Visualization of the Research Performance of LIS Doctoral Research in India: A Bibliometric Study

Dr. Bibhuti Bhusan Pattanaik
Assistant Librarian
Jawaharlal Nehru University
New Delhi
E-mail: pbibhuti@jnu.ac.in

Abstract - *The entitled study reviews the research profile of Library and Information Science (LIS) PhD of India, and make an assessment of the research contribution made by them with the help of bibliometric parameters. It evaluates the research both in qualitative and quantitatively that includes identifying research productivity, research trend, publication patterns, discover the key sources of publication, and visualize the research network of Indian researcher in LIS subject. All discussion and observation have been placed on record for the improvement of research, which represents a guiding tool for researcher and institutions in the future, to explore innovation in the area of LIS research.*

Keywords: Bibliometrics; mapping; research, authorship, collaboration

Introduction

In the contemporary world of rapid changes, it has been evident that research in LIS discipline is interdisciplinary. Over the years, it has increasingly popular for its extensive research diversities and its relevance in the changing environment. In recent years, researchers in LIS have adopted new methods, and are keenly focused on emerging trends in research that keep the pace of this dynamism and development of the profession. In this context, the following topic of discussion provides an insightful vision towards broadening the research scope of the LIS field of research, and find out its relevancy in research development. The current study based on bibliometric analysis, which aims to focus on research literature of established PhD scholars, and assess their research profiles for getting access to scholarly contributions, and their impact in research. The fundamental constituent of this study based on three key components, namely the producer (author or scholar), the artifact (their research publication), and the concept (the topics). All these components are essential indices in this evaluation of research. Through this above index, we will analyze the records for exploring both qualitative and quantitative data assessment, which will scrutinize the research output, and enable us to identify the publication trend, authorship patterns, ranks, and research collaboration networks. Thus the key objectives of this study are to map all segments of research, and facilitate scholars in the directions of further progress and development.

Literature review:

A series of literatures were reviewed for this topic of research. All theses reviewed literatures are of an important sources, which guided author on the right path to bring this work possible. The paper of Kumar & Sharma (2010) educates us about the historical perspective of LIS education in India, and its growth over the period. An extensive work on LIS research could be accessed from the book written by Singh, SP (2014). She compiled a

series of LIS PhD from the inception of LIS research to dated 2013, which provided ample of information about the research growth and development in this subject. In this context of study, few other papers have also been reviewed such as Mestri (2008), Shivalingaiah, N & Keralapura (2009) and Pandita, R & Singh, S (2017). All papers discussed about the LIS research trend, and research growth decade wise, university wise, state wise and the scholar-wise. Whereas Rana, R (2011) was elucidated the research patterns of PhD scholar of Panjab University from 1960 to 2009. Such studies can help the author to verify the research growth and patterns over the year in this subject domain.

Another set of papers based on bibliometrics and/or Scientometrics analysis has also been considered for review, the specific idea was to acquire knowledge, and study how the research output play the significant roles in evaluating research and increase the value of the institution and the researcher. On account of this, the paper of Mittal, R (2011) was reviewed to trace the emerging area of research and frequent topics of research in LIS-India during 1990 to 2010 as reflected through research journals. In the same line, Smith (2005) emphasized upon the importance of citations, and links in evaluating research publications. Harzing & Alakangas, (2015) assessed the coverage, stability and growth of three established databases (includes Google Scholar, Scopus and WoS) by reviewing the five major disciplines in the area of Arts & Humanities, and Science & Technology. The key findings is that all three databases provide sufficient stability of coverage to do research analysis. For the current topic, the author used Google Scholar database for the research data information. The paper of Li J., Sanderson M., Et.al., (2010) stated the assessment of LIS research profile. The key finding of this study revealed the emerging area of research, their research pattern, and access the research networks. There was another paper by Lee, S. & Bozeman, B (2005), they more elaborately discuss the role of collaboration in research, and its impact in scientific productivity. Whereas, the paper by Smith (2005) explained the impact of citations and links, and talked about their importance in the research study. The study made an assessment of LIS e-journals and discussed the role of citations and/or web links. Also, there were some papers on ETDs (Electronic Thesis and Dissertations) that discussed the importance of ETDs creations for research, and explained their role in open access to research contents. In this parlance, many important papers were reviewed such as *Sulaiman A, Rahman A (2014); Sheeja, N. K. (2012); and Sawant, S. (2013).* All these papers have instrumental about the ETDs creation and its role in open access to research.

