



A Study of India's research performance in Library and Information Science: A Bibliometric Analysis

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Abstract

This paper examines and assesses the LIS research productivity of Indian universities during the time frame from 2001 to 2010, and reviews the contributions made by the LIS PhD research scholars awarded degree during this timeline. The study evaluates and assesses research both qualitatively and quantitatively, which include the review of PhD thesis and the publication productivity from their PhD thesis. The study reveals many observations that represents a guiding tool for the research institutions and researchers.

Keywords: Research, PhD, LIS, ETD, Publication, Journal, Conference, Book

1. Introduction

Bibliometric assessment of research has always played a significant role in the improvement of the research practices. Fundamental constituents in the bibliometric analysis include producer (author or scholar), artifacts (publications), and concepts (topic/subject). All these components are the integral part of a process, which together contribute to the development and enrichment of research. These components are also essential indices in the evaluation of research output, research trend, productivity patterns, research collaboration, the rank of affiliating institutions, and, above all the impact of research. The author of the present study used these above mentioned components for analysis of research productivities of PhD scholar in LIS in India, and assesses their impacts on the scholarship in general. For the study both qualitative and quantitative assessments of diverse data have been undertaken. Qualitative analysis has helped in scrutinizing the research data, and assesses the research productivity. Quantitative analysis, on the other hand, has enabled to focus on aspects such as, publication patterns, authorship patterns, ranking of institutions, and research collaborations. The main purpose of the present study is quantifying the value of research and their impact on scholarship. The current topic aims to focus on the scenario of LIS PhD research of India. The study covers analysis specific to the thesis, books, journals and conference papers. All these sources of literature are examined further to access vital results, which include identifying research impact, research productivity, research trends, and publication pattern.



2. Literature Review

For this study a wide range of literature were well thought-out for the review. Some of the important papers that have been reviewed here, were Kumar & Sharma, (2010), Mestri, (2008), Pandita, R & Singh, S, (2017), Shivalingaiah, N & Keralapura, (2009), Rana, R, (2011), and Singh, SP, (2014). All these papers are of an important source for PhD data that highlighted LIS research growth decade-wise, scholar-wise, university-wise, state-wise and so on. Kumar & Sharma (2010) presented a historical perspective of LIS education in India and outlined the growth and development of the subject over a period. They illustrated in details the dynamics of LIS educations in India and presented a scenario of research trends in India in this subject domain. This reviewed help researcher to identify the historical growth of LIS research. In this context, Mestri, (2008) highlighted bibliographical listing of PhD theses in LIS, and explained the use of various bibliometric parameters to access the scholarly contributions of the PhD researcher. They studied 219 PhD theses produced from 45 Indian universities, and outlined a growth curve of research over the years as well as identified sources of research. Shivalingaiah and Keralapura, (2009), in their papers identified the issue like thrust and gray areas related to research. Also, they analyzed the research data decade-wise from 1980s – 2007. A total of 851 LIS PhDs were produced during the timeline in India. They have discussed the key finding such as LIS research trend, area of research and distribution of research in all level institutions/state and/or country. Such study represents as a guiding tool that leads broadening the research scope in the area of study. Another important source is a book authored by Singh (2014), who compiled a list of LIS PhDs across universities in India from the inception of the courses till 2013. Which become a source of reference for the current author, through which they extend their research study. The books have ample of information on PhD that is vital for the current study. In the same line Pandita and Singh (2017) papers were reviewed to access the scenario of PhD research in LIS in India during 2010 to 2014, and explored the key area of research. The study revealed that Gujarat state became the most popular state that was having a high of 16.38% doctoral productivity during this timeline. Whereas Rana (2011) had discussed the LIS research output of Panjab University from 1960 to 2009. In her paper, she has explained the growth and pattern of research in that university. Such study can be a valuable addition to this current topic of research that helps authors for thinking to study the publications as well as the authorship pattern like analysis. There was another set of literature, which discussed about the bibliometric analysis, citation analysis, and mapping of LIS research. On this account, following papers have been reviewed, they are Harzing & Alakangas (2015); Li J., Sanderson M., Et.al., (2010); Smith (2005); and Mittal, Rekha (2011). Harzing & Alakangas, (2015) in their paper they have examined a comprehensive list of research data from five major disciplines of both Arts & Humanities, and Science & Technology. All these data have been analysed to establish a



