



Research on Artificial Intelligence and its Application in Libraries and Librarianship: a Content Analysis

Mallikarjun Dora¹, Lavji N Zala² and Manoj Kumar Sa³

¹Assistant Librarian, Vikram Sarabhai Library, Indian Institute of Management, Ahmedabad, India, email: dora.mallikarjun@gmail.com

²Assistant Professor, Department of Library and Information Science, Sardar Patel University, Vallabh Vidyanagar, Gujarat, India, email: lavji_zala@rediffmail.com

³Indian Maritime University, Kolkata Campus, West Bengal, India, email: manojksa100@gmail.com

Abstract

A total of 115 selected articles indexed in the Web of Science core collection between 2015 to 2024 are analyzed quantitatively and qualitatively to identify the key research theme in Artificial Intelligence (AI) and its application in libraries and librarianship. The study also tries to find out the key journals and countries publishing on the topic. The study shows that the research on Artificial Intelligence (AI) and its application in libraries are divided into three key areas: Ethics, Library Services and Operations and Profession. The highest research is on Library Services and Operations, which constitute 69.56% of articles published in the area; the second was Profession, which has nearly 21% of articles, followed by Ethics, which consists of 9.56% of research articles. The keyword co-occurrence analysis shows AI research concentrates on three major keyword clusters: the artificial intelligence cluster, the ChatGPT/chatbot cluster, and the academic library cluster. The study shows that the impacts of AI on library services and operations continue to be one of the areas of LIS research. There is also concern about the library skill set and cost associated with implementing AI apart from the AI Policy in libraries.

Keywords: Artificial Intelligence, AI Policy in libraries, Library Services, Information Literacy, LIS research, ChatGPT

1. Introduction

Artificial intellect is characterized as "a machine that replicates certain aspects of human intelligence, including perception, learning, reasoning, problem-solving, linguistic interaction, and creative endeavors" (UNESCO, 2024). It is a compilation of technologies that integrate data, algorithms, and computational power (European Commission, 2020: 2). Artificial Intelligence comprises a collection of technologies applicable across several domains (Cox & Majumdar, 2024). The Stanford reports show that there were 2,42,000 research articles published on AI, while more than 62000 patents were filed on

AI(<https://aiindex.stanford.edu/report/>). In the case of the economy, McKinsey predicts that half of the today work activities could be automated between 2030 and 2060 (Chui et al., 2023). The PWC predicts a 26% boost in GDP for local economies from AI by 2030. AI will impact the economy, research, and everything aligned with human society, including health and education (PricewaterhouseCoopers, 2024). Artificial Intelligence (AI) is poised to disrupt industry, and education and libraries are part of it. Libraries are usually early adopters of any technology; this is true in the case of AI, too. Artificial intelligence can play/playing a significant role in improving efficiency by automating tasks, increasing research capability by systematic literature review or digital assistant, and helping in writing are few of them. IFLA(2020), in its AI policy report, mentioned critical areas like optical character recognition, knowledge discovery, and management. Cox & Mazumdar (2024) suggested the areas where library can use AI include Routine administration, Manual tasks, Collection management, Systematic reviewing, Reference queries and other user interactions, User liaison, Information literacy and other user training, strategy, and planning. Much research has also been conducted in areas where AI has or will impact, including library services and operations. There was also research on library professional skills and perception of AI apart from ethical and policy perspectives on AI-based technology implementation in libraries. Given the above, the present study tries to find out what research has been done on AI vis-a-vis library and profession by using the content analysis and keyword co-occurrence analysis method. The paper provides a comprehensive overview of AI research in LIS, specifically in terms of service, operation, profession, and ethical perspectives.

2. Review of Literature

Artificial Intelligence (AI) found its way into the library environment as a task requiring automation, personalization, and enhanced accessibility. The library literature on AI shows how AI plays an important role in different aspects of a library, including librarian skills, perception, copyright, and core library services. The early literature on AI was mostly on librarians perception of AI (Wood and Evans, 2018; Hervieux & Wheatley, 2021; Cox, 2021). Hervieux and Wheatley (2021) found that librarians generally recognize AI's potential to transform library functions but lack clarity on implementation. Cox (2021) makes the argument that librarians need to be more adept at utilizing AI to teach users. There was also concern among librarians on the implementation of AI in libraries; one of the reasons found was job security (Ajani et al., 2022), although there were positive views like improving library services and creating new job opportunities (Lund et al., 2020, Wood & Evans, 2018).