Objective of the study:

The following key objectives are investigated during the topic of discussion;

- Review the research output of LIS PhD in India;
- Identify the potential area of research in LIS PhD;
- Assess the scholarly impact of PhD research from their research publications, in particular available in the format of ETD, journal, book, and conference;
- Identify the most productive institutions, most prolific scholar and most frequent sources of research publication;
- Visualize the authors' research networks, and their patterns of publication; and
- Evaluate the citation impact on research.

Methodology:

To achieve the above goals, the author has featured a defined literature sample for this study. At the preliminary investigation a sample of ten years of LIS PhD from 2001 to 2010 have been collected from the national PhD thesis data catalogue of India, so-called *IndCat*, and arranged those PhD data in an Excel Sheet. Further, considering each PhD scholar as a prime indicator, research publications of thesis topic have been collected. All these publications along with citation counts have been retrieved from the *Google Scholar* database by using an open source software solution *Publish-or-Perish*, which helps in getting access to all bibliographic information on publications. The author has chosen the *Google Scholar* database over *SCOPUS* and *Web of Science (WOS)* for its comprehensiveness, openness, coverage and availability of all formats of publication details. As mentioned, the author (or scholar) indicator becomes the prime to this study, which helps in the listing of research publications, identify the sources of publications, their affiliations and research collaboration. All these data further help in arriving important conclusion and observations. Therefore, the essence of this study is visualizing the research performance of LIS PhD scholar, and effective use of that research for the future growth of research.

Data analysis

Research Scenario of LIS PhD during 2001 to 2010: The study revealed that during the cited timeline from 2001 to 2010, there were 79 LIS universities, who produced a total of 949 PhDs at an average of 12 theses per university (as shown in Table & Fig.1).

Table.1. Year wise distribution of LIS Research across the universities

Items	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Thesis	65	90	79	76	92	78	107	110	101	151	949
University	29	37	37	34	36	41	45	49	46	51	79
Publication	103	160	126	193	184	151	178	190	152	308	1745

It is noted here that, all these 949 PhDs have produced a total of 1745 research publications based on their thesis topics. Which further investigated to access the various mentioned objectives as specified above.
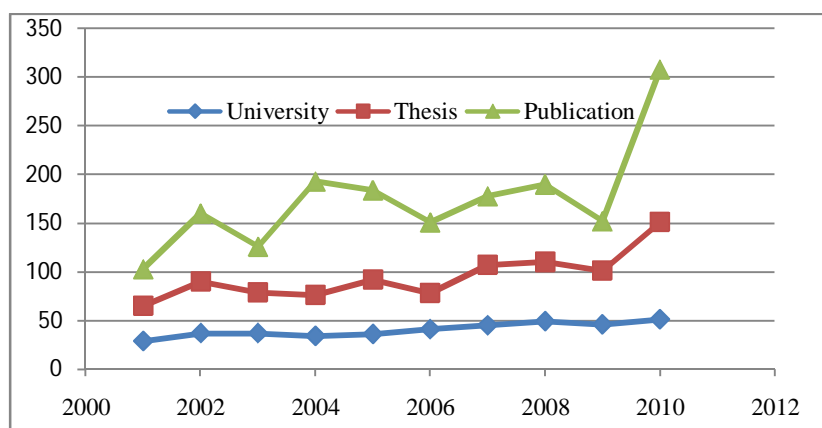

Figure.1Yearwise distribution of LIS Research across the universities

There is an indication of growth in the number of PhD versus the number of publications over the year. But the year wise figure demonstrated that, there is indication of inconsistency of research productivity patterns.