longitudinal comparison of three databases (including Google Scholar, Scopus, and WoS), and made an assessment on coverage, stability and growth in productions. The key research metrics used for this study include publications, citation, h-index, and half-life cycle. The authors concluded that all these three databases provide sufficient stability of coverage that helps researcher to do research analysis easily and effectively. For the current topic, we have used Google scholar database to access the LIS research publications. The paper of Li., Sanderson et.al., (2010) analyzed the LIS researcher profile, and made assessment to rank them by correlating the citation impact via calculating h-index and g-index value computed via WoS, Scopus and Google Scholar. They also analysed ranking of authors, and identified their role of collaboration in research. They conducted surveys on 101 research scholars and considered 42 judgements on 5 point quality research. In this account of the study, there was a paper by Mittal (2011). She traced the research trend scenario during 1990 to 2010 as reflected through journals. The key finding was the identification of frequent areas of research and emerging area of LIS research in India. Whereas, Smith (2005) talked upon the impact and value of citations and links, how they evaluated as an indicator for publications assessment. According to the assessment of various e-journals, it was seen that several journals having low citation, but received significant web hits, which also impacted the publication productivity. From all the above literature reviewed, the author observed that bibliometric or scientometrics analysis which have played significant roles in evaluating research. The key units of analysis identified as the topic, author and publication. All have contributed in the development of research. Furthermore, another set of literature has been reviewed to access the scenario of LIS research via ETDs, the key papers reviewed were Ahmed, A., Alreyaee, S., & Rahman, A. (2014); Goodfellow, L. M. (2009); Sheeja, N. K. (2012); Stock, C. (2008); and Sawant, S. (2013). Ahmed, Alreyaee, and Rahman (2014) highlighted about the scenario of ETDs repositories in Asia. They discussed how ETDs play a major role in highlighting these research impacts and enhancing the rank of the institutions. Whereas, Goodfellow (2009) suggested internationalization of ETDs, so that all scholars of nursing across the countries could benefit from it. Stock (2008) highlighted how important an ETDs as like an e-article. He, also discussed various factors of accessibility issues of ETDs. Sawant (2013) discussed the government initiation of ETDs in India, described how ETDs play an important role in dissemination of Knowledge. Sheeja, (2012), described the potentiality of open access to ETD in India, and acknowledged the need of it for the national development by highlighting the initiatives on national ETDs movement in India. All papers have similar opinion about the creations of ETDs and its availability in open access mode. All these reviewed literature helped author to determine the right direction to this topic of discussion.



3. Objectives

This study aims to investigate the following parameters as given below

- Assess the research contributions of all Indian universities in the field of LIS;
- Identify the research trend and the potential area of research;
- Assess the impact of LIS research publications in each format such as the e-thesis, journals, books, and conferences for outlining an elaborate map of research;
- Identify the publication and authorship patterns of LIS researcher during the timeline;
- Identify the most productive LIS research university of India;
- Identify the most prolific LIS author (scholar) of India; and
- Identify the most frequent sources chosen by the researcher for publications.

4. Scope of the Study

The scope of the present study intends to take into account the data of PhD thesis information as well as scholarly articles of the thesis produced in the form of books, journal articles, conference papers, and ETDs only, which have been indexed online. The study will aim to analyze the growth and development of LIS research quantitatively regarding publication output, affiliations, and collaborations to reflect the current research status and academic ability of LIS research. For this study, a comprehensive list of LIS PhD theses from 2001 to 2010 have been tabulated that have been retrieved from IndCat – Indian thesis catalogue, and different universities based e- thesis IRs system. Further analysis has been performed with the help of publication output of the scholarly theses.

5. Methodology

The sampling method was deployed to perform the whole analysis of the study, primarily the author investigated LIS-PhD research produced by universities in India during the time frame from 2001 to 2010. Further with the help of online software, namely Publish-or-Perish; the online publication data produced in any of the mentioned formats above, along with citation information were collected from the Google Scholar database, and organized in a Microsoft Excel Worksheet for further analysis and evaluation.

6. Data Analysis

6.1 The scenario of LIS PhD research in India during 2001 -2010

The following Table.1 presents details of distribution of LIS-PhD theses across 79 universities in India. Over the period of 10 years, a total of 949 PhD theses was produced with an average of 12.01 theses per



university. On account of year wise progress of PhD production, it was easily identified that the majority of them (nearly 58% of total thesis) were produced during 2006 to 2010. It was also depicted that the average number of thesis productions per universities ranges between 2 to 3 maximum per year. The publication details also framed, which revealed that a total of 1745 publications have been produced from 949 theses at an average rate of 1.84 publication.

Table 1
Distribution of LIS- PhD Thesis

Items	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Thesis	65	90	79	76	92	78	107	110	101	151	949
Percentage	6.85	9.48	8.32	8.01	9.69	8.22	11.28	11.59	10.64	15.91	100
University	29	37	37	34	36	41	45	49	46	51	79
Average	2.24	2.43	2.14	2.24	2.56	1.90	2.38	2.24	2.20	2.96	12.01
Publication	103	160	126	193	184	151	178	190	152	308	1745
Percentage	5.9	9.17	7.22	11.06	10.54	8.65	10.2	10.89	8.71	17.65	100

It also illustrated a detailed breakup of the total volume of publications on a yearly basis, which can be viewed as following figure. 1. There was no consistency of publication activities throughout the decade.

