

Original Article

Artificial Intelligence Applications in Library and Information Science (LIS): Opportunities, Challenges and Future Directions

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Manuscript ID:

yrj-150306

ISSN: 2277-7911

Impact Factor – 7.025

Volume 15

Issue 3

July-Aug-Sept.- 2026

Pp. 54 - 69

Submitted: 15 July 2026

Revised: 29 July 2026

Accepted: 1 Aug. 2026

Published: 10 Aug. 2026

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Quick Response Code:



Web. <https://yra.ijaar.co.in/>



DOI:
 10.5281/zenodo.23449000

DOI Link:
<https://doi.org/10.5281/zenodo.23449000>



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Abstract:

Artificial Intelligence (AI) is emerging as a transformative technology in Library and Information Science (LIS), influencing the organization, retrieval, management, preservation and dissemination of information. The integration of AI technologies, including machine learning, natural language processing, large language models, computer vision, robotics and generative AI, provides opportunities to improve the efficiency, accessibility and personalization of library services. AI-based applications can support automated cataloguing, metadata generation, intelligent information retrieval, virtual reference services, recommendation systems, digitization, institutional repositories, research assistance and library management. These developments are particularly significant for academic libraries, which increasingly support digital learning, interdisciplinary research and knowledge dissemination. However, AI adoption also presents challenges related to financial resources, technological infrastructure, data privacy, copyright, algorithmic bias, information accuracy, transparency and professional competencies. This paper examines the major applications of AI in LIS, reviews recent developments in the literature, identifies implementation challenges and proposes a strategic framework for responsible AI integration in libraries. The study adopts a narrative literature review approach based on scholarly publications and professional guidance documents. The paper argues that AI should be considered a complementary technology that strengthens librarians' professional expertise rather than a replacement for human judgement. A phased, user-centred and ethically responsible approach can help libraries improve service quality while preserving their fundamental values of equitable access to information, intellectual freedom and privacy.

Keywords: Artificial Intelligence, Library and Information Science, Academic Libraries, Generative AI, Machine Learning etc.

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How to cite this article:

Jagtap B. P. (2026). Artificial Intelligence Applications in Library and Information Science (LIS): Opportunities, Challenges and Future Directions. Young Researcher, 15(3), 54 – 69. <https://doi.org/10.5281/zenodo.23449000>

Introduction:

Libraries have traditionally served as institutions for collecting, organizing, preserving and disseminating information. The development of information and communication technologies has gradually transformed library operations from conventional manual systems to computerized library management systems, online public access catalogues (OPACs), digital libraries, institutional repositories and electronic resource management platforms. The emergence of Artificial Intelligence (AI) represents another important stage in this technological transformation.

Artificial Intelligence refers broadly to computational systems designed to perform tasks associated with human cognitive abilities, such as learning, language processing, pattern recognition, prediction and decision support. In the library environment, AI can help automate repetitive activities, understand user queries, classify information resources and provide personalized information services.

The growing volume of digital information has made efficient information organization and retrieval increasingly important. Traditional keyword-based retrieval systems may fail to identify the actual meaning or context of a user's query. AI-supported systems can improve discovery by interpreting natural language, identifying relationships between concepts and ranking information according to contextual relevance.

Recent research has examined AI adoption across technical services, reference services, circulation, collection development, user education and professional development. A systematic review published in 2025 identified reference and information services as a prominent area of AI adoption in academic libraries, while also highlighting funding and

professional competency development as important concerns. [1]

The International Federation of Library Associations and Institutions (IFLA) has likewise emphasized the need to assess AI in relation to library values, including privacy, openness, accountability, equitable access and freedom of expression. [2]

Against this background, the present paper examines the opportunities and limitations of AI applications in LIS and proposes practical strategies for their responsible implementation.

Statement of the Problem:

Despite increasing digitization, many libraries continue to face challenges such as limited staffing, inadequate infrastructure, repetitive technical work, growing information resources and - increasing user expectations. Conventional systems may not provide sufficiently personalized, conversational or context-sensitive information services.

AI offers potential solutions to these challenges; however, libraries differ considerably in their financial resources, technological readiness, staff competencies and institutional priorities. Unplanned adoption may introduce additional risks involving privacy, unreliable information, copyright infringement and excessive dependence on automated systems.

Consequently, there is a need to understand the applications, benefits, limitations and implementation requirements of AI in the LIS sector.