The research on the context of potential areas of library services where AI could impact shows seven areas where academic libraries can use AI applications: everyday web and mobile search in existing library systems, Search interface for knowledge discovery, conversational agents and voice assistant, user management, robotics process automation, and intelligent library (Cox, 2023). A recent study by Huang (2024) identified three important services where AI has already been implemented in Taiwanese libraries: (1) automatic indexing and classification, (2) intelligent data analysis for collection management, and (3) intelligent data for circulation management. Mahmud (2024) listed how artificial intelligence tools revolutionized the cataloging and classification work of the library in the area of

automated metadata generation, subject heading, authority control and automated classification. AI-assisted metadata generation tool enhances cataloging quality and ensures accuracy and uniformity in diverse collections (Chen & Li, 2024). Information literacy instruction is one of the significant areas in which AI will play an important role (Carroll & Borycz, 2024). Chatbot and AI-powered digital assistance services to provide dedicated reference services growing in libraries. Lappalainen & Narayanan (2023) describe implementing a chatbot for the library using the ChatGPT tool. Apart from these, artificial intelligence, as a technology, were found to be useful in backend library work, such as robotic process automation (Lin et al., 2022). AI also plays a role in personalized recommendations, where search results are tailored to individual requirements. AI can play a vital bridge in helping disabled users in accessing information through voice-activated tools with AI-driven transcription services.

Despite the benefit of AI-based tools, there were concerns too. The use of AI in libraries presents challenges such as user security, data privacy, algorithmic bias, and ethical concerns. (Miao, 2019). many studies point out the risk of algorithm bias and emphasize the importance of transparency and the need for libraries to adopt ethical AI in practice (Bradley, 2022; Rajkumar, 2024). Apart from the ethical issue, the cost and library skill set to adopt AI were important in implementing AI in libraries (Cox, 2023; Faga & Yusuf, 2023; Shahzad et al., 2024). AI will continue to evolve, and library professionals need to develop measured responses to its opportunities and challenges, including AI education and the LIS curriculum (Luca et al., 2022)

The literature review shows that several works of literature were published on AI covering different aspects of libraries and the LIS profession. Some studies used bibliometric analysis to find overall AI research trends. The present study attempts to find out the overall research trends by classifying overall AI research to track which specific area of libraries and professions the research was done. The study further explored the research trends by using keyword co-occurrence analysis. The study also investigates the key countries and journals publishing on AI theme.

3. Objectives

The study's primary objective is to investigate the research on AI and its application in the context of library services, operation, profession, and ethics.

- To provide a thorough examination of research conducted in Artificial Intelligence and its applications in libraries and librarianship..
- To identify countries and journals that publish in Artificial Intelligence and its applications.
- To find the most important keyword and cluster in AI research via keyword co-occurrence analysis.

4. Methodology

The study used the Web of Science core collection to find articles. The topic keywords were Artificial Intelligence, AI, and Generative AI in the subject “Information and Library Science” for the last ten years (2015-2024). The search was further refined by item type to only journal articles. The “Information and Library Science” subject category of Web of Science includes many journals with non-LIS focused research; the study excluded those journals too (ex. Telecommunication Policy, Government Information Quarterly). The search brought 424 articles downloaded to a spreadsheet for further analysis. The researcher evaluated these articles individually and removed bibliometric studies, literature reviews, and studies unrelated to libraries and librarianship. After excluding the non-relevant paper, the final sample consisted of 115 articles analysed further according to our research objective.

To classify all the articles, the author devised a classification scheme. The classification scheme consists of three broad areas of AI library research: Ethics, Library Services and Operations and Profession. Each key topic is further divided into subtopics. For the keyword co-occurrence analysis, the study used Vosviewer software, which is quite popular for bibliometric analysis.

5. Analysis and Findings

The importance of research in any discipline is measured by its growth in publication. Figure 1 shows the yearly growth of publications from 2015 to 2024. The data reflects an exponential growth pattern, evident from 2022 onwards. The rapid increase in the last three years highlights a likely boom in research or application of the subject under study. The sharp rise in recent years suggests that the subject has gained significant traction.