Popular Topic of LIS Research: It has also explored the key topic of LIS research in India, in particular in which topics/area PhD productivity frequency is high. From the study it was revealed that a highest frequency of *121* PhD research were from the topic related to *Library and Information Services (Facilities and Use)*, followed by topics such as *Information seeking Behavior (114), ICT application in Library (108), Bibliometric/Scientometric Study (102), Library development and management (62), Types of Library - academic, public, special (60), Consortium & Library Network (49), Collection development (35), Library Automation (30) and Librarianship (30)* respectively. While defining the categories of topic, we found all total of 39 different key topics had chosen by the LIS researcher. Another finding is nearly 75% of total PhD were identified from the above top-10 listed topic of research, which means there was a lack of diversity on the topic of research in this LIS subject domain in India, which need to improve further.

Analysis of Publications: The study can be extended for further evaluation by distributing the publications data format wise, year wise, and university wise to access the present research objective like scholarly research patterns, most prolific author, most productive universities, and most preferred sources of publications. On this account, it was accessed from the Table.2 & Fig. 2 that there were four categories of the format have been selected for the study. It was found to be ETDs (223), Journal articles (960), Books (120), Conference paper (344) and Other format of publications (98). The outcome result of this analysis revealed that only 13% of the total publications is produced as ETDs, which could be nearly 23% of total PhD thesis. It means many universities do not have the electronic / online version of their PhD thesis for access till date.

Table.2 & Fig.2 Distribution of Publications

Document Type	Frequency	%
ETD	223	12.78
Journal article	960	55.01
Books/ chapter	120	6.88
Conference Paper	344	19.71
Others	98	5.62
Total Publication	**1745**	**100**

Distribution of Publications Format wise

The study also revealed an overwhelming number of research were produced in the format of journal articles, which was highest of 960 in number, and translate into 55% of total volume of publications. Next in line were publications in the conference proceeding, which was nearly 20% of total publications. Whereas in book category the research percentage was lowest with 7% of total volume of publications that indicates an insignificant share overall. Further, the university wise distribution of research examined to identify each university

share and verify their ranking accordingly with reference to their rate of production in publications.

Table.3 Top 20 Universities producing the highest number of Publication

Rank	University	PhD Thesis Produced	Total Publication	Document				
				ETD	Journal Articles	Book/ Chpt.	Conf. Paper	Other Pub.
1	University of Mysore	30	122	8	95	3	13	3
2	University of Pune	36	91	15	45	2	28	1
3	Annamalai University	47	90	5	72	4	7	2
4	University of Madras	42	89	5	46	4	30	4
5	University of Kerala	16	73	4	30	13	18	8
6	Jadavpur University	25	61	8	30	3	16	4
7	Karnataka University	29	59	6	30	4	15	4
8	Andhra University	28	53	20	16	4	10	3
9	Jiwaji University	48	53	2	37	4	7	3
10	Sambalpur University	21	52	0	34	6	12	0
11	University of Calicut	24	51	5	23	8	13	2
12	Bundelkhand University, Jhansi	28	50	21	11	3	12	3
13	Bangalore University	9	44	2	25	0	14	3
14	Utkal University	12	40	0	24	5	9	2
15	Mangalore University	16	37	0	29	3	4	1
16	Osmania University	14	37	0	19	7	8	3
17	Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur	29	37	17	13	1	2	4
18	Vidyasagar University	13	36	2	23	2	9	0
19	Punjab University, Chandigarh	21	34	9	18	0	6	1
20	University of Delhi	22	34	0	20	3	10	1
	TOTAL	510	1143	129	640	79	243	52

While focused on ranking factors of it, the Table.3 marked that the Top-20 listed universities produced 65% of total volume of publications. Which means, the rest 59 universities having remaining 35% of publications count, which may be a concerned that need to resolve soon for the betterment of research? Also, there is a positive finding on this count, which revealed from this study. It was seen that the less thesis productive universities were ahead in publications ranking by having higher number of publications that indicates good number of research have been available for further research and other reference.