Significance of the Study:

The study is relevant to academic librarians, library administrators, information professionals, researchers, policymakers and LIS students. It provides a conceptual understanding

of AI technologies and their potential uses in modern libraries. It also offers a framework for institutions seeking to introduce AI-based services while maintaining professional standards and user trust.

Objectives of the Study:

The principal objectives are:

1. To explain the concept and major technologies of Artificial Intelligence relevant to LIS.
2. To examine the applications of AI in library operations and information services.
3. To assess the potential benefits of AI adoption in academic and digital libraries.
4. To identify the technological, financial, ethical and professional challenges associated with AI.
5. To suggest strategies for the responsible implementation of AI in libraries.
6. To identify future research directions in AI-enabled library and information services.

Research Questions:

The study addresses the following questions:

1. What are the major applications of AI in Library and Information Science?
2. How can AI improve the efficiency and effectiveness of library services?
3. What barriers restrict AI adoption in academic and other institutional libraries?
4. How can libraries ensure ethical, transparent and responsible use of AI?
5. What competencies and infrastructure are required for future AI-enabled libraries?

Review of Literature:

Research on AI in libraries has expanded alongside developments in machine learning, natural language processing and generative AI.

The literature indicates a gradual shift from isolated automation tasks towards integrated systems supporting information discovery, user assistance and research activities.

1. AI and Library Services: The IFLA Statement on Libraries and Artificial Intelligence discusses the potential of AI to improve text recognition, categorization, discovery and knowledge management. It also emphasizes that AI implementation should be guided by ethical standards and should not undermine user privacy or equitable access to information. [2]

Cox's work on developing a strategic response to AI identifies applications such as automated metadata creation, enhanced search services, translation, summarization and support for research data management. It also highlights the difficulty of converting experimental AI projects into sustainable library services. [3]

These perspectives indicate that AI adoption involves organizational planning and professional judgement in addition to technology acquisition.

2. Recent Systematic Reviews: Wang, Cudjoe and Xie examined AI applications and challenges in LIS through a systematic review of research published between 2000 and 2024. Their work provides a broad perspective on the relationship between AI technologies and major areas of library and information practice. [4]

A 2025 systematic review by Islam and colleagues analyzed 354 Scopus-indexed publications concerning AI in academic libraries published between 2010 and 2023. The study identified increasing scholarly interest in AI integration, data mining and personalized information services. [5]

Another systematic review, published in 2025, examined 29 studies concerning AI adoption in academic libraries. It organized applications into areas including technical

services, reference and information services, administration, circulation, collection development, information literacy and professional development. The authors also highlighted the importance of funding, staff training and further user-centred research. [1]

Tai and Ghosh discussed AI integration in library systems, identifying recommendation systems, information retrieval and optical character recognition as important areas for further development. [6]

3. Generative AI and LIS: Generative AI has introduced new possibilities for conversational reference assistance, summarization, translation, research support and the preparation of educational materials. However, generated responses may contain factual errors, fabricated citations or misleading interpretations.

UNESCO's guidance on generative AI in education and research advocates a human-centred approach that emphasizes data privacy, appropriate validation and institutional preparedness. These principles are relevant to libraries supporting students, faculty and researchers. [7]

4. Research Gap: Existing literature demonstrates growing interest in AI applications, but important questions remain concerning long-term service quality, implementation costs, user acceptance, regional differences and measurable institutional outcomes.

Further research is required on AI adoption in resource-constrained academic libraries, particularly in developing countries. Comparative studies examining traditional and AI-supported workflows, user satisfaction, information accuracy and return on investment would strengthen the evidence base for implementation decisions.

Research Methodology:

1. Research Design: The paper adopts a narrative literature review approach. It synthesizes scholarly literature, professional publications and institutional guidance concerning AI applications in LIS.

2. Sources of Information: The conceptual discussion draws on published research and professional resources available through sources such as:

- Scopus and Web of Science-indexed literature.
- Library and Information Science Abstracts (LISA).
- *The Journal of Academic Librarianship*.
- The International Federation of Library Associations and Institutions (IFLA).
- UNESCO publications concerning AI in education and research.

3. Search Concepts: Relevant literature can be identified using combinations of the following terms: "Artificial Intelligence in Libraries," "AI Applications in LIS," "Generative AI and Academic Libraries," "Machine Learning in Information Retrieval," "AI-Based Library Services," "Library Chatbots," and "Ethical AI in Libraries."

4. Method of Analysis: The selected literature is organized thematically under AI technologies, library applications, benefits, implementation challenges, ethical considerations and future directions.

