to 2013 are retrieved from the Scopus database using "Library and Information Science" and "India" as the keyword for search. For limiting the search results, other defined search criteria like Document type- Article, Subject area- Social Science, Source type- Journal, country- India and Year- 2004-2013 were used to find out the relevant

data. A total of 385 numbers of articles were retrieved for the period of 2004-2013. All the bibliographic data of the retrieved 385 articles were recorded in a MS excel spreadsheet and the analyses of recorded data were done by simple statistical percentage and average.

5. Data Analysis & Interpretation

Year wise growth of LIS Research Articles in India

Scopus database has indexed a total of 385 research articles in the field of Library and Information Science in India during the period of 2004-2013. During this period of ten years, it is found that a highest numbers of 80 (20.7%) articles have been indexed in the year 2013 and followed by 68 (17.6%) articles in the year 2011. Similarly the lowest numbers of articles were indexed in the year 2005, with 7 (1.9%). Further, Table-1 shows a negative average growth rate (-20.23%) of LIS research articles in the year 2005 and annual average growth rate at (16.49 %).

To calculate the growth of LIS research articles, the method applied was;

$$R = \left[\left(\frac{P_p}{P_o} \right)^{1/n} - 1 \right] * 100$$

Where;

R = Annual Research Growth in %

P_p = Publication Present

P_o = Publication Original

N = Interval between *P_p* and *P_o*

Table-1: Year wise growth of LIS research Publications

YEAR	Number of Publications	Percentage	Year wise growth of publications in (%)
2004	11	2.8	--
2005	7	1.9	-20.23
2006	21	5.4	24.05
2007	15	3.9	8.06
2008	27	7.1	19.67
2009	35	9.1	21.27
2010	57	14.8	26.49
2011	68	17.6	25.57
2012	64	16.7	21.61
2013	80	20.7	21.94
TOTAL	385	100	16.49(mean)

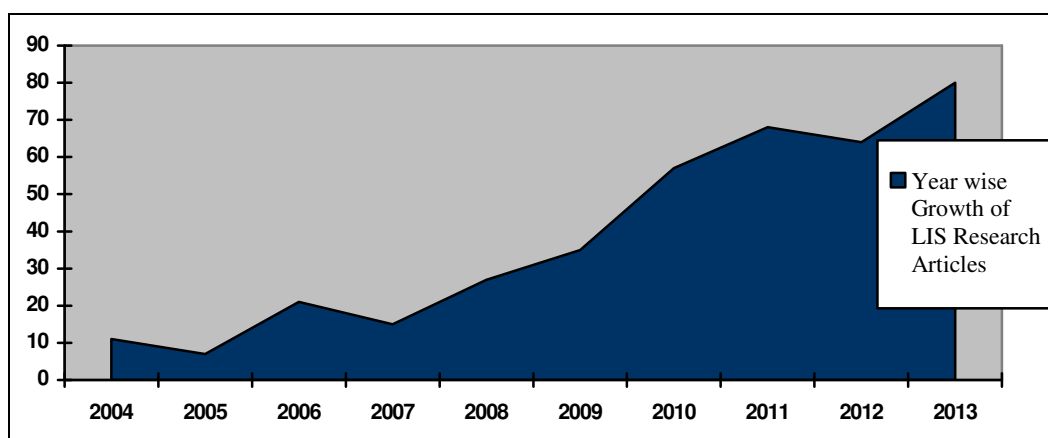


Diagram-1: Year wise growth of LIS Research Articles in India

Authorship pattern of the articles

Table-2 shows the seven types of authorship pattern used by their collaboration of contribution in the articles during 2004-2013. The numbers of articles contributed by each category of authorship pattern have been distributed in the following table to make an easy understanding of the authorship pattern. Two authors collaboration have dominated with highest 169 (43.89%) articles followed by One author with 124 (32.20%) articles, Three authors with 73 (18.96%) articles and Four authors with 13 (3.37%) articles. There are no contributions by six authors' collaboration and only least number of contributions has come out by \geq seven authors with 2 (0.53%) articles.