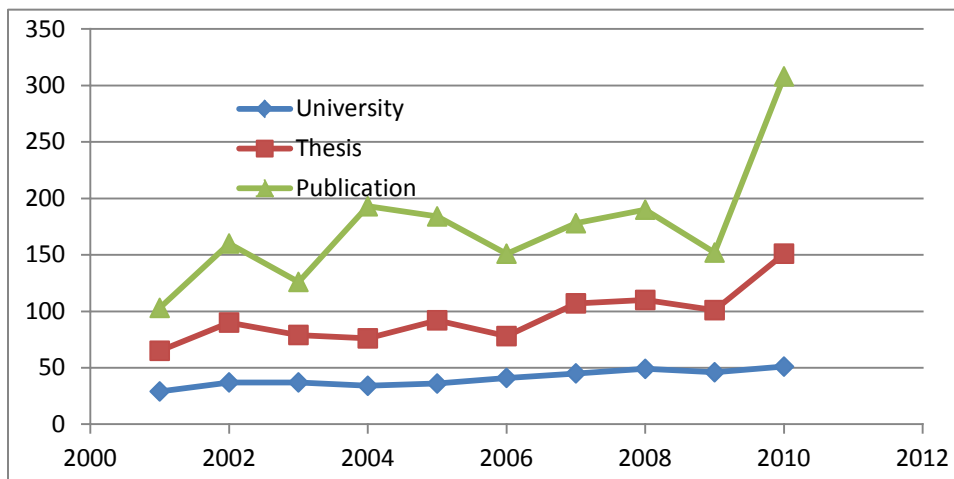


Figure 1: Yearwise distribution of LIS Research across the universities



6.2 Distribution of research topics in terms of popularity

The present study has also probed into the popular topics of research for doctoral theses in LIS, undertaken by the Indian scholars. As shown in the table below, 39 broad areas of research topics were identified.

Table 2
Areas of research in LIS in India during 2001 - 2010

Rank	Topic of Research	PhD(f)
1	Library Use or Information services (facilities and Services)	121
2	Information seeking behavior	114
3	ICT application	108
4	Bibliometrics	102
5	Library Development and Management	62
6	Library (academic, public, special)	60
7	Consortium and library network	49
8	Collection development and management	35
9	Library Automation	30
10	Librarianship, Professional attitude	30
11	Library Administration and Management	28
12	Digital Library, Digitization, Archives, Preservation, Conservation..	26
13	Information, data, knowledge, Knowledge Organization, Expert System, Thesaurus construction, Ontology	24
14	Historical growth and development of Literature	19
15	Marketing of Library Services	15
16	LIS education	13
17	Information management	12
18	Web, Search Engine, Social Media	12
19	Classification, Cataloguing	11
20	Information retrieval system	10
21	Career, job analysis	9
22	Information literacy	9
23	Financial aspect, budget, cost analysis, ROI	7
24	IPR, Copyright...	6
25	Community information and resources	5
26	Library building, Space management, environment factor...	5
27	User education, Training, Orientation	5
28	E-learning	4
29	Miscellaneous	4



30	Content management	2
31	Documentation and Record Management	2
32	Library Association	2
33	Open access	2
34	Conflict management	1
35	Indexing	1
36	Information access	1
37	Institutional repository	1
38	Library Policy, Legislations	1
39	Library security, care	1

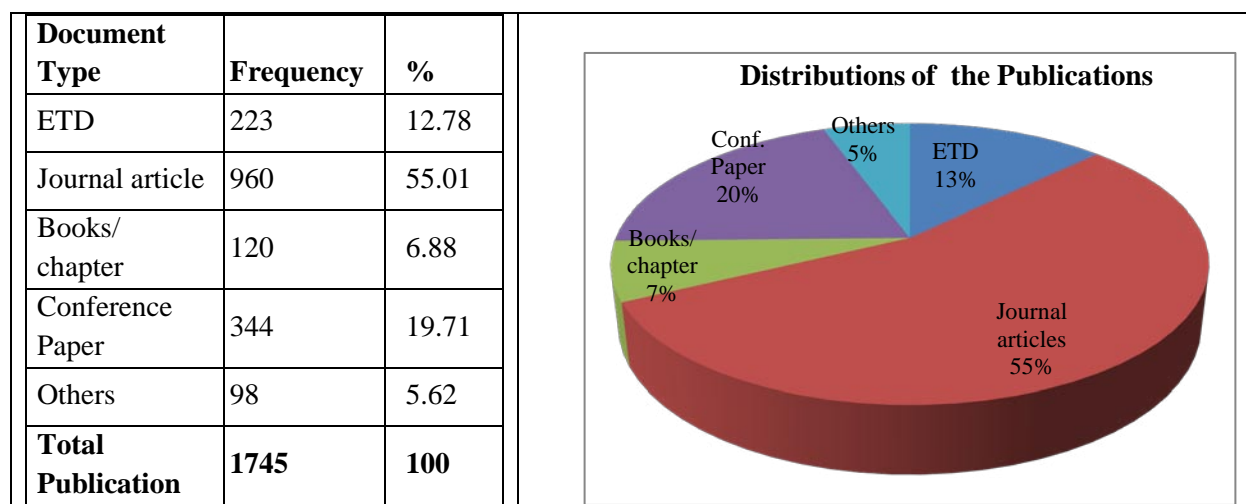
One finds that the most popular topic for LIS research pertained to their doctoral thesis was coming out to be 'library use or information services offered to the user'. The highest number of 121 PhDs was awarded. Rank-wise, the other popular research topics in LIS were listed in the above table. While considering the top 10 listed topics of research, we can identify a total frequency of 711 theses, which is 75% of total thesis. It means the majority of researches are confined to listed top 10 topics.

