

Trends in Library Science Education and Research in India during 21st Century: An Exploration through Network Visualization

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Abstract:

India has an impressive history of higher education dating back to the ancient times. Since independence from the British colonization, the education infrastructure in the country has flourished astonishingly. Libraries are integral to the education system, supporting the academic, research and extension activities of institutions by satisfying the information needs of stakeholders. With technological advancements, the functioning and services of libraries have undergone drastic changes. Congruently, the Library and Information Science (LIS) education and research have also been re-engineered over the period for developing the Library and Information Science Professionals (LISPs) having skills and capabilities for working in Information Technology based environment vis-à-vis for implementing the emerging technologies for value-added library services, in addition to having the basic skills of librarianship.

The present study elaborates the trends in LIS education and research based on network visualization of bibliometric indicators of journal articles in LIS indexed in the Indian Citation Index (ICI). The findings of the study are expected to be useful to the teachers, researchers, planners, policy-makers and funding agencies for gaining an understanding of the LIS education and research and its pattern in the country, and for taking necessary measures to fill the gaps.

Keywords: LIS education, research, recent trends, network visualization.

Background:

Education is the most decisive component for development and prosperity of a society. The quality of education provided by a nation determines its' place on the socio-economic map of the world. India has witnessed a swift growth in higher education after independence. While pre-independent India had only 20 universities and about 500 colleges, this number augmented to 48647 colleges and institutions in 2017 and 907 universities in 2019 (IndiaEducation, 2019; University Grants Commission, 2019).

Libraries are pivotal to the trinity of academic, research and extension activities of an education system and Library and Information Science Professionals (LISPs) are the link between right user(s) and right information available in accessible form(s) and format(s). The emergence of Information and Communication Technologies (ICTs) has given birth to the new formats of information resources and new manoeuvres for outreaching the users. The information needs and seeking behaviour of users have also undergone severe changes. They want information at their ease, in the format(s) they are comfortable with and at no cost of time. All this has transformed the roles, responsibilities and skills of LIS professionals. They are expected to "function more like consulting information engineers than as the traditional, passive custodians of information and dispensers of documents" (Jestin and Parameswari, 2005). Thus, constant appraisal of LIS education and research is pertinent to explore the prevailing scenario and take necessary measures for re-engineering the academic and research activities to prepare LISPs to meet the challenges and needs of emerging job market. The education and research are inter-dependent. While research is based on the existing academic activities and practices, the research findings are basic to transforming the educational practices to cope up with present needs and develop learners to meet the future demands.

Journals are the primary sources of information on a given subject. The assessment of scholarly communications published in form of journal articles in LIS can provide basic understanding of the recent trends in education and research in the subject. Bearing this in mind, the present study has been conducted to elaborate the trends in LIS education and research and its dynamics by analyzing the bibliometric indicators applying network visualization to the journals articles in LIS indexed in Indian Citation Index (ICI). The study aims to explore the chronological growth and distribution of articles in journals and subject endeavors based on keywords provided in the articles applying cluster approach of network visualization. The institutional productivity and collaboration trends have also been mapped out.

LIS education and research in India

The LIS education in India began in 1911 when W. A. Borden, an American disciple of Melvil Dewey started a library school at Baroda. Asa Don Dickenson holds the credit of initiating LIS education at university level by establishing library school at Punjab University, Lahore in 1915, to impart certificate course in LIS. Dr. S.R. Ranganathan made immense contribution for the sound foundation of LIS education at universities and library associations. The bachelor's degree programme in LIS began at Aligarh Muslim University. The certificate course started at Madras Library Association in 1929 was taken over by the Madras University in 1931, which was further exalted to the full time post graduate course in 1937. The University of Delhi started first master's degree course in LIS in the country in 1951. It also established an independent Department of Library Science, first of its kind in India. With the growth and development of education system in the country, and to meet the requirements for professional librarians, LIS schools/departments were established in various

universities. Gradually, the term Library Science evolved to Library and Information Science to encompass the wider spheres of the subject.

The research in LIS did not get impetus till the last quarter of 20th century. Though the first doctorate in the subject was awarded by Delhi University in 1957, the second Ph.D. in LIS was awarded after nearly two decades. The research at doctorate level got boost after 2009, when the UGC in its eligibility criteria for Assistant Professors and equivalent posts including Librarians, exempted the Ph.D. holders from passing National Eligibility Test for lectureship (University Grants Commission, 2010).

Data Visualization

Bibliometrics is the cost-efficient and time saving means of evaluating scholarly communications, as compared to peer-review process. It is used as a yardstick to have an understanding of the flow of scholarly information to support planning, administration and re-orienting the education and research activities. The term ‘bibliometrics’ was first used by Pritchard in 1969 and was defined as “application of mathematics and statistical methods to books and other forms of written communication” (Pritchard, 1969). Bibliometrics, despite being an acknowledged discipline require use of special tools to study the intricacies of scholarly communications by analyzing huge datasets containing a large number of records. This has resulted into emergence of visualization/ data mapping software. Bastian et al. (2009) say that “Visualizations are useful to leverage the perceptual abilities of humans to find features in network structure and data”.