Table-2: Authorship pattern used in the articles

Year	<i>Authorship Pattern used in the articles</i>							TOTAL*
	one	Two	Three	Four	Five	Six	> Six	
2004	5	3	2	1	0	0	0	11 (2.85)
2005	3	2	0	1	0	0	1	07 (1.84)
2006	4	9	4	4	0	0	0	21 (5.45)
2007	2	7	4	0	1	0	1	15 (3.89)
2008	7	16	3	0	1	0	0	27 (7.03)
2009	19	11	4	0	1	0	0	35 (9.09)
2010	17	24	14	2	0	0	0	57 (14.80)

2011	24	25	19	0	0	0	0	68 (17.66)
2012	21	31	10	2	0	0	0	64 (16.62)
2013	22	41	13	3	1	0	0	80 (20.77)
TOTAL*	124 (32.2)	169 (43.89)	73 (18.96)	13 (3.37)	4 (1.05)	0 (0.0)	2 (0.53)	385 (100.0)

*Figure within the deviation represents percentage

Authors' productivity

Table-3 depicts the authors' productivity of the Indian LIS research articles during 2004-2013. It is depicted from the table that about 756 numbers of authors have contributed a total of 385 articles and their Average Authors Per Article (AAPA) is found to be 1.96 and Productivity Per Author (PPA) is 0.5. Amongst the 756 numbers of authors maximum 731 authors were affiliated to India and their AAPA for Indian authors is 1.89 and PPA is found to be 0.52.

Table-3: Authors' Productivity

Year	<i>Authors' Productivity</i>						
	Total No. of Articles	Total No. of Authors	Total AAPA	Total PPA	Authors only affiliated to India	India AAPA	India PPA
2004	11	21	1.9	0.52	20	1.81	0.55
2005	7	20	2.85	0.35	20	2.85	0.35
2006	21	50	2.38	0.42	46	2.19	0.45
2007	15	40	2.66	0.37	38	2.53	0.39
2008	27	53	1.96	0.5	51	1.88	0.52
2009	35	58	1.65	0.6	56	1.6	0.62
2010	57	115	2.01	0.49	110	1.92	0.51
2011	68	131	1.92	0.51	129	1.89	0.52
2012	64	121	1.89	0.52	119	1.85	0.53
2013	80	147	1.83	0.54	142	1.77	0.56
TOTAL	385	756	1.96	0.5	731	1.89	0.52

Note: Average Authors Per Article= Number of Authors / Number of Articles
Productivity Per Author= Number of Articles/ Number of Authors

Lotka's Law of scientific productivity

Lotka's inverse square law of scientific productivity is a widely used law for bibliometric mapping of research outputs and authors' productivity in any discipline of knowledge. Lotka's law states that the number of authors making n contributions is about $1/n^2$ of those making one; and the proportion of all contributors, that make a single contribution, is about 60 percent. This means that out of all the authors in a given field, 60 percent will have just one publication, and 15 percent will have two publications, 7 percent of authors will have three publications and so on. In table-4, Lotka's law has been applied to the following data set, and result promulgated that with one article contribution only 124 (32.20%) authors were both observed and expected. Whereas for two articles contribution maximum 169 (43.89%) authors observed and 93 (24.15%) authors expected. Again for three articles contribution highest 73 (18.96%) authors observed and 79 (20.51%) authors expected. So, in the following data set it is found that the numbers of authors observed are somehow different with the numbers of authors expected.

Lotk'a formula for scientific productivity of authors is as follows;

$$X^n Y = C \text{ and } Y = C/X^n$$

Where, X= number of publications, Y= relative frequency of authors with 'X' publications and C= Constants depending on the specified field.

Putting the value of X= 1 and Y= 124, the calculation obtained was;

$$1^n \cdot 124 = C$$

$$\Rightarrow C = 124$$

Again putting the value of X= 2 and Y= 169 and C= 124 the calculation obtained were:

$$2^n \cdot 169 = 124$$

$$\Rightarrow 2^n = 124/169$$

$$\Rightarrow n \log 2 = \log 0.73$$

$$\Rightarrow n (0.301) = 0.73$$

$$\Rightarrow n = 0.73/0.301$$

$$\Rightarrow n = 0.41$$

Table-4: Lotka's Law of Scientific productivity

No. of Articles (x)	No. of Authors Observed (y)	Percentage (%) (Observed)	No. of Authors Expected (n= 0.41)	Percentage (%) (Expected)
1	124	32.20	124	32.20
2	169	43.89	93	24.15
3	73	18.96	79	20.51
4	13	3.37	70	18.18
5	4	1.03	64	16.62
6	0	0.00	59	15.32
7	1	0.25	56	14.54
8	0	0.00	53	13.76
9	1	0.25	50	12.98
10	0	0.00	48	12.46
>10	0	0.00	≤ 48	≤ 12.46

Degree of authors' collaboration

Degree of authors' collaboration examines the prominent area of inquiry indicating the trend in patterns of single and joint authors' publication. table-5, explains the applications of Subramanian's equation to calculate degree of authors' collaboration in different years. It is observed in the table that, the degree of authors' collaboration has ranged from 0.2 to 0.57 during the period of study and the mean value is found to be 0.36.

