International Journal of Information Science and Management
Vol. 21, No. 3, 2023, 19-34
DOI: https://dorl.net/dor/20.1001.1.20088302.2023.21.3.1.5 / DOR: https://dorl.net/dor/20.1001.1.20088302.2023.21.3.2.6

Original Research

Topic Modelling in Library and Information Science from the Primary Data: Swing in Thrust Areas

Mousumi Saha
Junior Research Fellow, Department of Library & Information Science, University of North Bengal, Raja Rammohunpur, West Bengal, India.
rs_mousumi@nbu.ac.in
ORCID iD: https://orcid.org/0000-0003-3736-6201

Saptarshi Ghosh
Professor, Department of Library & Information Science, University of North Bengal, Raja Rammohunpur, West Bengal, India.
sghosh@nbu.ac.in
ORCID iD: https://orcid.org/0000-0001-9567-5868

Received: 11 September 2021
Accepted: 22 June 2022

Abstract

This paper portrays the topic modeling approach in identifying critical facets in new Library and Information Science (LIS) research. Using machine language, topic modeling in statistics recognizes the "topics" in a document pool. Latent Dirichlet Allocation (LDA) is one such model for topic analysis and thus is used to classify text in the literary warrant in LIS in various locations worldwide. The study analyzed 734 articles published in 4 different LIS journals, i.e., Annals of Library and Information Studies (Indian), DESIDOC Journal of Library and Information Technology (DJLIT-Indian), College and Research Libraries (International), Liber Quarterly (International) from 2016 to 2020. LDA is used to analyze and manage the dataset. The study pivoted on the foundation of extracting 'topics' from these four journals using Mallet and Knime software to determine what research topics are essential at the national and global levels. The paper also visualizes a relationship map of distributed issues at the national and international levels to identify the sublime contexture of keyed-in tags. Furthermore, the study took a socio-cultural approach to LIS research with cross-country comparisons. The study found that the compared topics retrieved from both journals published in India and abroad where non-Indian journals varied significantly from those published in Indian journals. The study concluded that cross-cultural adoption is visible in the research activities over time. Moreover, this study identified the social parameters that describe the changes in the discipline.

Keywords: Topic Modelling, Socio-Cultural Approach, Research Trends, Cognitive Map, Knime, Mallet, Library and Information Science (LIS).

Introduction

In today's world, information is evolving rapidly, publishing thousands of articles daily. The new research focus is constantly changing, and each topic is gaining and obsoleting its relevance every day. Library and Information Science (LIS) has grown in popularity since its inception in 1887 (Singh, 2017), and it now covers a wide range of topics. Ghanadinezhad, Osareh, and Ghane (2022) forecasted the subject trend of LIS research until 2030 based on modeling previous research topics in this field, which has been done with text mining and an

in-depth learning approach. The findings showed that the most significant number of studies in the "*future would be related to Internet and web studies, and the growth rate of these topics will be higher"*. However, *topics related to libraries and their* work *processes and other traditional disciplines, such as theoretical foundations, will have a lower growth rate in Library and information science studies*. A similar approach to Iranian literature was explored by (Baghmohammad, Mansouri & Cheashmehsohrabi, 2021), which identified that Topic Modeling (LDA) and linear regression model could help identify the thrust areas of Library & Information Science. Their findings indicated that Library and Information Science Research in Iran has developed with the growth of technologies and global topics. They further stated the relationship between the Library and Information Science subject area and new fields of data mining, artificial intelligence, semantic retrieval, ontologies, information architecture, digital publishing, social networks, and databases. Methods for analyzing text data and topic modeling and its application, importance, and usage are studied in Library and Information Science (Lamba & Madhusudhan, 2018).

Based on articles published from 1990–to 2004 in 21 libraries and information science (LIS) journals, co-citation analyses were performed to study changes in research fronts over the last 15 years and identify the present and future. The results showed a stable structure of research fields: informetrics and information seeking and retrieval (ISR). However, experimental retrieval and user-oriented research have merged into one ISR field. IR and informetrics also show coming closer together, sharing research interests and methodologies. It makes informetrics research more visible in mainstream LIS research (Åström, 2006). With the LDA model, Sugimoto, Li, Russell, Finley and Ding (2011) analyzed the 3,121 doctoral dissertations completed between 1930 and 2009 at North American Library and Information Science programs. The authors compared other earlier analyses and provided validation for the use of LDA in a topic analysis of a discipline.

This literature indicated the emerging topics in Library and information science over the year. The difference between topics represents different research cultures globally. The study tries to compare the research culture from Indian and international perspectives and explain the socio-cultural impact on information generation. The gaps identified warrant framing a few research questions: a) What are the latest developments in LIS research that incorporate cognitive development? b) What are the thrust areas of global LIS research? c) How are the knowledge structure facets connected to the LIS domain? Furthermore, d) How does the socio-cultural approach affect global research in libraries?

To address these issues, we formulated a few research objectives of the study a) to identify the latest developments in LIS research that incorporate cognitive development, b) to trace the thrust areas of global LIS research, c) to pinpoint the facets of the knowledge structure connected to the LIS domain, and d) to validate the socio-cultural approach has the potential to affect global research in libraries.

Topic modeling provides techniques for organizing, interpreting, and evaluating vast amounts of textual data. It assists in identifying hidden topical patterns throughout the collection, annotating documents according to these topics, and using these annotations to organize, search, and summarise texts (Liu, Tang, Dong, Yao & Zhou, 2016). It is a statistical model for discovering the latent "topics" in collecting documents through machine learning. LDA is a popular and common modeling approach (Yau, Porter, Newman & Suominen, 2014). Subject modeling is a technique for extracting a group of words (i.e., a topic) from a set of

documents that best represents the information in the set. It is also text mining, a technique for identifying reoccurring patterns of words in textual data. A variety of methods are available for topic modeling. For example, the LDA model prescribes to take each document a mash-up of subjects found in the corpus. According to the approach, each word in the document corresponds to one of the document's subjects.