6.3 Analysis of Publications Productivity

The publication details further analyzed and discussed in the following section below:

a) Format wise distribution

As specified in the Table -1, universities in India logged a combined total of 1,745 publications in connection with 949 doctoral theses in the field of LIS during 2001 to 2010. Further, all these publications were categorically accessed in following formats.

Table 3
Distributions of the publications

In ETD format, 223 theses were published, which accounted for about 23% of the total theses. From the perspective of publications, it came to 13% of total publications. Another fact coming out of the study was that many universities did not have the provision of ETDs yet, which must be increased for strengthening the research scope in this field of study. The study revealed that an overwhelming majority of PhD scholars preferred to publish their thesis, in total or in parts, by means of journal articles. Altogether, 960 journal articles were published, which translates to 55% in terms of total volume publications, it's marked as highest among all categories of publication. Next in line was presentation and publication of research findings as conference papers. A total of 344 papers was listed, which is 19% of the total publications. It indicates that the LIS scholars were not much interested in presenting their work at conferences. Therefore, need improvement in this segment to reach a wider readership. Finally, publications in books were counted to be 120, which are 6% of total volume of publications, indicating an insignificant share. Therefore, the present author suggests far greater emphasis on conference and books publication as an effective means for the growth of quality research activities in India across the academic discipline.

b) Year wise distributions

The year wise distributions of all formats of publications revealed that there is a lack of consistency of publication activities throughout the year.

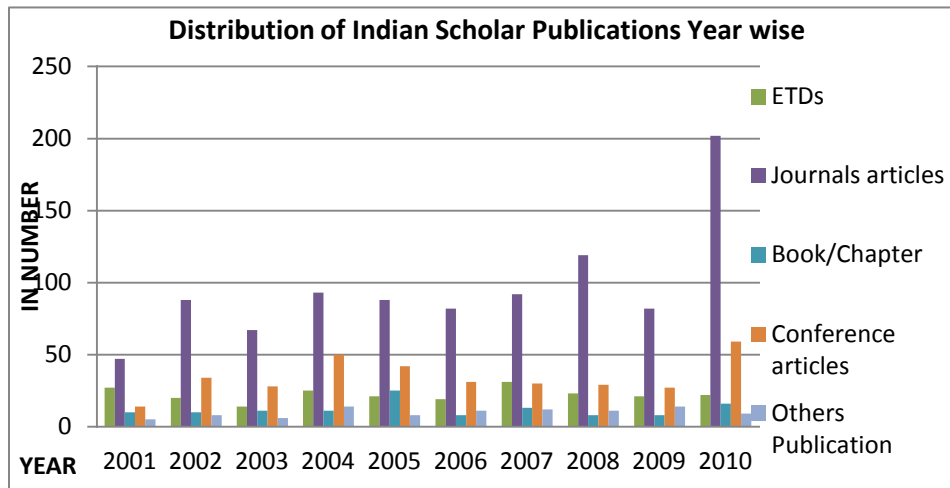


Figure.2 Distribution of Scholarly publications Year wise

As depicted, the year 2010 could be found to be the most productive year in all aspects with the highest percentage (17.65%) of share in the context of all formats of publications, and 2001 had the lowest percentage share (5.9%).

c) University wise distribution

The author has delved into details of these tabulated data, and has made various observations on different aspects. One of the key aspects of such analysis is to identify each university share, and verify the ranking of them according to the rate of productivity of the thesis as well as related publications.

Table.4
Indian Universities and their Publication Trend

University	PhD	ETD	Journal Article	Book /chpt	Conf Paper	Other	Total Publication
Aligarh Muslim University	8	6	22	0	2	0	30
Allahabad Agricultural Institute	1	0	0	0	0	0	0
Andhra University	28	20	16	4	10	3	53
Anna University, Chennai	2	0	1	0	1	1	3
Annamalai University	47	5	72	4	7	2	90
Awadhesh Pratap Singh Vishwavidyalaya	12	0	3	0	0	0	3
B. N. M University	1	0	0	0	0	0	0
Babasaheb Bhimrao Ambedkar	3	0	3	0	0	0	3