5. Scope and Limitations: The study focuses on conceptual and practical applications of AI in academic, public, special and digital libraries. It does not report original survey data, experimental findings or a statistically exhaustive systematic review. The discussion should therefore be interpreted as a literature-based synthesis rather than a quantitative evaluation of AI effectiveness.

Major Artificial Intelligence Technologies in LIS:

1. Machine Learning: Machine learning enables computer systems to identify patterns in data and improve task performance through training. Libraries can use machine learning to support document classification, recommendation systems, usage forecasting, collection analysis and automated identification of duplicate records.

For example, a recommendation system can analyze a user's selected subject areas and the relationships among catalogue records to suggest additional resources. Such systems should be designed to avoid reinforcing narrow reading preferences or excluding less frequently used materials.

2. Natural Language Processing: Natural Language Processing (NLP) enables computational systems to process and interpret human language. It supports conversational interfaces, query expansion, text classification, sentiment analysis, entity recognition and automatic summarization.

In libraries, NLP can help users search for information using ordinary language rather than exact catalogue terminology. A student asking, "Find recent research on biological control of crop pests," could be directed towards relevant books, articles, theses and institutional publications.

3. Generative Artificial Intelligence and Large Language Models: Generative AI systems produce text and other content in response to instructions. Large Language Models (LLMs) can support reference queries, document summarization, translation, research brainstorming and the preparation of user guides.

Libraries may use these tools to explain database search procedures, simplify technical

instructions and generate preliminary descriptions of information resources. However, generated answers must be checked against reliable sources because language fluency does not guarantee factual accuracy.

4. Computer Vision and Optical Character Recognition: Computer vision enables systems to interpret visual information, while Optical Character Recognition (OCR) converts printed or scanned text into machine-readable content.

These technologies are valuable for digitizing historical documents, manuscripts, newspapers, institutional reports and archival records. AI-enhanced OCR may improve recognition of degraded text, unusual fonts and complex layouts, although regional scripts and poor-quality scans may still require substantial human correction.

5. Expert Systems and Decision Support: Expert systems apply defined rules and domain knowledge to provide recommendations or support decisions. In libraries, such systems may help users identify appropriate databases, determine borrowing procedures or select search strategies.

Decision-support applications can also assist administrators with collection evaluation, resource allocation and service planning. Their recommendations should remain advisory and subject to professional review.

6. Robotics and Intelligent Automation: Robotics and intelligent automation can support material transportation, shelf scanning, inventory verification and selected repetitive operational tasks. Such applications are more feasible in institutions with suitable infrastructure, sufficient collections and adequate financial resources.

For smaller libraries, simpler automation and AI-assisted software may provide greater value than expensive robotic systems.

Applications of AI in Library and Information Science:

1. Automated Cataloguing and Metadata Generation: Cataloguing is a central technical service involving bibliographic description, subject analysis, classification and authority control. AI can assist librarians by extracting titles, authors, publication details, abstracts, keywords and other descriptive information from digital documents.

AI-supported systems may suggest subject headings, identify document types and generate preliminary metadata records. Machine learning can also help detect duplicate records and inconsistencies in bibliographic databases.

For example, an AI system processing a digitized research article may identify its title, author names, abstract, publication year and major subject terms. A librarian can verify these details before importing them into the Library Management System (LMS).

Benefits include:

- Reduced repetitive data-entry work.
- Faster processing of digital documents.
- Improved consistency in descriptive metadata.
- Assistance with retrospective cataloguing projects.

Nevertheless, automated metadata must be checked for errors, especially in author names, publication dates, multilingual records and subject classification. AI-generated descriptions should comply with the library's adopted cataloguing standards and metadata policies.

2. Intelligent Information Retrieval and Discovery: Traditional information retrieval often relies on exact keywords and predefined indexing. AI-supported discovery systems can incorporate semantic relationships, natural-language understanding and contextual ranking.

A user searching for “climate-resilient agriculture” may also be interested in materials indexed under drought tolerance, sustainable farming, water management or crop adaptation. Semantic retrieval can help identify these related resources.

AI can support:

- Natural-language searching.
- Query expansion and spelling correction.
- Semantic matching of concepts.
- Relevance ranking and recommendation.
- Discovery across multiple digital collections.

Libraries should retain access to conventional search options because users may need precise field-based searches, controlled vocabulary searches or reproducible scholarly search strategies.

3. AI-Powered Chatbots and Virtual Reference Services: Virtual reference services help users obtain information about library resources, databases, opening hours, borrowing rules and research procedures. AI-powered chatbots can respond to common questions at any time, reducing delays in routine assistance.