The study also identified the most prolific scholar as shown in the Table. 4 rank wise. It was observed from this top 10 list that the majority of scholars, who produced maximum research, were affiliated with the southern part of the Indian universities; there were 6 scholars in the top 10 list, followed by 2 each from the east and northern part. Another observation was majority of research were produced in the format of journal articles, followed by conference paper, and all received citations. Also, we have noticed, there were seven (7) thesis accessed online via ETDs, which indicate the research development progress in those areas of studies.

Table.4 Top 10 prolific Author (PhD Scholar) of India based on publication output

Rank	Scholar/Author	Year of PhD	Affiliation	State	Total publication	Document type					Total Citation
						E-thesis	Journal articles	Book/Chapters	Conf.	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

Further, the study also probes into analyzed the year wise trend of publications made by the scholar while their degree was on progress and/or after they attained their degree. The below mentioned Figure.4 showcase the scenario of it. It was revealed that only 39% of publications were produced while PhD work in progress, and 61% of publications followed after they awarded the PhD degree. It is indicative that there might be chances of duplication of LIS research, because of less productivity in publications during ongoing research work, and also most of the research under poor visibilities that affect the institutions' rank among the global scenario.
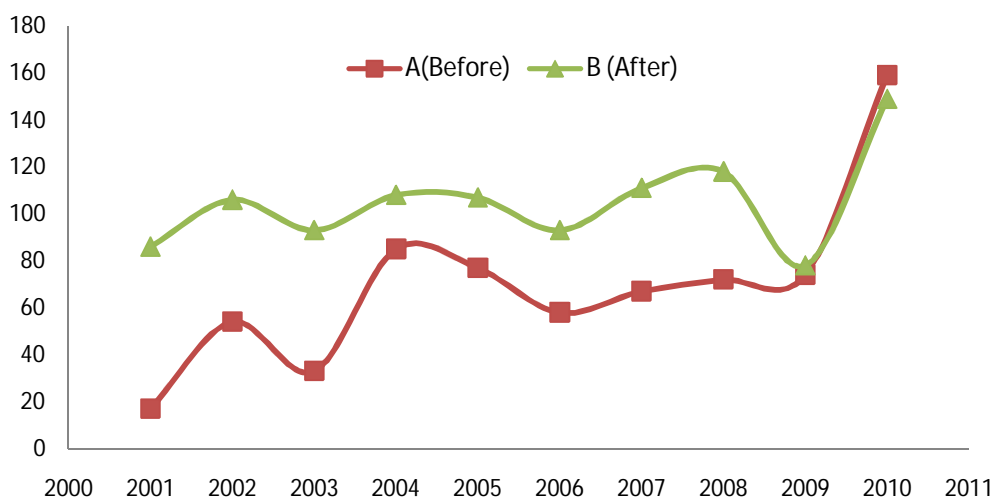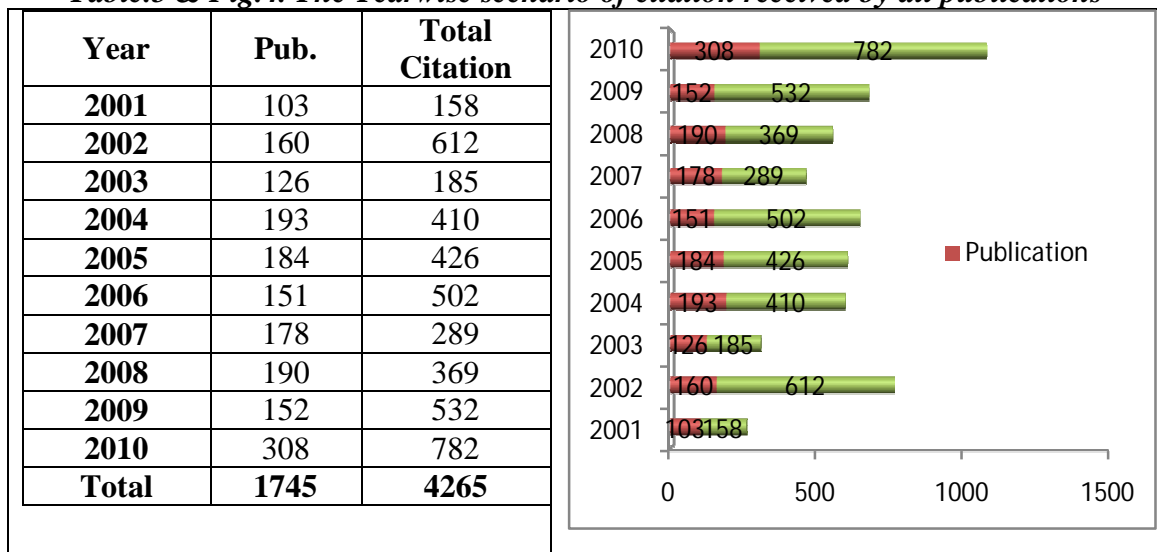