Sangam and Mogali (2012) call the visualization software as “visual tools for abstraction, summarization and presentation of large volumes of data which facilitate interactive exploration by users”. Network Visualization gives an overview of the scholarly landscapes making it more manageable and supports data informed-decisions by revealing the connections and context between units of analysis based on nodes and edges in a better-off and realistic manner.

Methodology

The study presents trends in LIS education and research applying network visualization to the bibliometric indicators of articles published in journals indexed in Indian Citation Index (an online bibliographic database) under the subject Library and Information Science. The methodology used in the present study is given below:

Dataset: To accomplish the objectives of study, data was retrieved from the Indian Citation Index (ICI). The ICI is bibliographic database containing metadata (including abstracts) and citations from more than 1100 Indian scholarly journals since 2004, encompassing various knowledge domains. For present study, total 3016 records pertaining to the subject of LIS for the period 2004 to 2018 were retrieved. The ICI allows downloading of 100 records at a time only. Hence, the 3016 records were downloaded in 31 sets, first 30 sets comprising 100 records each and the last (31st) set having 16 records. It is pertinent to mention here that the data retrieved for the purpose of this paper does not represent the total article productivity of India in LIS, but the articles published in journals indexed in ICI only. The ICI indexes only those journals which fulfill its’ evaluation criteria for inclusion.

Analysis of subject terms and institutions: Keywords listed in the “keyword” field in the ICI were considered for subject analysis. The singular and plural terms and the keywords representing same topic were standardized to avoid duplicity of occurrence of terms in subject visualization map.

At the time of exploring institutional visualizations, it was observed that the institutional names were not listed in uniform style, viz. some articles contained name(s) of institution(s), while others had name of department(s) along with name of institution(s). This made the analysis of institutional collaboration difficult using visualization software. Therefore, to reveal the actual picture of institutional collaboration trends, all institutional names were examined and standardized for visualization.

Data Visualization: The bibliometric indicators of 3016 articles in LIS were visualized using free-to-use software ‘VOSviewer’ (<http://www.vosviewer.com/>) and ‘Gephi’ (<https://gephi.org/>). The network visualization maps developed have nodes and edges. The nodes represent intuitions and subject terms (keywords) and edges are the strings connecting nodes in the network establishing their inter-connectivity under respective units of analysis. The distance of nodes vis-a-vis thickness of edges in the subject visualization maps developed using ‘VOSviewer’ reveal the strength of connection between keywords based on their co-occurrences.

Analysis and findings

Chronological distribution of articles

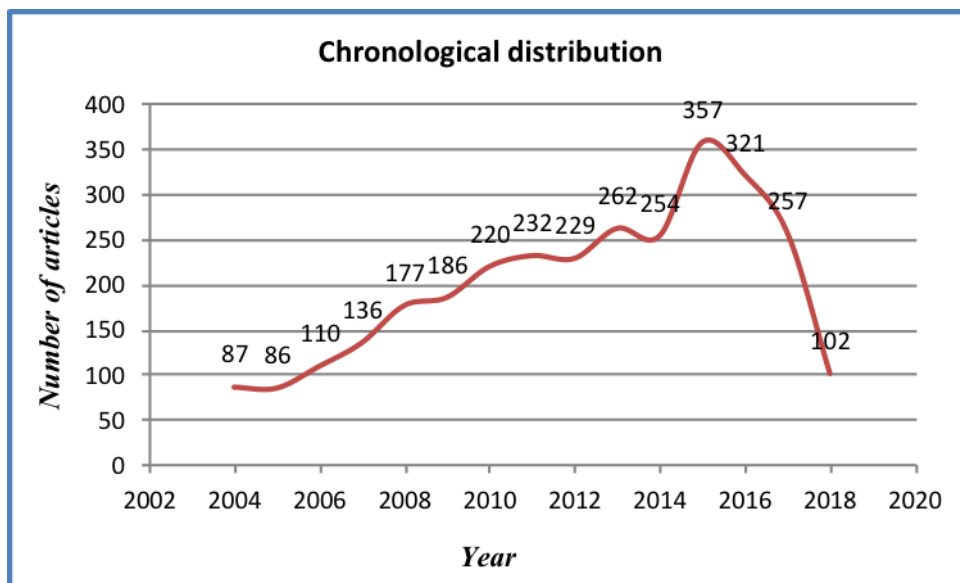


Figure 1: Chronological distribution of articles

Figure 1 depicts the chronological growth of articles in LIS during 2004 to 2018. The year 2015 witnessed the maximum number of articles probably because this was Centenary Celebration year of LIS Education, followed by the year 2016 and 2017. An almost continuous increase in articles has been observed from 2004 to 2015. Whereas, the number of articles shown a decrease after this period. To ensure quality control over publications, the University Grants Commission (UGC) has approved a list of journals encompassing all disciplines. The articles published in UGC approved journals only are considered for direct recruitment of faculty and other academic staff vis-à-vis their career advancement in India. Many of the journals indexed in ICI were removed from the UGC approved journals list 2017. This could be attributed as the reason for decrease in articles published in journals indexed in ICI during 2017 and 2018.