University, Lucknow							
Banaras Hindu University	7	0	17	2	4	0	23
Bangalore University	9	2	25	0	14	3	44
Berhampur University	8	0	6	3	0	0	9
Bharathidasan University	4	1	3	0	0	2	6
Bhavnagar University	2	1	1	0	0	0	2
Birla Institute of Technology, Mesra, Ranchi	1	0	2	0	1	0	3
Bundelkhand University, Jhansi	28	21	11	3	12	3	50
Cochin University of Science & Technology	1	0	1	0	0	0	1
Dr B R Ambedkar University, Agra	22	1	16	5	4	2	28
Dr Babasaheb Ambedkar Marathwada University, Aurangabad	21	3	8	2	1	5	19
Dr Hari Singh Gour Vishwavidyalaya, Sagar	16	0	14	0	0	3	17
Dr. Bhim Rao Ambedkar University, Andhar Pradesh	1	0	4	0	1	0	5
Gauhati University	28	8	11	1	7	1	28
Gulbarga University	13	1	13	3	5	5	27
Guru Ghasidas University	16	13	1	0	0	0	14
Guru Nanak Dev University, Amritsar	19	3	15	6	3	0	27
Hemchandracharya North Gujarat University	13	4	2	0	0	1	10
Hemwati Nandan Bahuguna Garhwal University	1	0	0	0	0	0	0
Indira Gandhi National Open University (IGNOU)	1	0	0	0	0	0	0
Jadavpur University	25	8	30	3	16	4	61
Jiwaji University	48	2	37	4	7	3	53
Karnataka open university	1	0	1	0	0	0	1
Karnataka University	29	6	30	4	15	4	59
Kurukshetra University	7	0	12	0	1	1	14
Kuvempu University, Shimoga	9	3	24	0	4	0	31
Madhya Pradesh Bhoj (Open) University	4	0	1	1	0	0	2
Madurai Kamaraj University	1	0	1	0	0	0	1
Maharaja Sayajirao University of Baroda	2	1	2	1	0	0	4



Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Satna	2	0	0	0	0	0	0
Makhanlal Chaturvedi National University of Journalism and Communication	7	0	0	0	0	2	2
Mangalayatan University	2	0	0	0	0	0	0
Mangalore University	16	0	29	3	4	1	37
Manipur University	7	5	11	2	6	0	24
Mizoram University	6	1	0	0	3	1	5
Mohan Lal Sukhadia University, Udaipur	4	0	0	0	0	0	0
Nagpur University	1	0	0	0	0	1	1
North Eastern Hill University, Shillong	16	5	11	0	1	6	23
Osmania University	14	0	19	7	8	3	37
Pandit Ravishankar Shukla University	4	2	0	1	0	1	4
Punjab University, Chandigarh	21	9	18	0	6	1	34
Pt Sundarlal Sharma Open University	1	0	0	0	0	0	0
Punjabi University, Patiala	10	2	5	0	2	0	9
Rabindra Bharati University	2	0	0	0	0	0	0
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur	29	17	13	1	2	4	37
Sambalpur University	21	0	34	6	12	0	52
Sant Gadge Baba Amravati University	12	10	7	1	3	0	21
Sardar Patel University	5	1	1	0	2	1	5
Saurashtra University	1	0	2	0	0	0	2
Shivaji University, Kolhapur	3	0	2	0	0	2	4
Shreemati Nathibai Damodar Thackersey Women's University	6	1	9	0	9	0	19
Sri Krishnadevaraya University	13	4	6	0	0	0	10
Sri Venkatswara University, Tirupati	20	4	12	3	4	2	25
Swami Ramanand Teerth Marathwada University	4	0	2	0	1	0	3
Tilka Manjhi Bhagalpur University	1	1	8	1	4	1	15
University of Burdwan	12	5	6	1	5	2	19
University of Calcutta	14	0	9	0	4	3	16



University of Calicut	24	5	23	8	13	2	51
University of Delhi	22	0	20	3	10	1	34
University of Jammu	6	4	6	1	2	1	14
University of Kashmir	2	1	9	0	3	0	13
University of Kerala	16	4	30	13	18	8	73
University of Lucknow	9	2	4	2	5	0	13
University of Madras	42	5	46	4	30	4	89
University of Mumbai	5	0	6	1	2	0	9
University of Mysore	30	8	95	3	13	3	122
University of Pune	36	15	45	2	28	1	91
University of Rajasthan, Jaipur	14	1	10	1	2	0	14
Utkal University	12	0	24	5	9	2	40
Vardhaman Mahaveer Open University	4	0	4	1	3	0	8
Vidyasagar University	13	2	23	2	9	0	36
Vikram University	21	0	6	2	6	2	16
	949	223	960	120	344	98	1745

From the study, as many as 743 publications are found to be in the credit of the listed top-10 universities, which comes with a share of 42.5%. The other 69 universities had a total of 1,002 publications, which is 57.4% of the total publications. Based on these statistics, one may establish that 13% of universities had 43% of publications to their credit. The rest of 87% of universities had only 57% of publications to their credit.

d) Most productive institutions with the high volume of publications (Top-20 list)

The following table offers data of the top 20 Indian universities that ranked both publications wise and thesis wise with reference to their research productivity.