Subramanian's equation

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

C= degree of collaboration,

Nm= number of multi-authored work,

Ns= number of single-authored works.

Table-5: Degree of authors' collaboration

Year	<i>Authors' Degree of Collaboration</i>			
	Single Authors (Ns)	Multiple Authors (Nm)	(Ns+Nm)	Degree of Collaboration
2004	5	6	11	0.54
2005	3	4	7	0.57
2006	4	17	21	0.23
2007	2	13	15	0.2
2008	7	20	27	0.29
2009	19	16	35	0.57
2010	17	40	57	0.31
2011	24	44	68	0.36
2012	21	43	64	0.34
2013	22	58	80	0.28
TOTAL	124	261	385	0.32 (mean)

Subject orientation of LIS research articles

Table-6, depicts the major subjects orientation of LIS research, which shows that amongst the whole 385 articles, total 385 (100%) articles have Social Sciences orientation, 125 (32.46%) articles have computer Science orientation, 74 (19.22%) articles have Arts and Humanities orientation and 14 (3.63%) articles have Decision Sciences orientation. The lowest number of subject orientation have come up from Agricultural and Biological Sciences, Engineering and Psychology having 1(0.25%) article each.

Table-6: Subject orientation of articles

Subject orientation of articles	Total Articles (N=385)	Percentage (%)
Social Sciences	385	100.00
Computer Science	125	32.46
Arts and Humanities	74	19.22
Decision Sciences	14	3.63
Business, Management and Accounting	7	1.81
Economics, Econometrics and Finance	2	0.51
Agricultural and Biological Sciences	1	0.25

Engineering	1	0.25
Psychology	1	0.25

Geographical distribution of LIS articles

Geographical distribution of LIS research articles with collaboration to foreign countries shows that amongst the 385 articles, whole total 385 articles were contributed by authors of India. The authors of Bangladesh and United States have contributed 3 (0.71%) articles each. Lowest numbers of collaborative contributions have come up from Kenya, Qatar and Switzerland with only 1 (0.25%) articles each.

Table-7: Geographical distribution of LIS research articles

Rank	Name of the Country	Total Contributions (N=385)	Percentage (%)
1	India	385	100.00
2	Bangladesh	3	0.71
2	United States	3	0.71
3	Antigua	2	0.51
3	Belgium	2	0.51
3	China	2	0.51
3	Iran	2	0.51
3	Malaysia	2	0.51
3	Saudi Arabia	2	0.51
3	Swaziland	2	0.51
4	Kenya	1	0.25
4	Qatar	1	0.25
4	Switzerland	1	0.25

Most productive LIS authors during 2004-2013

Table-8 reveals the rank list of most productive LIS authors based on their numbers of contributions indexed in Scopus database. The table shows the author's rank, country name and numbers of contributions made during the period of study. Kademani, B. S. and Kumar, V. has ranked 1st position with 13 numbers of articles contributed each. Mukherjee, B. has ranked 2nd position with 11 numbers of contributions. However, the third position has been occupied by Sagar, A. with 10 numbers of contributions.

Table-8: Most productive LIS Authors' during 2004-2013

Sl.No	Rank	LIS Authors	Country	Contributions (N=385)	Percentage
1	1	Kademani, B.S.	India	13	2.86
2	1	Kumar, V.	India	13	2.86
3	2	Mukherjee, B.	India	11	2.42
4	3	Sagar, A.	India	10	2.21
5	4	Panda, K.C.	India	9	1.98
6	4	Mahajan, P.	India	9	1.98
7	4	Thanuskodi, S.	India	9	1.98
8	5	Kalyane, V.L.	India	8	1.76
9	5	Madhusudhan, M.	India	8	1.76
10	5	Gul, S.	India	8	1.76
11	6	Kumar, S.	India	7	1.54
12	7	Khan, A.M.	India	6	1.33
13	7	Gupta, D.K.	India	6	1.33
14	7	Swain, D.K.	India	6	1.33
15	8	9 authors 5 Articles each		45	9.92
16	9	9 authors 4 Articles each		36	7.93
17	10	24 authors 3 articles each		72	15.86