Journal wise distribution of articles

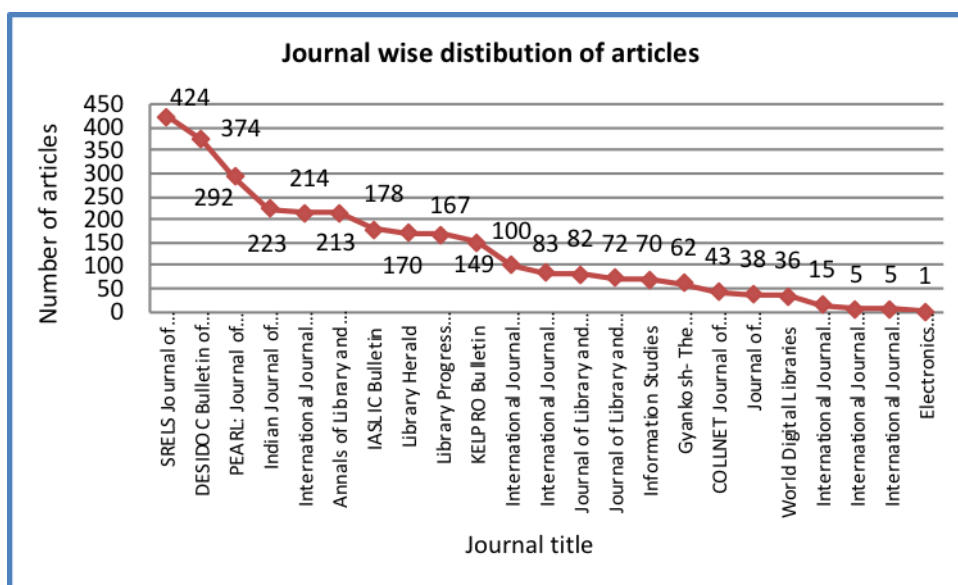


Figure 2: Journal-wise distribution of articles

Total 3016 articles indexed in the ICI under the subject of LIS are distributed over 23 journals (Figure 2). The SRELS Journal of Information Management emerged as the lead journal with publication of maximum number of articles (n=424) during 2004-2018. The DESIDOC Bulletin of Information Technology, PEARL: Journal of Library & Information Science, Indian Journal of Information, Library & Society and International Journal of Information Dissemination and Technology published 374, 292, 223 and 214 articles respectively, to be among top five journals. The articles published in these five journals constitute 50.63% of the total 3016 articles under study. The Annals of Library and Information Studies (213), IASLIC Bulletin (178), Library Herald (170), Library Progress (International) (167) and KELPRO Bulletin (149) are among the top ten journals having maximum number of journals indexed in the ICI.

Data Visualization:

The data visualization presenting subject mapping and institutional contribution and collaboration trends is given below:

Subject analysis:

The keywords having frequent occurrences are representative of the major subject(s) being discussed in articles. The number of keywords to be chosen for the visualization depends upon how many keywords appear in articles and at what frequency rate. For the purpose of present study, keywords having ≥ 5 occurrences were considered for developing network visualization maps. The nodes in the maps represent frequency of occurrence of terms and edges (links between nodes) represent the co-occurrences of respective terms in articles.

The LIS education and research are getting transformed at rapid rate. Under influence of ICTs many new topics emerge and other become obsolete even during a short span of period. In view of this, the visualization was distributed into 3 groups, to observe the changes taking place in the subject every five years. The presentation of subject terms in 3 graphs also makes it easy to understand the connection of nodes.