Table.5
Top 20 Universities producing the highest number of Publication

Rank	University	Rank Thesis wise	PhD Thesis Produced	Total Pub.	Document				
					ETD	Journal Articles	Book/ Chpt.	Conf. Paper	Other Pub.
1	University of Mysore	5	30	122	8	95	3	13	3
2	University of Pune	4	36	91	15	45	2	28	1
3	Annamalai	2	47	90	5	72	4	7	2



	University								
4	University of Madras	3	42	89	5	46	4	30	4
5	University of Kerala	21	16	73	4	30	13	18	8
6	Jadavpur University	11	25	61	8	30	3	16	4
7	Karnataka University	6	29	59	6	30	4	15	4
8	Andhra University	8	28	53	20	16	4	10	3
9	Jiwaji University	1	48	53	2	37	4	7	3
10	Sambalpur University	15	21	52	0	34	6	12	0
11	University of Calicut	12	24	51	5	23	8	13	2
12	Bundelkhand University, Jhansi	9	28	50	21	11	3	12	3
13	Bangalore University	38	9	44	2	25	0	14	3
14	Utkal University	33	12	40	0	24	5	9	2
15	Mangalore University	22	16	37	0	29	3	4	1
16	Osmania University	26	14	37	0	19	7	8	3
17	Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur	7	29	37	17	13	1	2	4
18	Vidyasagar University	29	13	36	2	23	2	9	0
19	Punjab University, Chandigarh	16	21	34	9	18	0	6	1
20	University of Delhi	13	22	34	0	20	3	10	1
TOTAL			510	1143	129	640	79	243	52



The study claimed that the most Top-20 listed universities were produced a maximum of 54% thesis and 65% publications respectively. Thus, it is concluded that the majority of universities were still under poor visibility in terms of research productivity. The possible reason may be the non-accessibility of research in the public domain. Therefore, the concert measure should take up to improve publication productivity.

e) Top 10 prolific Authors/Scholars

The current list depicts the top 10 LIS PhD scholars (author) on the basis of the frequency of publication they have had. As per the list shown, R. Raman Nair (2004) PhD from University of Kerala leading in the list with 28 publications to his credit, which received 64 citations. Other names listed in the top were seen from the table below.

Table 6
Top 10 prolific Authors (PhD Scholars) of India based on publication output

Rank	Scholar/Author	Year of PhD	Affiliation	State	Total publication	Document type					Citation
						E-thesis	Journal articles	Book/Chapters	Conf. Proceedings	Other if any	
1	Raman Nair, R	2004	University of Kerala	Kerala	28	1	6	2	12	7	64
2	Gavgani, Vahideh Zarea	2010	Osmania University	Andhra Pradesh	23		16	3	4		71
3	J K Vijayakumar	2005	Bundelkhand University, Jhansi	Uttar Pradesh	17	1	4	1	9	2	93
4	Jayakanth, Francies	2010	Bangalore University	Karnataka	17		8		9		33
5	Sudhier, K G	2006	University of Kerala	Kerala	16		12	1	3		64
6	Mulla, K R	2009	University of Mysore	Karnataka	15		14		1		65
7	Sinha, Manoj Kumar	2004	Tilka Manjhi Bhagalpur University	Bihar	15	1	8	1	4	1	65



8	Senthil Kumaran, P	2005	University of Madras	Tamil Nadu	13	9	1	2	1	18
9	Jeevan, V K J	2006	Utkal University	Orissa	12	9		3		32
10	Fayaz Ahmad Loan	2010	University of Kashmir	J&K	11	8		3		25

We have observed from the list that the majority of the universities were from the southern part of India (6), followed by the east and north (2 each) part of India. No one listed from the western part of India. Another observation was about the total productions and different formats of publications. It was seen that a total of 167 publications has been identified from these top ten ranked holder. They have been distributed in following manner, a highest of 95 journal articles, 50 were of conference papers, 11 in other formats, 9 in books and 7 were in ETDs formats. Also, all scholars received citations for their works.

f) Volume of publications Before versus Volume of publication After Doctorate (Year-wise trend)

To access the year wise trend of publications, it has also studied the publication patterns of researchers in LIS. The following table gives us an idea of state of publication by PhD scholars before and after being awarded their doctorates. Two categories A and B have been created. Category-A represents publication made by PhD scholars before completing and submitting their thesis. The Category-B pertains to publications made by the scholars following completion of their PhD thesis. The first category has covered the entire period right from doing registration for PhD to that of PhD submission. As one can see from the table below, the PhD scholars did the major part of publications after submission of their thesis. To be more precise, out of a total of 1,745 publications, 1,049 publications were made after being awarded the PhD degree and only 696 publications were made during the course of PhD research.

Table 7
Distribution of publications before and after award of PhD degree
(A –Before & B - After)

Year	PhD (frequency)	Publication(frequency)	A	B
2001	65	103	17	86
2002	90	160	54	106
2003	79	126	33	93
2004	76	193	85	108
2005	92	184	77	107
2006	78	151	58	93
2007	107	178	67	111
2008	110	190	72	118
2009	101	152	74	78



2010	151	308	159	149
	949	1745	696	1049

As discernible from the table above, 39% of publications were made while research work was in progress, and 61% of publications were made after their thesis was awarded. Hence, individual universities of India need to pay greater attention so as to initiate more impressive volume of publication activities by their research scholars while carrying on the work of their doctoral thesis. Because the ongoing study concluded that research presented, published during the thesis works having a greater impact and exposure to any field of research, and also it helps in minimizing the duplications of research in that particular area of research.

g) Most productive sources of Publication in all categories of item (Top -10 List)

Ranking of prime sources has also been placed for knowing the most frequent sources used in all categories of publication formats. The following table depicts the comprehensive list of the Top 10 sources of publications. In the case of ETDs 15 unique sources/links have been identified, of which Sodhganga e-thesis repository emerged as the most viable source among all. Coming back to the sources of journal publications, there were 205 unique journals, where the scholars published their work. The list shown below showcase the top ten journal sources with frequency of articles being published. SRELS Journal of Information management is turned out to be the most productive journal among all. Also, it was observed that researchers were chosen Indian based publisher rather than international publisher for journal publications.