The library and information science field covers both multidisciplinary and transdisciplinary approaches. The journals, the prime vehicles for information communication, manifest new connotations of the subject merged with the vocabularies of other subjects. Topic modeling approach in Library and information science helps identify thrust areas of contemporary research. It also portrays the relationship of the subject with other disciplines. Drawing up a cross-cultural relationship is the prime significance of this study. The study explores the issues contributing to the LIS field and shows mental bondage. The survey used topic modeling techniques to explain the patterns of research and knowledge structures in the LIS sector. Exploring information makes it challenging to identify trends in LIS knowledge.

One study in China showed that the subfields of Library and information science kept changing from 1998 to 2007: some subfields have emerged and developed a lot, e.g., webometrics and competitive intelligence; some subfields maintained, e.g., Bibliometrics and intellectual property; and some subfields have declined, e.g., cataloging. Compared with the international LIS, Chinese LIS had some unique subfields from 1998 to 2007, such as competitive intelligence and intellectual property (Ma, 2012). Academic usage of computational linguistics methods, the traditional indicator in pattern recognition and text mining tools, compares scientific publications to conventional documents. A new method for tracing knowledge transfer was suggested, and understanding university-industry knowledge transfer by introducing an additional perspective increased (Woltmann & Alkærsig, 2018). Franceschini, Faria and Jurowezki (2016) opined that the relationship between innovation and sustainability has skyrocketed in the last two decades, and new terms have appeared. However, only very few bibliometric analyses have reviewed some of these terms (eco-innovation, environmental innovation, green innovation, and sustainable innovation), and they concluded that such terms are mostly interchangeable. The bibliometric analysis tracks meanings and a community associated with these four terms and shows some overlaps, especially between eco-innovation and environmental innovation. Detecting what type of knowledge constitutes a discipline, tracking how the knowledge changes and understanding why the changes are triggered, and the key issues in analyzing scientific development from a macro perspective analyzed by the evolution of the topic. By analyzing 65,887 AI-related research articles published over ten years from 2009 to 2018, researchers could uncover hierarchical structural evolution and, more precisely, inspect disciplinary development. From a hierarchical topic model that can construct a topic tree with multi-layer organizations and design a visual analysis model for the topic tree to systematically and visually investigate how knowledge transfers along the topic tree and how the topic tree changes over time. Then, researchers discovered the latent relationship between the sub-structures within a topic and the triggering reason for the knowledge migration. In conclusion, different topics have different development patterns, and the recent artificial intelligence revolution stems from the interactions among the different topics (Qian, Liua & Sheng 2020). The bibliometric study of Library and Information Science (LIS) aimed to provide topical boundaries, major areas, and research tendencies (Figuerola, Marco & Pinto,2017). Characterizing knowledge structure, the evolution of research topics, and

the emergence of topics have always been important in information science (IS). Dual-map overlays of journals show that the knowledge base of IS research has shifted considerably since 2010, with emerging topics including scientific evaluation indicators, altmetrics, science mapping and visualization, bibliometrics, citation analysis, and scientific collaboration (Hou, Yang & Chen, 2018). The statement includes a data analysis that reveals the cognitive structure of the LIS discipline. The internet has helped the development of mental ideas in LIS significantly. The ever-changing landscape of cognitive development in the LIS field is made possible by thriving modern information technology and a stagnant technology from the past (Milojević, Sugimoto, Yan & Ding, 2011). In the new article, Lamba and Madhusudhan (2019) use LDA to classify subjects appearing on the LIS from 1981 to 2018. In India, Bibliometrics, information communication, and Information and Communications Technology (ICT) are major research areas (Lamba & Madhusudhan, 2019). Existing studies thoroughly covered the 5 LIS journals' development from 2000 to 2002 to 2015–2017, showing their importance in furthering LIS research (Miyata, Ishita, Yang, Yamamoto, Iwase & Kurata, 2020). The theoretical approach and empirical work are crucial in determining knowledge structure. Subjects studied by the LIS domain have shifted from networks and the internet to social media and mobile applications in the current technological environment (Han, 2020). These ALIS and DJLIT journals, and their citation and impact factors, are compared (Garg & Bedi, 2014). There are several bibliometric and scientometric methods used to conduct a literature search. The DJLIT performs a bibliometric study to discover articles and references' authorship patterns, geographic distribution, and who deserves credit (Thavamani, 2013; Verma, Devi & Brahma, 2017; Khan, 2016). According to Google Scholar, Naidu (2017) and Renjith (2018) found that "the output pattern and citation rates are inconsistent" (Naidu, 2017 and Renjith, 2018). The conceptual and thematic structure of Library and information science (LIS) research can be mapped and analyzed using co-word analysis. The word 'Science' is the most prominent and pivotal keyword among the nodes in the co-word network of LIS literature, according to an examination of LIS core journals indexed in the Web of Science between 1990 and 2016. During those years, other concepts like information seeking and retrieval, the internet, and the World Wide Web drew the attention of researchers (Mokhtarpour & Khasseh, 2020). Based on the time series analysis, Taşkin (2021) forecasted an incredible diversity of future research topics in the LIS area, ranging from fake news to predatory journals, open government, e-learning, and electronic health records. He divided the fields into four sub-fields: (1) librarianship and law librarianship, (2) health information in LIS, (3) scientometrics and information retrieval, and (4) management and information systems, all of which had radically different publication and citation patterns from one another.