Articles published during 2004-08

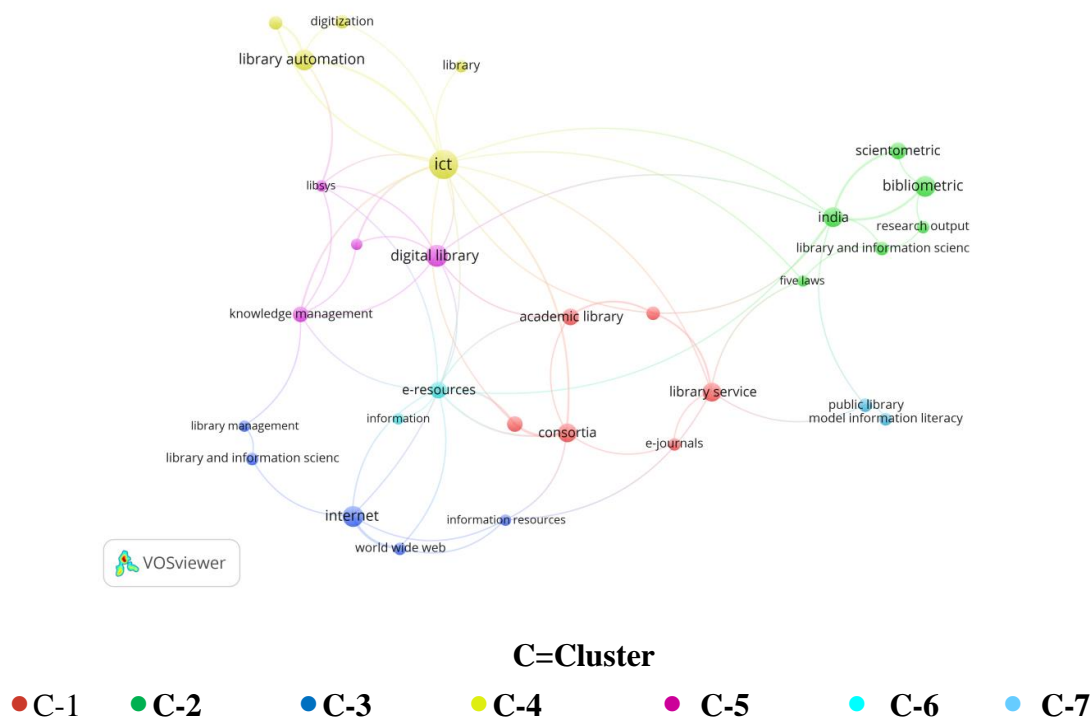


Figure 3: Visualization based on keywords during 2004-08

Total 30 of the keywords given in articles published during 2004-2008 have ≥ 5 occurrences each. The network visualization map of these 30 keywords is given above. Figure 3 consists of 7 clusters based on the cluster schema of VOSviewer. A careful observation of graph reveals that the topics pertaining to electronic information resources in academic libraries have been the focus of cluster 1, 3 and 6. The e-resources started gaining popularity with the beginning of 21st century in India, which is perceptible in the subject analysis of articles published during 2004-2008. Cluster 2 represents the articles on bibliometric/ scientometric studies. The libraries began to automate their house keeping operations and services during this phase and started applying technology for knowledge management. Clusters 4 and 5 are representatives of library automation and digitization.

A similar trend as depicted in visualization was also observed in the syllabi of LIS education programmes during early 2000's. The Curriculum Development Committee (CDC) on LIS set up by the University Grants Commission in its report submitted in 2001 emphasized to prepare LIS professionals to face the challenges being posed by ICT to prepare them towards a sustainable professional competence, besides recommending other LIS education reforms. Thereafter, the LIS schools started revising the course curriculum of LIS programmes in adherence to the recommendations of CDC. In addition to the core subjects of LIS, the topics of computer basics, its architecture, types of network, introduction to programming languages, overview of operating systems, viz. MS-DOS, WINDOWS, Linux, and library automation using SOUL (software) and digital and virtual libraries found place on the syllabus of most of the LIS schools during that period. Since, the libraries were under automation phase, the LIS programmes included contents to familiarize the students with computer technology and to prepare them for library automation.