Table 8
Item wise listing of Top-10 sources of publications

Rank	ETD	(F)	Journals	(F)	Conference paper	(F)	Book Agency	(F)
1	Sodhganga	181	SRELS Journal of Information Management	111	CALIBER, Inlibnet	75	ESS ESS Publications New Delhi	30
2	RTMNU-IR	18	Annals of Library and Information Studies	93	PLANNER, Inlibnet	28	Allied Publishers, New Delhi (INDIA)	14
3	IR@Jadavpur University	8	DESIDOC Journal of Library &	55	ILA - India	14	IGI Global	6



			Information Technology					
4	Thesis @Madras University	4	Library Philosophy and Practice	45	IASLIC	13	Concept Publishing Company	4
5	Eprint Mysore	2	Pearl: A Journal of Library and Information Science	44	ICDL	9	LAMBERT Academic Publishing	4
6	IR@SUV Tirupati	2	Library Herald	32	A-LIEP	5	BR Pub. Corp.	3
7	IR@ University TM, Bhagalpur	1	IASLIC Bulletin	24	Digital information exchange. Annual conference	5	Information Science Reference, USA	3
8	IR@ North hill University	1	Information Studies	23	DRTC Seminar/Conference/Workshop	5	K.K. Publications, Delhi	3
9	IR@AMU	1	Library Progress (International)	19	FID Conference and Congress	5	Mahamaya Publishing House	3
10	IR @ Bundelkhand University	1	Indian Journal of Information Science and Services	18	ICADL - International Conference of Asian Digital Libraries	5	Shubhay Prakashan, Mumbai	3

In the case of conference paper presentation and publications, CALIBER international conference turns out to be the most frequent among all; nearly 22% papers have been published in it. However, In the case of the book publications majority of them preferred ESS-ESS Publications, Delhi. From the above findings, we are more conclusive and focused about the regularity, and research openness role in increasing the visibility of research. It is indicated that half of the publications (52%) were from these top ten listed sources, which reveals the visibility of LIS research of all categories.

h) Authorship and Co-authorship Analysis

The following table depicts the authorship pattern, which identify the frequency of publications to the credit of authors and co-authors. As depicted here, a total of 1424 publications was identified having both single authors and co-authors pattern. It is noted here that, the ETDs (223) and others (98) publications



were not included in the study of authorship patterns, we have included only the formats of publications in journals, books and conference proceedings. As shown below, out of 1424, nearly 28% of publications (401) written by single authors, and the rest 72% of publications (1023) was of multiple authors. Further categorization revealed that the majority of co-authors publication (25%) have fallen into the category of multi (3-5) co-authorship, followed by Mega co-authorship with 20%, and single and double co-authorship with 14% and 13% papers respectively. Also, the study counts the publications ratio per author, as per the illustration single authorship ratio counted two publications for each author, whereas co-authorship ratio counted as one publication per author.

Table 9
Publication patterns and Co-authorship Analysis

INDIA				
No. of authors	Total Nos. of Publications	Percentage	Total Nos of Author	Publication Ratio per Author
Solo author	401	28.16	215	1.86
Single co-authorship	203	14.26	111	1.82
Double co-authorship	179	12.57	152	1.17
3-5(Multi co-authorship)	352	24.72	325	1.08
>= 6(Mega co- authorship)	289	20.29	376	0.76
Total	1424	100	964 (co-author) + 215 (solo)	1.2

The key finding of this study is about the indication of research collaborations. Over 72% publications are having authors' collaboration.

i) Research Collaboration

Research collaboration is an important perspective for the progress of the research, which allows newer innovation. Through this study, we are able to explore the degree of collaboration and level of collaborations that is having significant roles in identifying research trends and newer area of research.

- Degree of Collaboration (DC) - which measure co-authors publications from the total publications can be calculated as illustrated below. The calculations have been processed through Subramanyam (1983) formula of DC, which can be explained as;

Table.10
Degree of Collaboration (DC)
(TSA-P: Total Single author paper; TCoA-P: Total Co-authors paper)

INDIA				
Year	TSA-P	TCoA-P	Total	DC
2001	33	38	71	0.54
2002	34	98	132	0.74
2003	22	84	106	0.79
2004	51	103	154	0.67
2005	38	117	155	0.75
2006	36	85	121	0.70
2007	46	89	135	0.66
2008	41	115	156	0.74
2009	25	92	117	0.79
2010	75	202	277	0.73
Total	401	1023	1424	0.72
%	28.16	71.84	100	

$$DC = Nm / (Nm + Ns) = 1023 / (1023 + 401) = 0.72$$

Where DC = Degree of Collaboration

Nm = Number of multiple authored papers (papers having more than one author)

Ns = Number of single-authored papers

It has cleared here that the degree of collaboration of LIS research in India become 0.72. The above calculation may help researchers in analyzing the trend of research collaborations during the corresponding years.