Materials and Methods

We made the sample from 4 different SCOPUS enlisted journals to identify the most popular Library and Information Science research topics. We examined the global trends in LIS by selecting articles *from two Indian journals and two international journals between 2016-2020. While choosing the journals in both cases, we focused on open-access publications and specificity to the LIS (Library & Information Science) field.* The search query 'Library and Information Science' resulted in 61 journals, most of which were multidisciplinary in scope. *Hence, the journals were chosen sequentially, hitting the connotation "Library & Information Science" as the first occurrence*. We looked at a corpus of 736 papers from four selected

journals published between 2016 and 2020, but two articles had some technical glitches. Hence the population we trimmed to Seven hundred and thirty-four for this study. Also, not all data sets include editorial articles and messages. Every journal was accessed from its website and imported into a text file. The list on the following page contains journals and their total number of articles.

We used LDA topic modeling to process and analyze the data. The Dirichlet distribution uses a technique known as topic modeling to find a theme in a data set. In addition, a general probabilistic model is essential for collections of discrete data, such as text corpora, employed in the "Latent Allocation Dirichlet" (Blei, Ng & Jordan, 2003). The Mallet and Knime software was used to process the data. The details steps used in this study are as follows:

First, articles are downloaded from their respected journal website in a PDF format. Then, each PDF file is converted to a text file, excluding reference parts from the articles. Finally, the articles are arranged in a separate folder according to their respective journals.

Second, MALLET removes the stop words and identifies the cluster of keywords and document frequency per each selected journal's keywords. A visual representation of the process of topic modeling using the LDA model is (Figure 1):

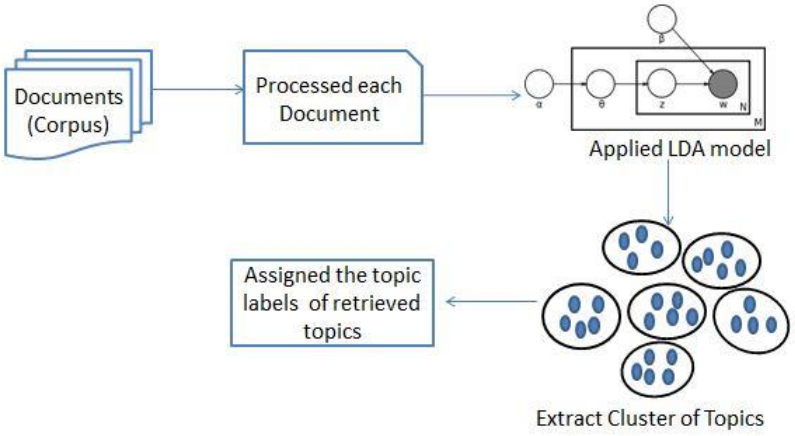

Figure 1: Diagrammatic Representation of Topic Modeling Process

In the LDA model, a parameter that determines the extent of a topic's presence in a document is "alpha" (α) and "beta" (β), and it relates to the document-topic intensity and topic-word density. Also considered are other factors in the LDA model, such as M is the number of documents. The number of words in all the documents designated by N. W specifies the exact phrases, and Z represents the nth term in the paper.

Third, the retrieved keywords are arranged in a table format and assigned topic labels based on the frequency of the documents per keyword. Finally, the study compares all four journals based on their research areas and then sums up all topic labels and identifies the global trend topics in the LIS field.

Fourth, the Knime software connects facets of the knowledge structure. For example, the study calculated the Term Frequency (TF), Document Frequency (DF), and Inverse Documents Frequency (IDF) of 400 retrieved keywords and the portrayed interrelationship between retrieved keywords. Lastly, discuss the impact of the socio-cultural approach in the LIS field globally.

Results

Based on the output of MALLET and KNIME software, the analysis is conducted for the study. Table 1 represents the list of journals included in the study and shows the number of articles published and the publisher of the journals.

Table 1
List of Journals

Journal Name	Number Of Articles	Publisher With Place
Annals of Library and Information Studies (ALIS)	128	NISCAIR, India
DESIDOC Journal of Library and Information Technology (DJLIT)	266	DESIDOC, India
College and Research Libraries	242	ACRL, USA
Liber Quarterly	98	Association of European Research Libraries, Europe

Between 2016 and 2020, the corpus contained 128 articles (Table 2). We chose ten topics for research. Bibliometrics studies predominate in this journal's Library and Information Science research field. Bibliometrics research includes bibliometrics (2), scientometrics (1), research performance (4), and citation analysis (9). Social networking was the third topic, and it addressed issues such as the "invisible college," "knowledge skills," and students' responses. The fifth topic, information retrieval, covered various topics, including data processing, metadata, and communication. From a philosophical perspective, information science represents topic six. Topic 7 addressed the bibliography, as the research area indicated that references were accurate. Subject 8 covered library services, including resources, users, and libraries. The final ranked topic was a search system emphasising the techniques, tools, resources, and technology used when conducting web searches.

Table 2
LDA topic and word result of ALIS (N= 128)

Rank	Topic Labels	Retrieved Keywords
1	Scientometrics	Research, journals, science, paper, journal, published, Indian, sciences, India, institutions.
2	Bibliometrics	Research, publications, countries, papers, university, top, China, global, network, paper.
3	Social Networking	Study, students', respondents', Library, social, information, science, university, skills, knowledge.
4	Research Performance	Information, journals, Library, list, book, Indian, published, table, LIS, language.
5	Information Retrieval	System, metadata, OPAC, information, process, communication, social, book, genre, model.
6	Information Science	Information, data, research, researchers, quality, knowledge, performance, libraries, life, quality.
7	Bibliography	References, review, errors, journal, journals, research, scholarly, number, reference, Wikipedia,
8	Library Services	Library, libraries, access, university, resource, services, digital,

Rank	Topic Labels	Retrieved Keywords
		academic, professional, users.
9	Citation Analysis	Number, articles, authors, citations, keywords, study, table, words, found, data,
10	Discovery System	Search, Library, web, users, tools, discovery, website, national, information, user.