Articles published during 2009-13

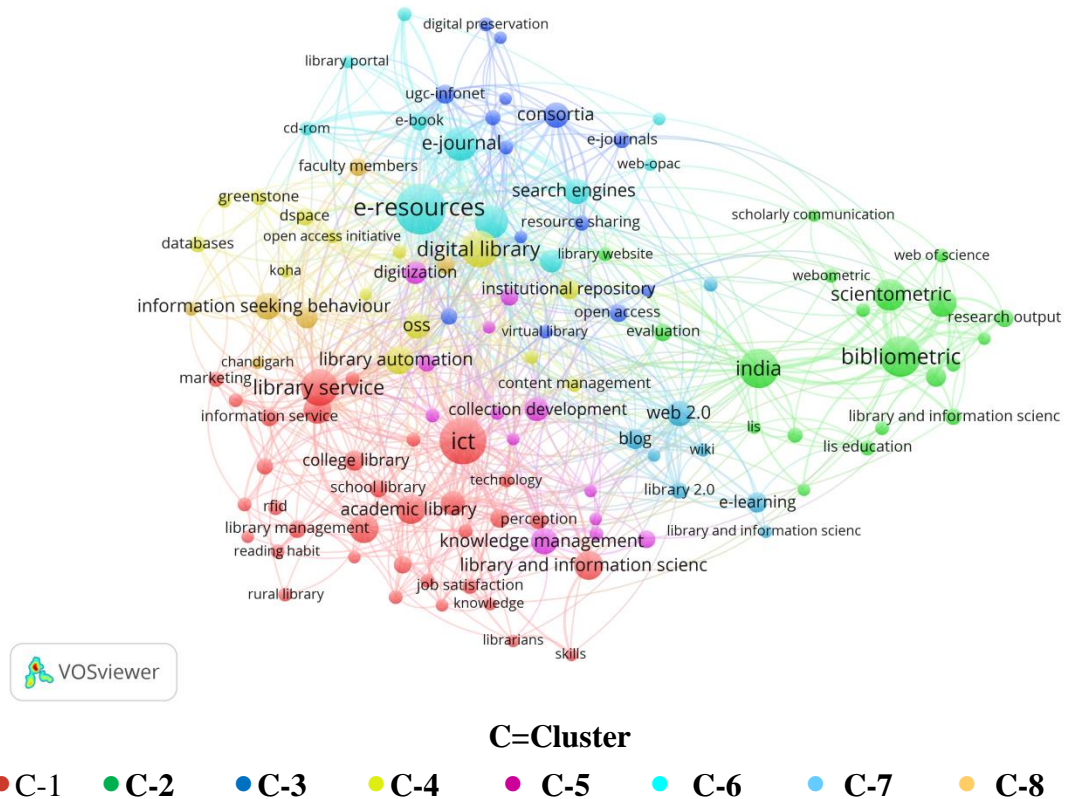


Figure 4: Visualization based on keywords during 2009-13

The articles published during 2009-2013 contained 2268 keywords and 127 of these had ≥ 5 occurrences each. The clusters based on frequency and co-occurrences of these 127 keywords are given in figure 4. Cluster 1 is representative of core library science topics including academic libraries, human resource management, collection development and management, information and knowledge management, library services, user studies, marketing, total quality management, different types of libraries, professional skills of LIS professionals as well as use of technology in providing library services. This makes it pertinent that the core subjects are basic to LIS education and research and will remain integral to these through all phases of development and transition. Cluster 2 is oriented towards bibliometric/scientometric/webometric studies and citation analysis. Cluster 3 contains terms representing the resource sharing initiatives including consortiums, networks and gateways etc. Cluster 4 deals with topics of library automation and preservation of information and knowledge by creating institutional repositories using open source software. Cluster 5 represents the topics of collection development and knowledge management in digital era. It also covers the topics of semantic web and web ontologies. Cluster 6 is about the bibliographic databases and other electronic resources, including CD-ROMs, e-journals, e-books, web portals, web-OPAC, search engines, etc. Cluster 7 includes the terms representing the application of Web 2.0 for providing library and information services, including blogs, social network sites, wikis, etc. It also deals with the cloud computing. Cluster 8 is about user studies including studies of information needs of users, their information seeking behaviour vis-à-vis information use studies.

The topics of collection development, collection management, human resource management, information and knowledge management, marketing of information resources and services, etc. have been basic to the LIS education. In support of the results revealed by visualization (Fig. 4), an observation of the LIS curriculum of universities in India during 2009-10 reveals that the Information Technology course was updated to encompass the contemporary trends in ICT applications, vis. application of web technologies in libraries including Web 2.0 and Web 3.0 features and functions, RSS feeds, Instant Messaging, Blogs, Web OPACs, etc. Development of institutional repositories, particularly using Green Stone Digital Library, DSpace and E-Prints was also incorporated in the syllabi. The multimedia applications, open source software and their applications, e-resource sharing, digital content management, federated search engines and artificial intelligence, etc. also appeared on LIS syllabi.

The topics included in LIS education are in line with the trends revealed via visualization of keywords provided in articles under study.