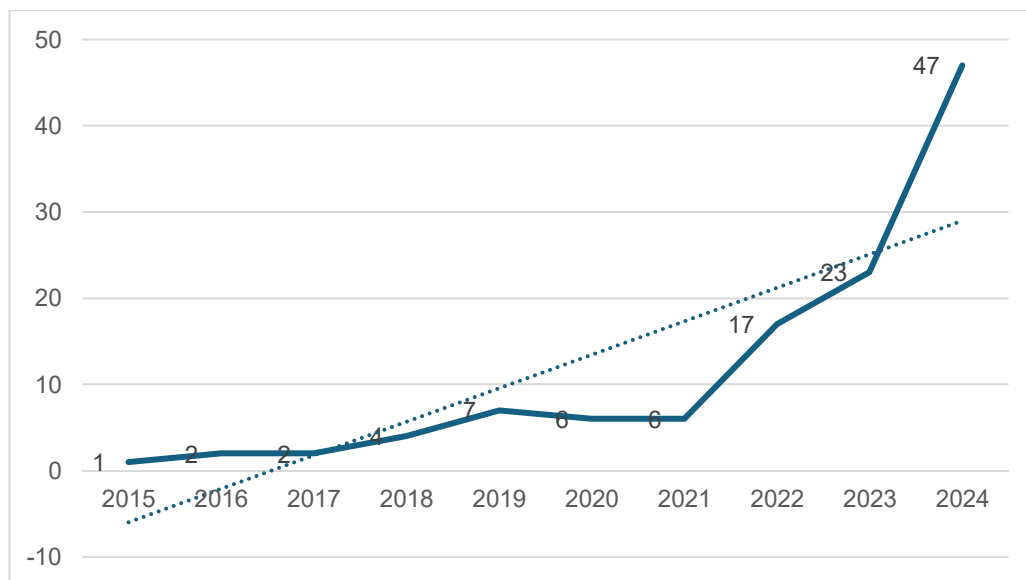


Figure 1: Annual growth of Publication 2015-2024

Journals are vital sources of research publishing. Forty-two journals published 115 articles. Table 1 revealed the top journals that published AI and its application related research in the LIS field. Journal of Academic Librarianship tops the list with a maximum of 16 (13.91%) articles, followed by the South African Journal of Libraries and Information Science and Journal of Web Librarianship with 8 (6.96%) and 7 (6.09%) articles, respectively. Other top journals were the Journal of Library Administration and the Journal of the Australian Library and Information Association.

Table 1: Leading Journals publish AI literatures

Sr. No.	Journal Name	No of Articles	%
1	Journal Of Academic Librarianship	16	13.91
2	South African Journal of Libraries and Information Science	8	6.96
3	Journal of Web Librarianship	7	6.09
4	Journal of Library Administration	6	5.22
5	Journal of the Australian Library and Information Association	6	5.22
6	Library Hi Tech	6	5.22
7	Journal of Librarianship and Information Science	5	4.35
8	College & Research Libraries	4	3.48
9	IFLA Journal-International Federation of Library Associations	4	3.48
10	Information Technology And Libraries	4	3.48
11	Technical Services Quarterly	4	3.48
12	Evidence Based Library and Information Practice	3	2.61
13	Global Knowledge Memory and Communication	3	2.61
14	Information Development	3	2.61
15	Journal Of Business & Finance Librarianship	3	2.61

Table 2 shows the Geographical distribution of articles on AI and its application in LIS. There were 39 countries; the table below represents countries with highest number of publications. Among the top contributing countries, the USA published the highest number of 37 (28.68%) articles, followed by India with 9 (6.98%) and Pakistan with 8 (6.20%) articles respectively. Canada and the UK had seven publications each, and South Africa and China had 6 and 4 publications, respectively.

Table 2: Top Contributing Countries

Sr. No.	Country	No of Publications	%
1	United States of America	37	28.68
2	India	9	6.98

3	Pakistan	8	6.20
4	Canada	7	5.43
5	UK	7	5.43
6	South Africa	6	4.65
7	China	4	3.10
8	Australia	3	2.33
9	Germany	3	2.33
10	South Korea	3	2.33
11	Türkiye	3	2.33

5.1. Content Analysis

Table 3 represents the overall research trends in AI and its application in Library and Information Science. The researcher devised a classification scheme to classify research. The classification scheme was developed by getting insights from the relevant literature especially the paper by Cox and Mazumdar (2024). All the articles were divided into three main topics: Ethics, Library Services, and Operations and Profession. Further, each topic is classified into subtopics. The main topic Ethics has two subtopics: Copyright/Academic Integrity and Policy. The Library Services and Operations has six subtopics: Information Literacy, Library Administration/Strategy, Sustainable Development, Systematic Literature Review, and User Liaison. The Profession topic includes Education, Perception, and Professional Competency/Leadership, which are three subtopics.