- Level of collaboration - measures the affiliated institution's contribution to research collaboration at different level. In this study all the level of collaborations were examined further. It was verified that local level (co-authored of the paper from the same institution) papers became the most prevalent types across all the affiliated universities in which the research was conducted. Less in number in the case of domestic level (co-author from other institutions of the country), and international level (co-author from other nations) was found in this study.



7. Findings and Discussion

- The above study reveals that, 949 LIS PhD thesis were produced during 2001 to 2010 at an average of 12 theses per universities. Also, a total of 1745 publications was conferred at an average rate of 1.84 publication per thesis. Thus, concert measure should take up to improve the research publication productivity.
- The study also identified the most frequent research area in LIS PhD. As per the study, 75% of research topics have been chosen from the top ten listed topics as shown in Table.2. Therefore, to increase the research scope and institutional value, other topics of research should also be undertaken by the researcher.
- The extended analysis of publications reveals many other research findings. Format wise distributions identified the most frequent format of publications. It is found that journals became the most preferred chosen format for publications with (55%), followed by conference papers (20%), ETDs (13%), book (7%), and 5% in other formats respectively. Whereas, university wise distributions helped in the ranking of the university, which have been accessed from Table.4 and 5; and year wise distribution of publication data revealed the most productive year of research. It was seen from the study that the year 2010 became the most productive year. All these discussions are of a great help to research and researchers.
- Based on the research output, it was also established that 87% universities were having 57% of publications, and 13% universities had 43% publications. The possible reason may be the poor visibility or accessibility of research. Therefore, all LIS institutions must increase their research productivity, and make them available in the public domain.
- Year wise trend of publications revealed the scholarly patterns of publication before and/or after the Scholar's PhD submission. The study revealed that 39% of publications were made while research work was in progress, and 61% of publications were made after their thesis was awarded. Hence, more attention required at institutional level to initiate more publications while carrying on the work of PhD. So that duplications of research may minimize, and improve the research scope in any field of research.
- Another finding was identifying the most prolific author, for getting access to research publication patterns, it was observed that the majority of them have chosen journal as prime media for publication. The reason may be the provision of frequent accessibility and widely chosen medium of communication for thesis research finding. Also, journals are always evaluated and validated by the peers in the field.



- While introspecting various sources of publication, it was observed that, nearly 52% of publications were from these top ten sources including all categories/formats. In the case of ETDs, Sodhganga repository emerged as most viable sources, and SRELS journals, CALIBER conference, and ESS ESS publication referred as most preferred sources that many scholars opted for their publications.
- From the above findings, we are more conclusive and focused about the regularity, and research openness role in increasing the visibility of research.
- The others finding of this study is identifying the authorship patterns, and research collaborations. It was noticed that over 72% publications are having authors' collaboration.

8. Conclusion

From the above discussion, we observe that there is a need for improvement in research and publication productivity. Also, it was seen majority of volume of researches produced from a minimum group of universities only, still many LIS universities in India were under poor visibility, therefore certain measures should be taken care of, by the universities for the growth of presentation and publications of research, so that maximum utilizations of research is possible. In this account, we may conclude that the creation of ETDs for PhD research is one of the essential areas that all universities of India should implement soon. Also, there is a need of improvement in other media of publication format. As discernible from the study, there is lack of papers in the format of conference and books that must be improved in future for the betterment of research. Both the media have great impact on research, which largely promote openness to research, and reached to a wider readership. The other revelation of this study is about the publication patterns before versus after conferring PhD degree. It was noticed here that most of the researchers were producing their publication after they have conferred their degree, which may lead to duplication in research, because of non-availability of research in public domain for a longer period. Therefore, certain policy should be formulated at institutional level, so that during on going work of PhD, maximum publication is possible. Also, we identified the LIS research trend, which revealed that most of the research in LIS were confined to particular topics, which need to be improved further for the growth and development of the wider area of research. While analyzing all the categories of sources of publications, we may conclude that we should also focus on international publications that will help in improving the ranking of the institution at global scale. While evaluating authorship patterns, the positive conclusion is finding of research collaboration, but the majority of them are of local level collaboration. Therefore, Indian researcher must look for these above factors for the improvement in research. The most essential and important task for more substantial research growth in terms of quality and quantity,



emerging in this study is the creation of the research profile of researchers and get them access for all. It can help in the growth of research, and establish research networks to make research available to global communities from a single point of access.

9. Recommendation and Suggestions:

Following topics of studies are suggested and recommended as an extension of the current study.

- Study on Creation of Research Profile Database
- Identify the research productivity ratio in accordance to Gender (Male Vs Female Scholar), and analyze the pre-dominance factors of it.
- Access and study the citation behavior of above discussed research data via quantitative assessment based calculation such as h-index, p-index and half-life; and
- All levels of research collaborations that includes co-authors' affiliation need to be evaluated further.

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