Fig.3 Distribution of publications before and after award of PhD degree (A –Before & B - After)

The stated topic also reviewed the sources or links of research publications, where most of the LIS PhD scholars were preferred to publish. It was noticed that more than half of the publications were published in the listed top 10 selected sources for each category of formats. The most emerged sources in case of ETDs were Sodhganga e-thesis repository with 181 e-thesis, followed by Institutional Repositories of Nagpur University (18), Jadavpur University (8), Madras University (4), Eprint@ Mysore University (2), SUV, Tirupati (2), UTM, Bhagalpur (1) and North Hill University (1), Aligarh University (1) and Bundelkhand University (1) respectively. For the journal article publications rank wise, they were SRELS journal (111), Annals of LIS (93), DESIDOC Journal (55), Library Philosophy and Practice (45), Pearls: A journal of LIS (44), Library Herald (32), IASLIC Bulletin (24), Information Studies (23), Library Progress (19), and Indian Journal of Information Science and Services (18) respectively. Whereas CALIBER conference with highest frequency of 75 papers was become the most preferred conference sources of avenue for LIS researcher in India. The other top ten listed conferences were rank wise PLANNER (28), ILA (14), IASLIC (13), ICDL (9), A-LIEP (5), Digital information exchange annual conference (5), DRTC-seminar/conference (5), FID conference and congress (5), and ICADL - International Conference of Asian Digital Libraries (5). In the category of the book following publisher/book Agency were most preferred for LIS PhD researcher. Among all ESS ESS, Delhi book publication with highest of 30 publications. It follows Allied Publisher, Delhi (14), IGI Global Pub. (6), Concept Publishing (4), Lambert Academic Publishing (4), BR Publication (3), Information science reference, USA (3), KK publication, Delhi (3), Mahamaya Publishing House, Orissa (3), and Shubhay Prakashan, Mumbai (3) respectively.

We noticed from the above study that the majority of the researcher chosen Indian based publisher/aggregator for their research publications, and also findings shown most of the sources are available in open access platform, which revealed the increasing visibility of research across all categories of research.

While analyzing the above publication data for reviewing the citation impact, we noticed that, there is an indication of year-wise growth in citation count per publication. Also, we observed that a total of 515 publication did not receive any citation, which is 29.5% of total publications.

Table.5 & Fig.4. The Yearwise scenario of citation received by all publications

Year	Pub.	Total Citation
2001	103	158
2002	160	612
2003	126	185
2004	193	410
2005	184	426
2006	151	502
2007	178	289
2008	190	369
2009	152	532
2010	308	782
Total	**1745**	**4265**

From the study, we may also identify the range of citation as per the citation received against the frequency of publication. As mentioned in the Table.6, a highest of 39.4% citations was noticed against 281 publications, which received most citations of range between 21-50 citations each.