Table 3: Key topics of research

Main Topic	Total (%)	Subtopic 1
1. Ethics	11 (9.56%)	-
1.1 Copyright, Academic Integrity	-	6
1.2 Policy	-	5
2. Library Services and Operations	80 (69.56%)	-
2.1 Information Literacy	-	12
2.2 Library Administration/Strategy	-	6
2.3 Library Services for Users	-	54
2.4 Sustainable Development	-	2
2.5 Systematic Literature Review	-	4
2.6 User Liaison	-	2
3. Profession	24 (20.86)	-
3.1 Education	-	2
3.2 Perception	-	16
3.3 Professional Competency/Leadership	-	6
Total	115	115

The content analysis of the articles shows that Library Services and Operations, with 80 (69.56%) of articles, was the popular areas of AI research in LIS, followed by Profession,

with 24 (20.86%), with the second most popular topic, and Ethics with 11 (9.56%) was the least interest topic of research. Among the subtopics, the highest research was done on "Library Services for Users," with 54 (46.95%) articles on the topic, followed by Perception with 16 (13.91%) articles, and the third popular one was Information Literacy with 12 (10.43%) articles. The subtopics like Copyright, Academic Integrity, Professional Competency, Library Administration and Strategy, AI Policy, and Systematic Literature Review also drew researchers' attention. There was very little research on User Liaison, Sustainable Development, and Education.

5.2. Keyword co-occurrence analysis

Keyword co-occurrence analysis studies how often words appear together in a text corpus; in this case, the keywords were from the author-provided keyword and the keyword plus from the Web of Science database. The co-occurrence analysis provides insight into the focus of the specific research and helps the researcher identify the trends in that particular field. The study was done by using Vosviewer software. The keyword co-occurrence analysis brings 32 keywords that came together at least 3 times. The co-occurrence brings five clusters of research with three significant three clusters and two small clusters. The lines between terms represent the frequency of co-occurrence in the literature. Thicker lines indicate stronger connections or more frequent co-occurrence between keywords.

The term "artificial intelligence" appears at the center and was the most significant node, indicating that it's the primary focus of the analysis. Most terms in the network connect to it, suggesting that AI is the focal point of various subtopics within this field.

Red Cluster: Contains terms like "generative AI," "chatbots," "ChatGPT," "natural language processing," and "language models." This cluster seems to focus on the application of AI tools and language technologies. It reflects interest in conversational AI and generative AI tools used for tasks like information retrieval and language processing.

Green Cluster: Includes keywords such as "libraries," "library services," "emerging technologies," "education," and "perceptions." This cluster highlights the role of AI in libraries, focusing on how these technologies are integrated into library services and Education.

Blue Cluster: Contains terms like "services," "technology," "impact," and "efficiency," emphasizing the general benefits AI brings to library operations and its impact on efficiency and service quality.

Yellow Cluster: Includes terms like "academic librarians," "opportunities," "big data," and "robots." This group focuses on the potential future opportunities AI brings to libraries, especially for academic librarians, and how big data and robotics could play a role in library management.