Articles published during 2014-18

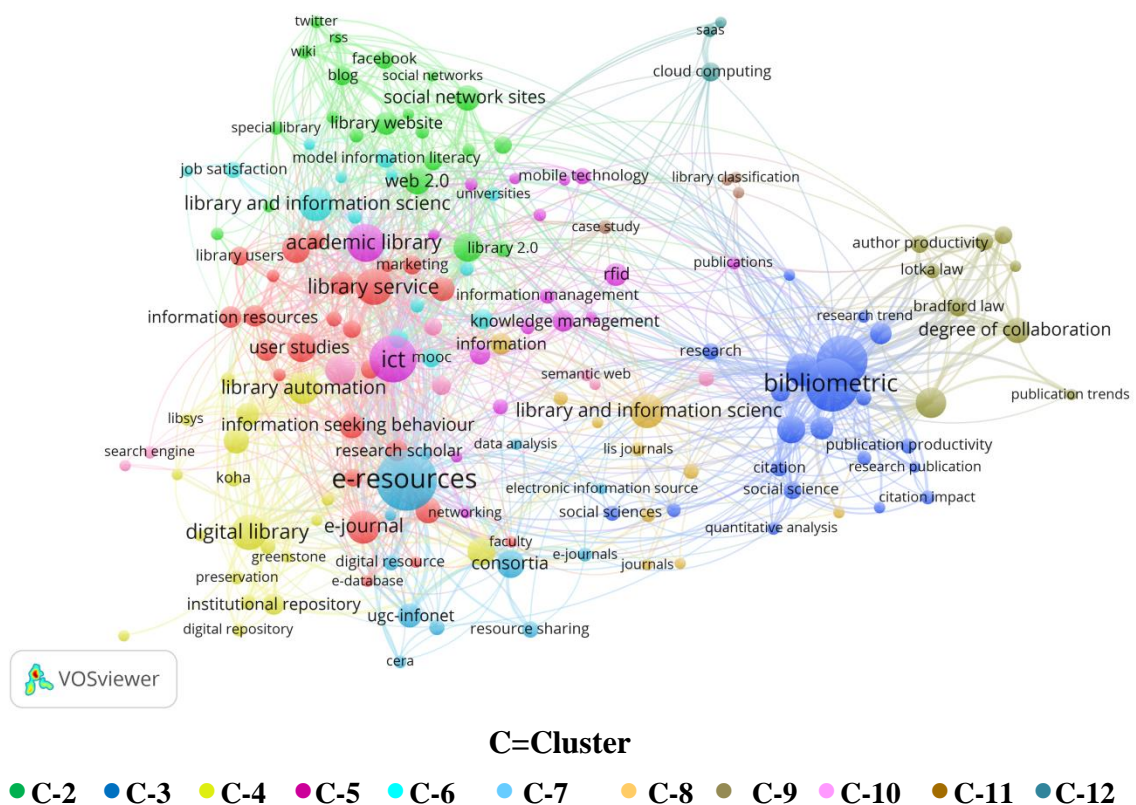


Figure 5: Visualization based on keywords during 2014-18

During the period 2014-18, the articles witnessed 2908 keywords including 174 having ≥ 5 occurrences. The visualization map given in figure 5 reveals that during this span, cluster 1 is focused on collection development of electronic information resources involving e-books, electronic databases, e-journals, etc. The needs based collection development, based on user studies including assessment of information needs, information seeking behaviour, reading habits and user satisfaction studies remained centric. Cluster 2 pertains to the web 2.0 / Library 2.0 technologies for out-reaching and engaging users towards libraries. The various social network tools, vis. blogs, facebook, RSS, twitter dominate this cluster. Cluster 3

remains focussed on literature evaluation using quality indicators (h-index, citations, impact factor, etc.). Cluster 4 is based on the keywords representing digital collection management and digital preservation using open source software. The mention of KOHA, DSpace and Greenstone reveal their utilization and popularity among libraries in the country. While cluster 5 deals with the ICT applications in libraries for modernization and re-engineering to cope with the changing scenario and use of mobile technology for library services, cluster 6 is about the continuous professional development and job satisfaction of LISPs for developing their capabilities for meeting the challenges of emerging scenario. The model information literacy and MOOCs are also constituents of this cluster. Cluster seven is devoted to the resource sharing through consortia initiatives and cluster 8 is based on the open access movement. Cluster 9 deals with the topics of research collaboration analysis and different laws of bibliometric/ scientometric analysis. Cluster 10 deals with information retrieval including use of discovery tools, web ontologies, search engines, etc. Cluster 11 is concerned about the contribution of Dr. S R Ranganathan towards Library and Information Science and library classification. Cluster 12 is about cloud computing and its' different services including PAAS and SAAS.

The user centric electronic information resources and services including online books and journals, subject directories, search engine intricacies, etc. have been central to the LIS education during last 5 years. The concepts of data mining, electronic and network publishing, open source software, KOHA Library management Software, digital libraries and their management, e-books, databases, ETDs, archiving and preservation of digital collection, digital library initiatives, Open Access Initiatives, communication technologies, vis. Radio Frequency Identification (RFID), networking, resource-sharing, copyright issues in digital age, artificial intelligence, etc. have been incorporated in LIS syllabi in recent times.

The bibliometrics/ scientometrics has always been integral to LIS education. However, in view of emergence of different forms and formats of information resources, this term has evolved to webometrics and altmetrics over the period. The quality indicators vis. h-index, impact factor, i10 index and their significance in academic evaluation is being taught to student in present times.