18	11	74 authors 2 articles each	148	32.59
19	12	30 authors 1 article each	30	6.60

Most productive LIS journals during 2004-2013

Bradford's Law is used in determining the increasing productivity of number of core journals in any given field. The law states the increasing productivity of journals from one zone to the next in the mathematical expression $1:n:n^2$. According to Bradford's law contributing journals can be divided into three equal zones, each containing the same number of productivity. Table-9 depicts that first 2 journals produced 122 articles, next 6 journals produced 136 articles and remaining 50 journals produced 127 articles which mostly meets the Bradford's law of scattering of journals. Again it is found that Library Philosophy and Practice have contributed highest 69 (17.92%) articles and secured the number 1 rank. It is followed by DESIDOC Journal of Library and Information Technology with 53 (13.76%) articles and number 2 rank and Annals of Library and Information Studies have ranked 3 with 29 (7.53%) articles.

Table-9: Most productive LIS Journals during 2004-2013

Rank	Contributing Journals	No. of articles	Percentage (%)	Cumulative	
				No. of articles	Percentage (%)
1	Library Philosophy and Practice	69	17.92	69	17.92
2	DECIDOC Journal of Library and Information Technology	53	13.76	122	31.68
3	Annals of Library and Information Studies	29	7.53	151	39.21
4	International Information and Library Review	27	7.02	178	46.23
5	Electronic Library	26	6.75	204	52.98
6	Malaysian Journal of Library and Information Science	22	5.72	226	58.70
7	Scientometrics	17	4.42	243	63.12
8	Library Review	15	3.89	258	67.01
9	Library Hi Tech News	13	3.38	271	70.39
9	Program	13	3.38	284	73.77

10	Webology	11	2.85	295	76.62
11	2 numbers of journal with 7 articles	14	3.63	309	80.25
12	2 numbers of journal with 6 articles	12	3.12	321	83.37
13	1 number of journal with 5 articles	5	1.29	326	84.66
14	3 numbers of journal with 3 articles	9	2.34	335	87.00
15	11 numbers of journal with 2 articles	22	5.72	357	92.72
16	28 numbers of journal with 1 article	28	7.28	385	100.00
TOTAL		385	100		

Average length of LIS research articles

In identifying of pages range of LIS research articles published during 2004-2013, it is found that maximum 171 (44.43%) articles are published under the pages range of 1-10 and it is followed by 133 (34.51%) articles within the pages range of 11-20. Only 3 (0.78%) articles were appended with 31 & more pages.

Table-10: Average length of papers

Page Range	Average length of papers											Percent (%)
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL	
0	0	0	2	1	11	7	1	26	2	1	51	13.25
1-10	5	3	8	4	4	17	28	22	31	49	171	44.43
11-20	5	3	9	9	8	9	25	16	25	24	133	34.51
21-30	1	1	2	0	4	2	3	4	5	5	27	7.03
≥ 31	0	0	0	1	0	0	0	0	1	1	3	0.78
TOTAL	11	7	21	15	27	35	57	68	64	80	385	100.00

Conclusion and Findings

The present study has been summarized with the following research findings;

- The publication of LIS research articles in India ranges from 7-80 articles with a yearly average growth of 16.49%.

- It is found that highest 169 (43.89%) articles have been contributed by two authors collaboration.
- The Average Authors Per Articles (AAPA) was found to be 1.96 and Productivity Per Authors (PPA) as 0.5. Whereas AAPA of Indian authors was found to be 1.89 and PPA as 0.52.
- The study witnessed a poor International collaborative research in the field of LIS. Only 23 (5.74%) articles out of 385 have been contributed by the authors of foreign countries, which is comparatively very low contribution.
- Kademani, B. S. and Kumar, V. are identified as most productive LIS authors with a highest contribution of 13 (2.86%) articles.
- Library Philosophy and Practice has been identified as most favored LIS journal having 69 (17.92%) articles publication out of 385 LIS research articles.
- Most of the LIS research articles are published within the pages range of 11-20. Whereas the promulgated pages range is not healthy for a research article.
- With the application of Lotka's law to the present data set, it is revealed that the numbers of authors observed are somehow different with the numbers of authors expected.

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