Table.6 Range of citation received by the research article

Frequency of papers received citations				
Period	Range of Citation	Pub. (f)	Total Citation	% of Total Cit.
2001-2010	0	515	0	0.00
	1	86	44	1.03
	2-5	369	410	9.61
	6-10	133	303	7.10
	11-20	167	501	11.75
	21-50	281	1681	39.41
	51-100	169	906	21.24
	101-200	25	420	9.85
Total	0-200	1745	4265	100

To visualize the research performance in terms of authors' research network, further analysis has been made to access the result, which is figured from the Table.7 and Table.8 below. The study revealed that nearly 65% (1127) research publications have been produced collaboratively, of which majority of publications identified as multi-author papers. Whereas, the authors ratio versus publications production result shown that joint authorship patterns is likely be more followed by the solo authorship productivity, in individual categories of analysis. Overall average authorship has obtained/calculated as 1.27 per each contributor.

Table.7 University wise Publication patterns and Co-authorship Analysis

INDIA				
No. of authors	Total Nos. of Publications	Percentage of Publication in each category	Total Nos of Author	Publication Ratio per Author
Solo author	618	35.4	372	1.66
Single co-authorship	222	12.7	110	2.01
Double co-authorship	196	11.2	150	1.3
3-5(Multi co-authorship)	382	21.8	332	1.15
>= 6(Mega co- authorship)	327	18.7	407	0.8
Total	1745	100	1371	1.27

The study has also extended to view the result of the each category of mentioned publication. The year wise distributed publications result shown in Table.8 revealed following observation. It was clear indication that the activities of producing journal publications are more as compare to other publications in each category of authorship. Also, the study revealed the solo author publications were identified as highest in number as compared to other categories of collaborative publications.

Table.8. Distribution of publications in terms of authors' involvement

INDIA (University wise Publication Patterns of Authors)					
No. of authors	TOTAL Pub.	ETD	JOURNAL	CONFERENCE	BOOK	ANY OTHER
Solo author publication	618	167	250	98	53	50
Single co-authorship	222	17	130	50	18	7

publication						
Double co-authorship publication	196	17	118	46	7	8
3-5(Multi co-authorship) publication	382	14	252	79	21	16
>= 6(Mega co- authorship) publication	327	8	210	71	21	17
Total	1745	223	960	344	120	98

In addition, depending upon the nature and requirements, the data have been analyzed for identifying the research collaborations in terms of degree of collaborations, and level of research collaboration. The DC (degree of collaboration) can be measured to know the number of co-authors associated with a paper. Whereas, the Level of collaboration can be explored to verify the possibilities of collaborations in different level, including Local, Domestic, and International level collaboration. The study revealed that a total of 618 papers were solo authored and rest 1127 papers were collaborative, so the degree of collaborations become DC= $Nm/ (Nm + Ns) = 1127/ (1127+618) = 0.65$, Where DC = Degree of Collaboration, Nm = Number of multi-authored papers, and Ns = Number of single authored papers.

On the other hand to represent the level of collaboration, further the co-authors' research work have been verified to identify their institutional affiliation while producing their research. On this account following observations have been made, as depicted in table. 9 below.

Table.9 Co-authorship analysis on account of level of collaboration

Year	Local Level co-author (From the same Institute)	Collaborative papers at Local Level (from the same institute)	Domestic Level co-author (author from the other Institute)	Collaborative papers at domestic level (author from other institute)	International Level co-author (From other international institute)	Collaborative papers at international level (author from other countries)
2001	17	35	21	26	3	5
2002	30	75	54	65	12	19
2003	54	49	34	61	6	4
2004	55	85	40	85	0	0
2005	72	105	50	66	1	1
2006	37	67	20	43	6	10
2007	37	63	32	53	2	6
2008	78	107	28	50	0	0
2009	54	73	34	63	0	0
2010	123	177	62	93	37	42
Total	557	836	375	605	67	87

The finding result of this analysis shows that local level collaboration becomes most preferred among all the LIS universities across India. The majority of the publications were produced by the researcher accompanied by their guide as joint author affiliated from the same institutions. Also, the study identified both domestic as well as international level collaboration in LIS research during the timeline. Further, the study analyzed the percentage of shares in all levels of collaboration and their participations.