$\alpha = 0.5$ $\beta = 0.01$

The dataset for research in this review comprised 266 articles, from which we derived ten topics (Table 3). According to this journal, user studies are the most crucial subject. Additionally, one section of the framework examined the clusters of users, libraries, and information use. The cluster of words revealed that topic 3 represents scientometrics as a topic. For topics 4 and 5, usage patterns, e-resources, and information-seeking behaviour requirements were identified. Topic 5 discussed the impact of social tagging on the knowledge domain; topic 8 focused on ICT, library software, and online services. In institutional repositories, the terms "plagiarism," "data," and "repositories" appear. Finally, but certainly, not least, topic ten discussed digital libraries.

Table 3
LDA topic and word result of DJLIT (N= 266)

Rank	Topic Labels	Retrieved Keywords
1	User Studies	Library, users', Library, resources, services, information, service, study, e-resources, collection.
2	Information Literacy	Information, digital, knowledge, technology, management, libraries, education, learning, ICT, literacy.
3	Scientometrics	University, medical, science, information, India, health, LIS, documents, university, patent.
4	Information Seeking Behaviour	Students, respondents, study, electronic, reading, internet, level, university, table, knowledge.
5	Social Tagging	Terms, study, web, tags, analysis, social, domain, subject, text, access
6	Social Networking	Library, Library, services, university, professionals, social, tools, information, media, websites.
7	ICT	Search, information, system, online, Library, software, features, user, users, legal.
8	Citation Analysis	Research, paper, publications, journals, journal, article, author's, citation, citations, published.
9	Institutional Repositories	Data, research, researchers, faculty, members, management, plagiarism, repositories, scholars, sharing.
10	Digital Libraries	Books, e-access, language, open, digital, publishers, book, e-book, titles.

$\alpha = 0.5$ $\beta = 0.01$

Between 2016 and 2020, the journal published 242 articles and generated ten keyword clusters to identify LIS research topics (Table 4). The first topic alluded to keywords with a high level of involvement in data management. The keyword for topic two was readily visible on the discovery system. Libraries and the challenges of the digital environment represent in

topic 3. The fourth topic concentrated on the wide variety of professional library occupations, while the fifth focused on library activities. A thorough examination of the pertinent documents revealed that the relevant subject was users' rights under the revised copyright law comes under topic 6. Topic 7 addressed the research topic of collection development. Due to their significance, Information literacy (8) and metadata (9) have drawn the attention of researchers. Finally, topic 10 describes open access publishing, where many keywords reflect the practice of open publishing, encompassing open access and open publishing policies.

Table 4
LDA topic and word result of College and Research Libraries (N=242)

Rank	Topic Labels	Retrieved Keywords
1	Data Management	Data, information, digital, services, research, management, social, Library, researchers, practices.
2	Discovery System	Search, results, databases, discovery, research, Library, users, participants, found, information.
3	Library Service	Library, students, student, services, study, service, online, group, graduate, resources.
4	Librarianship	Work, librarians, participants, people, academic, experiences, experience, leadership, status, women.
5	Academic Libraries	Research, librarians, faculty, academic, Library, respondents, survey, percent, libraries, profession.
6	Copyright	Library, data, study, academic, copyright, student, percent, variables, higher, university.
7	Collection Development	Book, collection, Library, print, collections, book, titles, percent, e-books, materials.
8	Information Literacy	Students', information, literacy, instruction, learning, skills, student, assessment, research, sources.
9	Metadata	Study, language, analysis, topic, review, literature, research, terms, reading, English.
10	Open Access	Access, journal, articles, open, authors, publishing, author, published, citations, resources.

$\alpha = 0.5$ $\beta = 0.01$

We used the Mallet software to analyze 98 articles and compiled a list of ten topics (Table 5). Subject 1 focused on information and communication technologies, emphasizing digital libraries and the collection of electronic resources. The second topic focused on open science. In topic 3, the usage of information by library users was identified. Topic 4 is concerned with methods and strategies for digital preservation. While the most frequently occurring cluster of keywords included open access (5) and open review (6), they are unrelated. Librarianship was the subject of research for topic 7. Topic 8 discusses the rapidly changing landscape of publishing procedures. According to an examination of the document in question, topic 9 was entirely devoted to digital-to-text conversion and digitization policies. Near the conclusion, data management was identified as a topic with a rank of 10.

Table 5
LDA topic and word result of Liber Quarterly (N= 98)

Rank	Topic Labels	Retrieved Keywords
1	ICT	Library, libraries, collections, users, impact, questions, services, approach, public, search
2	Open Science	Open, research, libraries, science, access, university, Library, European, academic, project.
3	Information Use	Students, information, respondents, study, survey, sources, academic, results, and faculty.
4	Digital Preservation	Digital, preservation, content, information, cultural, system, web, Wikipedia, German, objects.
5	Open Access	Journals, access, open, articles, journal, published, number, publications, and publishing.
6	Open review	OA, review, institutions, reviewers, costs, process, agreement, springer, cost, paper,
7	librarianship	Knowledge, Library, research, librarians, skills, training, learning, information, participants, management.
8	Digital publishing	Publishing, digital, model, publishers, scholarly, support, content, access, book, design.
9	Digitization	Library, university, digital, work, staff, materials, webinar, digitization, research, humanities.
10	Data Management	Data, research, management, repositories, researchers, repository, policy, services, RDM, support.