Institutional Collaboration

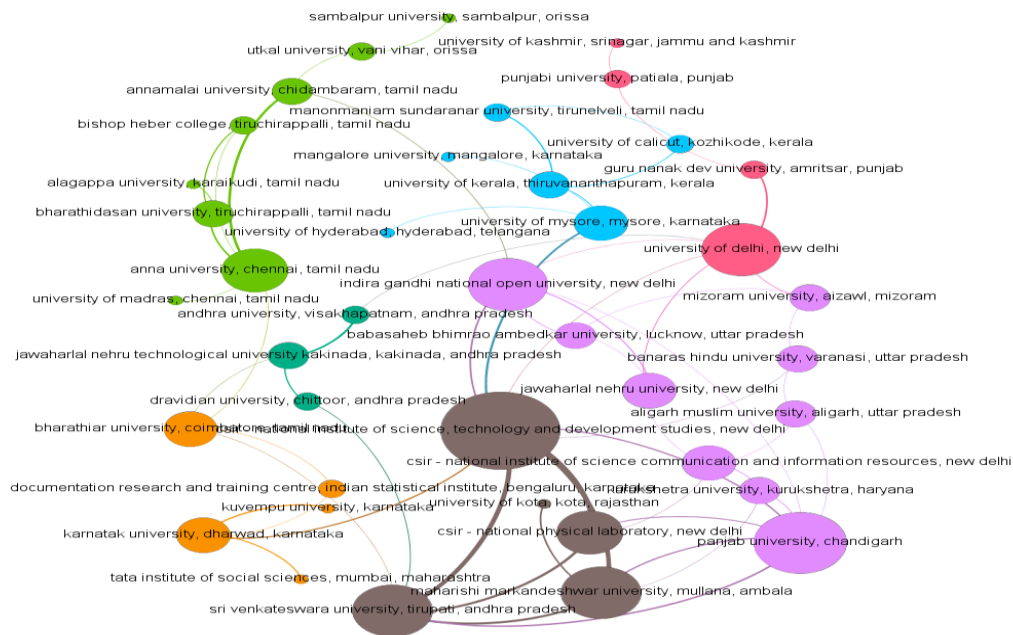


Figure 6: Institutional collaboration

Figure 6 presents visualization of inter-institutional collaborations for articles under study. The size of nodes represents the article productivity of institutions and stings connecting them reveal their collaborations. The University of Mysore, Karnataka was found to be the lead institution having contributed largest number of articles (n=107) in the subject of LIS. It was followed by the University of Delhi, New Delhi with contribution of 90 articles. The University of Kerala, Thiruvananthapuram; CSIR-National Institute of Science, Technology and Development Studies, New Delhi; Annamalai University, Chidambaram, Tamil Nadu; Karnataka University, Dharwad, Karnataka; Panjab University, Chandigarh; Guru Nanak Dev University, Amritsar, Punjab and Banaras Hindu University, Varanasi, Uttar Pradesh are among top 10 major contributing institutions.

In terms of collaboration, the CSIR-National Institute of Science, Technology and Development Studies, New Delhi is the largest collaborator (total link strength=52), followed by Sri Venkateswara University, Tirupati, Andhra Pradesh and Maharishi Markandeshwar University, Mullana, Ambala. The CSIR-National Physical Laboratory, New Delhi; Panjab University, Chandigarh; Indira Gandhi National Open University, New Delhi; Anna University, Chennai, Tamil Nadu; Karnataka University, Dharwad, Karnataka; University of Delhi, New Delhi and University of Mysore, Mysore, Karnataka are amongst the major collaborators.

Discussion

LIS has advanced to gain the status of an independent discipline of study and research over the period. Various types of institutions including, universities, deemed universities, affiliated colleges, polytechnics, professional associations and documentation centres, etc. are offering LIS education in India. The University Grants Commission (an affiliating body) made substantial efforts towards LIS education by setting up various committees to give recommendations on the different aspects of the discipline, for updating LIS education as per job requirements. Focus of LIS education is shifting from theoretical aspects to practice oriented topics. The advantageous influence of ICTs has transformed the library operations

and services around the globe. The libraries in India are no exception to this. Almost all the libraries of universities vis-a-vis of other institutions of higher education have automated their operations and services. The school libraries are also following the footsteps and there are a few state-of-the-art schools in the country. A large number of universities in India have implemented Radio Frequency Identification (RFID) technology.

Keeping pace with the technological advancements and job requirements, the course curriculum of universities/ institutions offering LIS education is continuously revamped and updated to include cutting edge topics as per the changes in LIS. The topics about automation and digitization of library operations, development of institutional repository, digital collection development, data mining and data handling, information literacy, information and knowledge management, change management, e-learning, ICT based marketing techniques, web applications, content management software, discovery tools, federated search engines, subject portals and gateways, databases and their search strategies, etc. can be found on the syllabus of LIS schools/ departments of various universities. The combination of technology based topics with core subjects is making LIS students capable to survive and thrive in the ICT based job environment. Corresponding to the developments in LIS education and practice, the research topics are also slanted to explore the applications and usage of ICT based tools, resources and services. A shift is being observed from theoretical to problem based research topics having practical applications. The tug of war between the “L” and “I” will always be debatable.

The e-resources started gaining popularity with the beginning of 21st century in India, which is perceptible in the subject analysis of articles published during 2004-2008. The visualization of keywords makes it obvious that the topics pertaining to electronic information resources remained the focus of articles published during this period. The library automation and digitization of information resources also attained attention during this phase. Though the penetration of ICTs transformed the information resources and services of libraries, the topics of core library science have not lost their grasp. During 2009-2013, the biggest cluster of keywords represented topics of different types of libraries, their services, human resource management, collection development and management, information and knowledge management, user studies, marketing, total quality management, professional skills of LIS professionals as well as use of technology in providing library services. The user studies have always been basic for improving the library services and these remained central to the articles published during 2014-18 for collection development of e-resources. A careful observation of all three subject visualization maps reveals that the significance of Web applications has increased over the period. The marketing and provision of library and information services using blogs, social network sites, wikis, etc. became more obvious during last span of years under assessment.