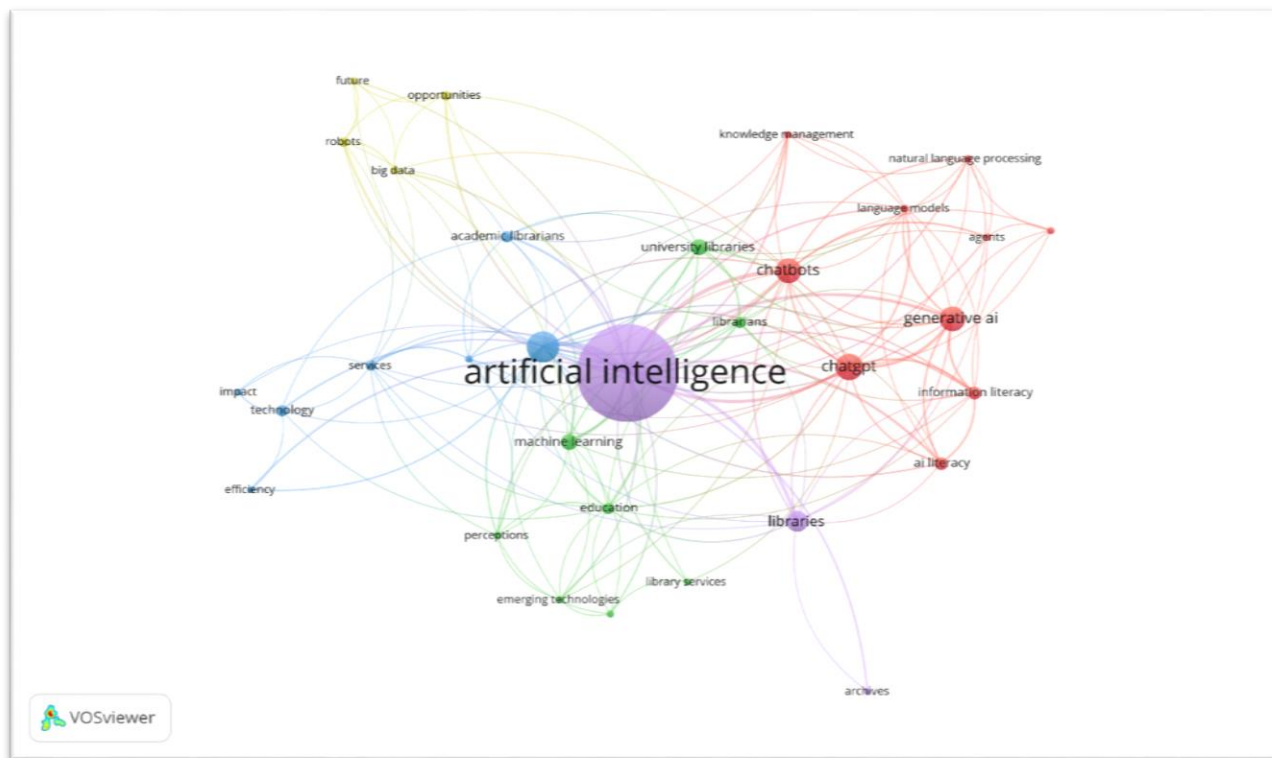


Figure 2: The Keyword co-occurrence analysis

6. Discussion and Conclusion

The study investigates the trends in AI and its application research in libraries and librarianship; apart from the research trend, the paper also examines the growth of AI research, the key LIS journals publishing AI research, and the top countries producing AI research. While there are bibliometric studies done on AI research, they did not explicitly do the content analysis by classifying the articles to identify the AI research topics in Library and Information Science. The present study found that the highest number of research is on Library Services and Operations (69.56%), followed by Profession (20.86%) and Ethics (9.56%). In the Library Services and Operations topics, the popular subtopics for research are Library Services for Users and Information Literacy. The subtopic Library Services for Users and Information Literacy consists of more than 80% of research articles on Library Services and Operations. Many research articles under this subtopic on how AI can benefit library services are cataloging, classification, reference, digital assistance, and collection management. The researcher also gives much interest to the perception of the library professional on the use/role of AI in the library. There is also research on the ethical aspect of AI, which deals with subtopics like integrity, copyright, and policy context. Many countries, associations, and institutions are implementing policies for the right use of AI. The Association of Research Libraries issued a guideline for AI use (<https://www.arl.org/news/association-of-research-libraries-releases-guiding-principles-for-artificial-intelligence/>) with seven fundamental principles. The analysis shows the United States of America, India, Pakistan, Canada, and the UK are the major producers of AI literature in LIS. The Journal of Academic Librarianship published the most significant

number of articles on AI, followed by the South African Journal of Libraries And Information Science, the Journal of Web Librarianship, the Journal of Library Administration, the Journal of the Australian Library and Information Association, and Library Hitech. The research by Hussain & Ahmad (2023) analysis shows countries like the USA, India, Pakistan, UK are the top countries publishing articles on AI.

AI is inevitable and is going to revolutionize library services and operations. While libraries will automate services with AI, IFLA (2020) advises that precautions must be made to prevent adverse effects on service quality and staffing. Policy regarding the ethical use of AI in libraries is crucial for maintaining ethical standards, safeguarding users, avoiding discrimination, encouraging accountability and openness and building trust on both sides. This study provides valuable insight into the research trends with a key focus area in AI in LIS research. The findings will be helpful to researchers, educators, and librarians in their teaching, research, and understanding of the current use of AI in libraries and also give future direction to research on the specific aspect of AI in libraries.

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