$\alpha = 0.5$ $\beta = 0.01$

Following a topic modeling approach in four selected journals, we identified forty key topics that appeared at least twice in 734 articles published between 2016 and 2020 (Table 6). At some point, each of these forty significant research areas intersects with another. As a result of removing the overlapping sections, only twenty-eight distinct topics remained, considering global trends in Library and Information Science. The following table is part of the resource offering, including a list of 28 library and information science topics.

Table 6
Overview of selected journals

Annals of Library and Information Studies	DESIDOC Journal of Library and Information Technology	College and Research Libraries	Liber Quarterly
Scientometrics	User Studies	Data Management	ICT
Bibliometrics	Information Literacy	Discovery System	Open Science
Social Network Analysis	Scientometrics	Library Service	Information Use
Research Performance	Information Seeking Behaviour	Librarianship	Digital Preservation
Information Retrieval	Social Tagging	Academic Libraries	Open Access
Information Science	Social Networking	Copyright	Open Review
Bibliography	ICT	Collection Development	Librarianship

Annals of Library and Information Studies	DESIDOC Journal of Library and Information Technology	College and Research Libraries	Liber Quarterly
Library Services	Citation Analysis	Information Literacy	Digital publishing
Citation Analysis	Institutional Repositories	Metadata	Digitization
Discovery System	Digital Libraries	Open Access	Data Management

The study identified several potential research areas within and outside the country (Table 7). Scholars in India are interested in citation analysis, bibliometrics, and scientometrics, according to Tables 2 and 3. However, due to the increased usage of social tagging, digital libraries, and social media in LIS research, India is becoming increasingly important, although global journals have mainly focused on data management and open access. Researchers from all over the world are interested in users' perspectives and use of information. The research community paid close attention to information technology between 2016 and 2020. Additionally, it identified that the demand for library services and information literacy are significant research areas for LIS. In recent years, LIS research has concentrated on 'Blockchain,' 'Linked data,' and' sentiment analysis.'

Table 7
List of trending research areas of LIS globally

Academic Libraries	Information retrieval
Bibliography	Information Science
Bibliometrics	Information Seeking Behaviour
Citation Analysis	Information Use
Collection Development	Institutional Repositories
Copyright	Librarianship
Data Management	Library Services
Digital Libraries	Metadata
Digital Preservation	Open Access
Digital Publishing	Open Science
Digitization	Scientometrics
Discovery System	Social Networking
ICT	Social Tagging
Information Literacy	User Studies

Table 8 shows the frequency of each recovered phrase, document, and inverted document, as well as their rank. The table contains the ***top 30 words*** from the 400 extracted keywords. The term "research" is the most widely used, with a phrase frequency of 40 and a document frequency of 20. The terms' library' and 'information' rank second and third, respectively, with a term frequency of 38 and a document frequency of 19. The result is followed by the terms' libraries', 'study', 'universities', and 'academics'.

Table 8
Term Frequency, Document Frequency, and Inverted Document Frequency

Term	Index	TF	DF	IDF
Research	1	40	20	1.395326
Library	2	38	19	1.417603
Information	3	38	19	1.417603
Libraries	4	26	13	1.582413
Study	5	24	12	1.617175
University	6	20	10	1.696356
Academic	7	18	9	1.742114
Services	8	18	9	1.742114
Digital	9	16	8	1.793266
Data	10	16	8	1.793266
Users	11	14	7	1.851258
Journals	12	14	7	1.851258
Access	13	14	7	1.851258
Students	14	14	7	1.851258
Journal	15	12	6	1.918205
Percent	16	12	6	1.918205
Published	17	12	6	1.918205
Student	18	12	6	1.918205
Management	19	12	6	1.918205
Search	20	10	5	1.997386
Knowledge	21	10	5	1.997386
Respondents	22	10	5	1.997386
Books	23	10	5	1.997386
Articles	24	10	5	1.997386
Open	25	10	5	1.997386
Social	26	10	5	1.997386
Participants	27	10	5	1.997386
Researchers	28	10	5	1.997386
Librarians	29	10	5	1.997386
Citations	30	8	4	2.094296

Each cluster of words in each journal has a discreet relationship. To show how closely related each topic area is, they are all connected to their respective keyword clusters (figure 2). LIS's overall research strategy is to provide relevant resources to users. Individuals with varying skill and experience levels engage in various forms of information seeking to meet their informational needs.