The bibliometric/scientometric studies have been used considerably since last quarter of 20th century for evaluating the growth and frontiers of scholarly communication. The term bibliometrics evolved to other counterparts viz. webometrics, altmetrics, etc. over the time to encompass the assessment of literature being published in various forms and formats. Such studies are getting considerable attention of scholarly spheres in recent times as quantitative and qualitative measures of growth of literature and performance measurement. Articles representing bibliometric/ scientometric studies constituted significant part of LIS literature during the period under study. During recent years the focus of such studies has moved to examine the quality indicators viz. citations, h-index, impact factor, etc. Under the influence of high cost of information resources and growing demand of users for access to wider collection of information resources, the resource sharing initiatives attained attention. This

depicts the concerns and attempts of institutions of higher education and their monitoring agencies for cost-efficient analysis and economisation of funds by promoting resource sharing to facilitate access to wider number of information resources to their stakeholders. During last phase of years explored, studies on use of open source software viz. KOHA library automation software and DSpace and Greenstone digital repository software have become more apparent. Evidences of emphasis on modernization and re-engineering of libraries have been observed and the subject of continuous professional development of LISPs for developing their capabilities for meeting the challenges of emerging scenario has been identified.

Beginning with e-resources and automation of libraries in 2004-2008, the LIS literature has witnessed articles on different aspects of technology applications, including collection development of electronic information resources, their management, marketing, out-reaching users using social networks, digitization of information resources, and assessment of quality and quantity of scholarly communications, etc. The continuous professional development of LISPs using technology, viz. MOOCs has started attaining attention. All libraries cannot afford to acquire all required ICT infrastructure or own platforms for services. Similarly all libraries do not have expertise to handle the information technology based backend issues. The importance of cloud computing in such scenario becomes more tangible. However, the phenomenon of cloud computing has not attained much attention in LIS education and research. Virtual Reality and Augmented Reality application in libraries are increasingly gaining ground throughout the world and need to be introduced in LIS education and research in India too to cope up with the advancements in librarianship happening around the globe.

Albeit, the Indian sub-continent boasts of having the oldest history of LIS education in the South-Asian region, it is not free from hitches. There is lack of uniformity in terms of course nomenclature, duration, course content and teaching method, etc. Majority of the institutions offer bachelors' and master's degrees of one year duration each, while, a few universities have started two years integrated courses leading to master's programme, as per UGC Model Curriculum. Some of the LIS departments have also started offering Choice Based Credit System (CBCS). The course content of the LIS departments is not uniform. While many have incorporated cutting edge topics to make learners Technology savvy, others still focus on theoretical papers. Mushrooming of institutions offering LIS education through distance mode has influenced the professional quality.

The absence of quality control body has led to the escalation of LIS schools in an unplanned way especially in colleges. The accreditation of LIS schools/ departments has yet to gain attention. The draft of National Policy on Library and Information Systems is collecting dust on the shelves of Govt. Developments since 1986. The implementation of recommendations of Working Group on Libraries to constitute the permanent National Knowledge Commission on Libraries which raised some hope for making forecasts and plans for LIS professionals' requirements at different levels is very slow. Lack of appropriate and regular funding is the major obstacle in the way of revamping LIS education. The greater involvement of IT in LIS sector requires adequate infrastructure for practical training of students. Language is another obstacle in professional development of students. Schooling influences their options for the medium in higher education. Students from non-English medium schools and rural background areas face problems in getting opportunities to join the advanced organizations. Lack of adequate number of teachers to impart education is another problem of LIS schools. Sometimes, LIS professionals with a little experience are appointed on adhoc basis to save funds, ignoring the recommendations of UGC Committees.

Conclusion

The ICTs have totally transformed the profession of librarianship, earlier it was a slower change relatively. Today one cannot imagine a library without computer or information resources in electronic format. The LIS education and research in India has been re-engineered over the period of time to meet the challenges and utilize the opportunities offered by the ICTs. During 21st century, LIS education and research has evolved to encompass the subjects of mere automation of library operations to technology based resources, services, tools and applications and facilities. The situation varies in each continent and country depending upon the education system, the importance of libraries in society, infrastructure available and dependence on libraries for fulfilling information needs. There are countries still struggling with digital, gender and information divides. In a country like India there are so many wide variations regarding library services provided to users. LIS is the most dynamic and transitional discipline. In view of the international developments in librarianship, there is need to incorporate more cutting edge topics in education and research in LIS in the country including cloud computing, virtual reality, augmented reality, Near Field Communication (NFC), etc. LIS educationists and professionals will always be on their toes as to see what's coming next in our profession and it's the capability of being flexible and futuristic that will keep us relevant and thriving!

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