Table.10. Percentage of share and participation in all levels of collaboration

Level of Collaboration	Total Collaborative Papers	% of share	Total number of authors	% of participation
Local Level (from same Institute)	836	55	557	56
Domestic Level (from other Institute)	605	39	375	37
International Level (From other international institute)	87	6	67	7
Total	1528		999	

As shown above in the table. 10, it is a clear indication that nearly 55% of publications was local level papers, and 56% of authors have been involved to produce all those publications. In case of domestic level collaboration, 39% papers were produced by 37% of co-authors from other institutions across the India. Also, there were international level collaborations, which are marked with 6% papers, those produced by 7% international authors. The key findings are, the majority of research collaborations were of local level, and very less in international level. Therefore, to increase the visibility of LIS research, we must focus the research publications at all levels, so that the research performance of LIS will increase and its impact will affect the research at global scale.

Result:

The outcome result of the above study revealed that a total of 949 LIS PhD thesis was conferred during 2001 to 2010 that tabulated 1745 publications in totality, which was marked at an average rate of 1.84 publications per thesis that need to improve. Further evaluation of the publication has been done by distributing the data topic wise, year wise, university wise, and format-wise to get into the research scenario of LIS India. The key finding on this account revealed that nearly 75% of research topics were from Top-10 listed topics, which become a concern that should resolve sooner for the improvement in the extensive area of research. The year wise distribution revealed the year 2010 became the most productive among all. University wise evaluation sets the ranking of universities on account of their research production. It was established from this study that 75% of universities were having only 34.5% of total publications and 25% (top-ranked) universities had 65.5% publications. The possible reason may be the poor accessibility of research in many universities in India, because of poor ICTs infrastructure to build and developed e-contents of the research, and non-availability of full-text research papers in the public domain. The format-wise study identified that journal-based publications were most preferred among all, with a score of 55% productivity, which followed by conference papers (20%), Electronic Thesis (ETDs) of 13%, Book (7%), and in other formats (5%) respectively. The study also analyzed the year wise trend of publications. It revealed the scholarly research patterns before and after the Scholar's PhD. It was observed that only 39% of publications were produced while PhD work was in progress, and other 61% publications ensued after they attained their PhD degree, which escorted for increasing in duplication of research. Therefore, more attention required at an institutional level to initiate more research publications while carrying the work of PhD. While introspect the authors' account for evaluation, it was identified that all top-10 authors mainly chose the journal based publication, for its peers value, wider scalability and accessibility. The citation analysis result illustrated that over 71% of publications were

received citations, except in the year 2001, 2004 and 2007, the citation index graph shown an increasing trend. While verifying top sources of publications, it was seen that overall, 52% of publications were from these top-10 sources. Such a study can help in knowing the regularity and impact of sources and their role in increasing the visibility of research. It was revealed the most emerged sources that have been chosen frequently in each category of publications. In case of ETDs, *Sodhganga repository* emerged as most viable sources, and *SRELS journal*, *CALIBER conference*, and *ESS ESS publication* referred as most preferred sources that many scholars opted for their publications. The others finding of this study is identifying the authorship patterns and research collaboration network. It was noticed that over 65% of publications have authors' collaborations, and most of them are of local (institutional) level collaboration.

Conclusion:

From the above discussion, we may conclude that there is a need for improvement in research and publication productivity in the LIS field in India. It was found that research in many LIS universities is still under poor visibility; on this account the creation of ETDs for PhD is essential area that needs to be improved. Also, other media like book and conference publications must also improve, which have the wider readership, and they promote open access to research. Another revelation was about scholars' publication patterns. To improve upon, the Institutional policy should be framed, so that maximum research publication may be made available during the ongoing work of PhD. Also, the study identified most researches were confined to fewer topics only that need to improve. Other observations were about the publications in reputed international sources, which was lacking while reviewing all media of sources. Because, it was proven that publication available in international sources earn more impact in research and the institution at global rank. The positive finding of the study is the authors' research collaboration. But most of them are of local level collaboration that must look upon. Therefore, the most important task for all academia is to review their role in substantial research growth both qualitative and quantitative. It is recommended that concert measure should take up by institutions to design an efficient online research network system (or model) that will able to showcase the researcher profile, and map all research to visualize them at the global platform.

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