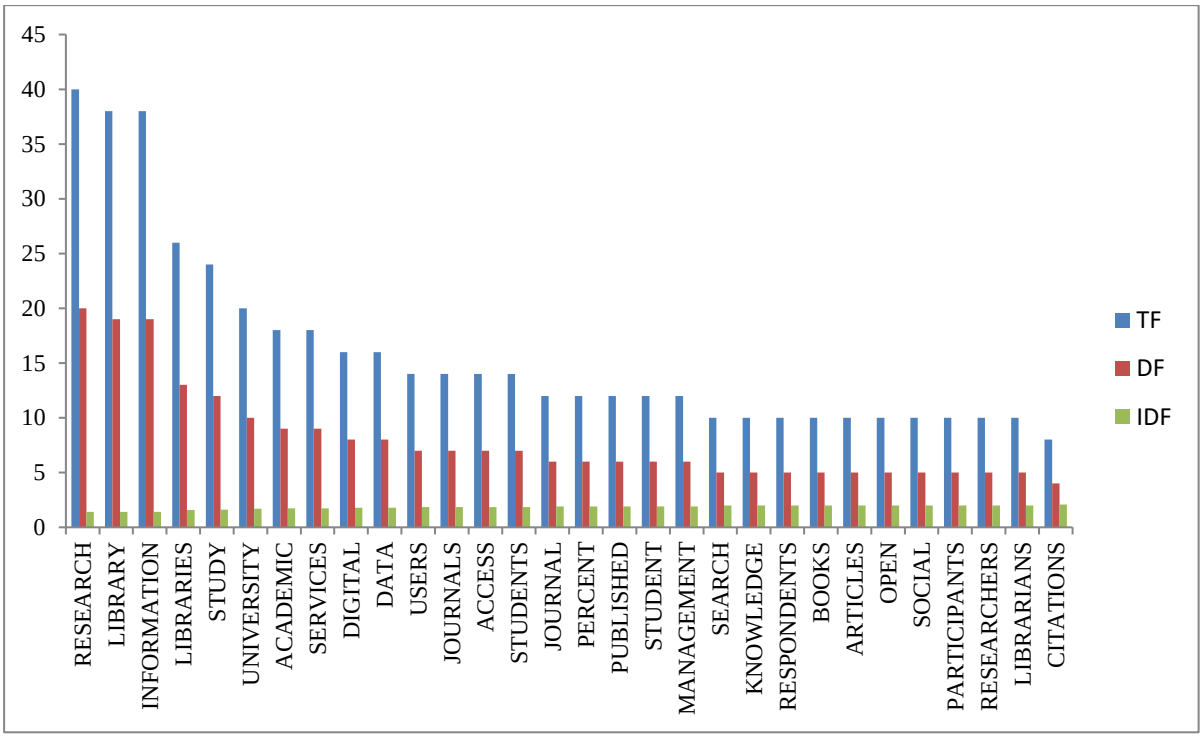

Figure 2: Term Frequency, Document Frequency, and Inverted Document Frequency

In the Bibliometrics study, the area of interdisciplinary relationships, collaboration, and "knowledge users" was examined to measure research performance. Figure 3 depicts a knowledge structure that connects topics and clusters of words.

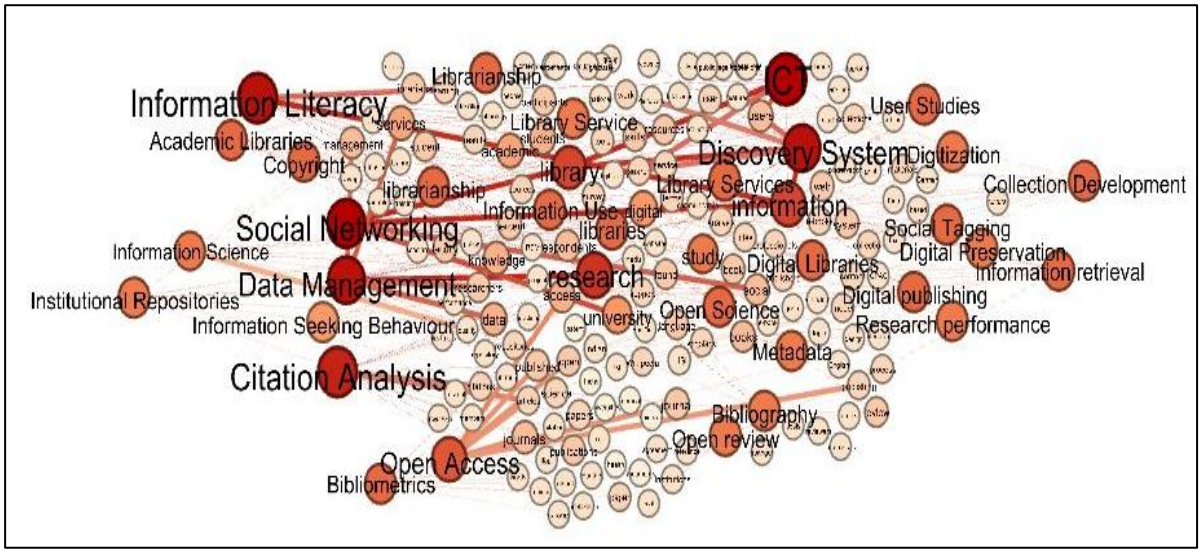

Figure 3: Knowledge Structure of LIS Topics

Discussion

E.M. Rogers 1962 propounded the diffusion theory of knowledge adoption and knowledge synthesis in a society. Barring its flaws, *he vouched that adopting a new idea, behavior, or product (i.e., "innovation") does not happen simultaneously in a social system; instead, it is a process whereby some people are more apt to adopt the innovation.* Early innovation adopters have different characteristics than people who perceive an innovation later. Roger mentions the

established adopter categories of innovators, early adopters, early majority, late majority, and laggards (LaMorte,2022). This study compared the topics retrieved from journals published in India and abroad. As a result, the topics covered in non-Indian journals varied significantly from those published in Indian journals. Cross-cultural adoption is visible in the research activities. Over time, this has increased.

Library and information science evolution are inextricably linked to society and culture. Along with societal development, LIS has grown in its scope. LIS phenomena are influenced by various factors, including distinct societal and cultural environments and their underlying similarities and differences in scholarly study. Lor (2017), in his *International and Comparative Librarianship Study*, argued in favor of this proposition. As a combinatory approach of Rogers and Lor, this study took a socio-cultural approach to examine the changing landscape of Library and information science. Cognitive development and knowledge acquisition are social processes sharpened by interaction with social agents and culture. It is self-evident that social activities promote human cognitive development (Vygotsky, 1986). The measurement of research performance and the importance of indicator standardization is essential, including aspects such as interdisciplinary relations, collaboration, and 'knowledge users' in research (Van Raan, 2004). The cognition and socio-cultural approaches focused on a vibrant global exchange of ideas, reflections, and proposals among scholars. The sociocultural approach applied to research on conceptual change entails three main interrelated issues: first, the change is conceived not in terms of modifications to conceptual structures but rather in terms of a change in embedding these structures. Second, concepts are part of the social practices in which people participate. Last, conceptual change in research is that knowledge does not transfer between tasks as it is wholly tied to the context of its use, as some empirical evidence supports (Mason,2007). Researchers and participants interact, influencing one another (Wang, Bruce & Hughes, 2011). New information is processed following the constructivist concept (Duit & David, 2003) of subject development, reorganizing the knowledge development process. The digital environment appears to be influencing changes in LIS research, and this environment invites us to induct digital adoption theories like TAM (Technology Acceptance Model) and its variants. The Research fields in the LIS area are influenced by various social, cultural, and technological developments in the community and within the field (Ghanadinezhad, Osareh & Ghane,2022). The subject's initial research focuses on library history, library education, library service, and the subject headings established by Sugimoto et al. (2011).

Aström (2007) identified four research areas in the field of Library and information science: "information seeking," "information retrieval," "informatics," and "information search." In Table 7, the analysis highlighted numerous research fields of the selected journals acquired by LIS researchers appear to be the thrust areas. Throughout this study, the authors uncovered several new topics, such as blockchain, sentiment analysis, and more. The study discovered that Library and Information Science has diverse research areas and cultural backgrounds. While the two Indian journals, ALIS and DJLIT, both focused on LIS-related research, the two journals' visions of LIS-related research varied, as illustrated in Table 6. The study also found that Researchers are interested in user studies, information-seeking behavior, and information literacy to discover new knowledge through interaction with participants. The study found that each keyword retrieved from selected journals is linked to each other in a relationship, as shown in Figure 2. Hence, we are confident that the socio-cultural approach has influenced the

development of LIS and cultural disparities in study areas worldwide.

Conclusion

The study used topic modeling to estimate trending research areas in LIS from 2016 to 2020. Topic modeling is a valuable strategy for discovering the central topics of a collection of documents by determining the underlying structure of word clusters. The results of the study show that LIS research uses innovative technologies. This study used a socio-cultural approach to describe the changes. In the article, societal developers helped maintain the relevance of construction. Other innovation studies, such as digital preservation, digital publishing, and more, have recently emerged alongside an expanded focus on current technologies, such as digital preservation, digital publishing, and more. Researchers learned that interaction with society and culture is related to research activities. Librarianship, open access, and data management have been relegated to a supporting role in the digital environment.

References

Åström, F. (2007). Changes in the LIS Research Front: Time-Sliced Co-citation Analyses of LIS Journal Articles, 1990–2004. *Journal of the American Society for Information Science and Technology*, 58 (7), 647–657. https://doi.org/https://doi.org/10.1002/asi.20567

Baghmohammad, M., Mansouri, A. & Cheashmehsohrabi, M. (2021). Identification of topic the development process of knowledge and information science field based on the topic modelling (LDA).*Iranian Journal of Information Processing and Management*, 36(2), 297- 328. https://doi.org/10.35050/JIPM010.2020.001 [in Persian]

Blei, D. M., Ng, A. Y. & Jordan, M. I. (2003). Latent Dirichlet Allocation. Journal of Machine Learning Research 3, 993-1022, 993-1022. Retrieved from https://www.jmlr.org/papers/volume3/blei03a/blei03a.pdf

Duit, R. & Treagust, D. (2003). Conceptual change: A powerful framework for improving science teaching and learning. *International Journal of Science Education*, 25 (6), 671–688. https://doi.org/http://dx.doi.org/10.1080/09500690305016

Figuerola, C. G., García Marco, F. J. & Pinto, M. (2017). Mapping the evolution of library and information science (1978–2014) using topic modeling on LISA. *Scientometrics*, 112(3), 1507-1535. https://doi.org/10.1007/s11192-017-2432-9

Franceschini, S., Faria, L. G. D. & Jurowetzki, R. (2016). Unveiling scientific communities about sustainability and innovation. A bibliometric journey around sustainable terms. *Journal of Cleaner Production*, 127, 72–83. https://doi.org/10.1016/j.jclepro.2016.03.142

Garg, K. C. & Bebi. (2014). A citation study of Annals of Library and Information Studies (ALIS) and DESIDOC Journal of Library and Information Technology (DJLIT). *Annals of Library and Information Studies*, 61 (3), 212–216. Retrieved from https://nopr.niscpr.res.in/bitstream/123456789/29481/4/ALIS%2061(3)%20212-216.pdf

Ghanadinezhad, F., Osareh, F. & Ghane, M. R. (2022). Forecasting the subject trend of International library and information science research by 2030 using the deep learning approach. *International Journal of Information Science and Management*, 20(1), 471- 492. https://dorl.net/dor/%2020.1001.1.20088302.2022.20.1.26.9

Han, X. (2020). The evolution of research topics in LIS between 1996 and 2019: an analysis based on latent Dirichlet allocation topic model. *Scientometrics*, 125(3), 2561-2595. https://doi.org/10.1007/s11192-020-03721-0

Hou, J., Yang, X. & Chen, C. (2018). Emerging trends and new developments in information science: a document co-citation analysis (2009–2016). *Scientometrics*, 115 (2),869-892. https://doi.org/10.1007/s11192-018-2695-9

Khan, I. (2016). A scientometric analysis of desidoc journal of library and information technology (2010-2014). *Library Hi Tech News*, 33 (7), 8-12. https://doi.org/10.1108/lhtn-03-2016-0014

LaMorte, W. W. (2022). *Diffusion of innovation theory*. Boston University School of Public Health, 4. Retrieved from https://sphweb.bumc.bu.edu/otlt/mph-modules/sb/behavioralchangetheories/BehavioralChangeTheories5.html

Lamba, Manika & Madhusdhuan, Margam. (2018). Application of Topic Mining and Prediction Modeling Tools for Library and Information Science Journals. In Library Practices in Digital Era: Festschrift in Honor of Prof. V Vishwa Mohan. BS Publications. https://doi.org/10.5281/zenodo.1298739

Lamba, M., & Madhusudhan, M. (2019). Mapping of topics in DESIDOC Journal of Library and Information Technology, India: A study. *Scientometrics*, 120 (2), 477-505. https://doi.org/10.1007/s11192-019-03137-5

Liu, L., Tang, L., Dong, W., Yao, S. & Zhou, W. (2016). An overview of topic modeling and its current applications in Bioinformatics. *SpringerPlus*, 5, 1608. https://doi.org/10.1186/s40064-016-3252-8

Lor, P. J. (2009). *International and comparative librarianship*. In Encyclopedia of library and information sciences (pp. 2847-2855). CRC Press. Retrieved from https://peterlor.com/the-book/

Ma, R. (2012). Discovering and analysing the intellectual structure and its evolution of LIS in China, 1998-2007. *Scientometrics*, 93(3), 645-659. https://doi.org/10.1007/s11192-012-0702-0

Mason, L. (2007). Introduction: Bridging the cognitive and socio-cultural approaches in research on conceptual change: Is it feasible? *Educational Psychologist*, 42 (1), 1-7. https://doi.org/10.1080/00461520709336914

Milojević, S., Sugimoto, C. R., Yan, E. & Ding, Y. (2011). The cognitive structure of library and information science: Analysis of article title words. *Journal of the American Society for Information Science and Technology*, 62 (10), 1933–1953. https://doi.org/10.1002/asi.21602

Miyata, Y., Ishita, E., Yang, F., Yamamoto, M., Iwase, A. & Kurata, K. (2020). Knowledge structure transition in Library and information science: topic modeling and visualisation. Scientometrics, 125 (1), 665-687. https://doi.org/10.1007/s11192-020-03657-5

Mokhtarpour, R. & Khasseh, A. A. (2020). Twenty-six years of LIS research focus and hot spots, 1990–2016: A co-word analysis. *Journal of Information Science*, 47(1), 1-15. https://doi.org/10.1177/0165551520932119

Naidu, P. G. (2017). Google Scholar research impact of DESIDOC Journal of Library & Information Technology: Citation Analysis. *International Journal of Library and Information Studies*, 7 (1), 168–175. http://ijlis.org/img/2017_Vol_7_Issue_1/168-175.pdf

Qian, Y., Liu, Y., & Sheng, Q. Z. (2020). Understanding hierarchical structural evolution in a scientific discipline: A case study of artificial intelligence. *Journal of Informetrics*, 14(3), 101047. https://doi.org/10.1016/j.joi.2020.101047

Renjith, V. (2018). Citations of DESIDOC Journal of Library and Information Technology: Statistical Analysis of Google Scholar Based Research Impact for the Period of 2006 to 2015. *Library Philosophy and Practice (e-journal)*.

Singh, A. P.(2017). Development and Changing Paradigm of LIS Education (Guest Editorial). *DESIDOC Journal of Library & Information Technology*, 37(1), pp. 1-2. Retrieved from file:///C:/Users/drghane/Downloads/11037-Article%20Text-30719-1-10-20161228.pdf

Sugimoto, C. R., Li, D., Russell, T. G., Finlay, S. C. & Ding, Y. (2011). The shifting sands of disciplinary development: Analysing North American library and information science dissertations using latent Dirichlet allocation. *Journal of the American Society for Information Science and Technology*, 62 (1), 185–204. https://doi.org/10.1002/asi.21435

Taşkın, Z. (2021). Forecasting the future of Library and information science and its sub-fields. *Scientometrics*, 126**,** 1527–1551. https://doi.org/10.1007/s11192-020-03800-2

Thavamani, K. (2013). Bibliometric analysis of the DESIDOC Journal of Library & Information Technology for the year 2007- 2011. *International Journal of Information Dissemination and Technology*, 3 (1), 38-41.

van Raan, A.F. (2004). Measuring science. In: Moed, H.F., Glänzel, W., Schmoch, U. (eds) *Handbook of Quantitative Science and Technology Research*. Springer, Dordrecht. https://doi.org/10.1007/1-4020-2755-9_2

Verma, M. K., Devi, K. K. & Brahma, K. (2017). Bibliometric study of DESIDOC Journal of Library and information technology during 2005-2016. *International Journal of Information Dissemination and Technology*, 7 (3), 162-169. https://doi.org/10.5958/2249-5576.2017.00017.6

Vygotsky, L. (1986). *Thought and language*. Cambridge, Mass: the MIT Press.

Wang, L., Bruce, C. & Hughes, H. (2011). Socio-cultural theories and their application in information literacy research and education. *Australian Academic and Research Libraries*, 42 (4), 296-308. https://doi.org/10.1080/00048623.2011.10722242

Woltmann, S. L. & Alkærsig, L. (2018). Tracing university-industry knowledge transfer through a text mining approach. *Scientometrics*, 117(1), 449–472. https://doi.org/10.1007/s11192-018-2849-9

Yau, C. K., Porter, A., Newman, N. & Suominen, A. (2014). Clustering scientific documents with topic modeling. *Scientometrics*, 100(3), 767-786. https://doi.org/10.1007/s11192-014-1321-8