A chatbot integrated with a library website might answer questions such as:

- How can I access electronic journals?
- How do I renew a borrowed book?
- Which databases cover agricultural sciences?
- How can I locate a thesis in the institutional repository?
- What are the procedures for obtaining a no-dues certificate?

A reliable system should use verified institutional information and direct users to authoritative resources. Complex research queries, complaints, sensitive issues and questions requiring professional judgement should be referred to library staff.

4. Personalized Recommendation Systems:

Recommendation systems suggest books, journal articles, databases and other resources according to users' interests or the relationships among resources.

In academic libraries, recommendations may be based on subject categories, course reading lists, publication metadata and related citations. For example, a student consulting a textbook on agricultural entomology could receive suggestions for related journals, reference works and research publications.

Personalization should not become intrusive surveillance. Libraries should minimize collection of identifiable user data, provide meaningful privacy choices and ensure that recommendation systems do not systematically disadvantage less popular subjects or authors.

5. Digital Libraries and Institutional Repositories: Digital libraries and institutional repositories preserve and provide access to scholarly publications, theses, dissertations, reports, teaching materials and other institutional outputs.

AI can strengthen these systems through automatic document classification, keyword extraction, semantic search, duplicate detection and metadata enrichment. NLP can help users identify documents relevant to a research question without requiring them to know the exact title.

AI-assisted repository development may also support the identification of missing metadata and the categorization of documents into subject collections.

For academic institutions, these applications can improve the discoverability of institutional research and make scholarly outputs more accessible to students, faculty and external researchers.

6. Digitization and Preservation of Library Resources:

Digitization is important for preserving rare books, manuscripts, institutional records and other documentary heritage. AI-based image enhancement, OCR, layout detection and handwriting recognition can help convert physical documents into searchable digital resources.

For instance, scanned annual reports may be processed to extract tables, headings and paragraphs. Searchable text enables users to locate specific information without reading the entire document.

AI can also assist in identifying damaged pages, duplicate images and inconsistencies in digitized collections. However, digital preservation requires more than automated text recognition: libraries must maintain reliable storage, backups, file integrity checks, metadata and sustainable preservation formats.

7. Research Support and Scholarly Communication:

Academic libraries increasingly support researchers throughout the research lifecycle. Generative AI and other intelligent tools can assist with preliminary literature exploration, topic refinement, terminology identification, citation discovery and summarization.

Potential applications include:

- Generating preliminary search terms and synonyms.
- Identifying relevant subject databases.
- Summarizing documents for initial screening.
- Supporting reference management workflows.
- Explaining research data management procedures.
- Assisting with research impact and scholarly communication queries.

AI-generated references must be verified against original publications and trusted bibliographic databases. Researchers should read the original sources before citing their findings, and any use of AI should comply with institutional and publisher policies.

8. Information Literacy and User Education:

Information literacy enables users to identify information needs, locate relevant resources, evaluate evidence and use information ethically. AI creates both new learning opportunities and additional information-literacy requirements.

Libraries can organize training programmes on prompt formulation, source verification, responsible use of generative AI, privacy protection, copyright and the identification of misleading content.

Interactive AI tools may provide demonstrations of database searching and explain the differences between scholarly publications, popular articles and unverified online material.

The librarian's role is especially important in teaching users that AI-generated responses are not automatically authoritative. Users should be encouraged to verify claims through scholarly databases, official documents and original research.

9. Collection Development and Management:

AI can support collection development by analyzing circulation patterns, subject demand, bibliographic data, publication trends and electronic resource usage.

Such analysis may help librarians identify underrepresented subject areas, evaluate resource utilization and plan future acquisitions. Predictive analytics can provide additional evidence for budget allocation and collection review.

However, low usage does not necessarily mean that a resource lacks value. Rare reference

works, archival materials, accessibility resources and specialized research publications may be essential despite limited circulation. Decisions should therefore combine AI-generated analysis with professional expertise and institutional objectives.

10. Circulation and Inventory Management:

AI-assisted systems can support borrowing forecasts, overdue-resource reminders, duplicate detection, inventory planning and identification of unusual circulation patterns.

When combined with barcode or RFID systems, intelligent analytics may help identify discrepancies between catalogue records and physical holdings. Some inventory tasks can be partially automated, although physical verification remains important.

Libraries must also ensure that circulation analytics do not expose individual reading histories or become a basis for unjustified monitoring of users.

11. Translation and Multilingual Access:

Multilingual information access is especially important in institutions serving users with different language backgrounds. AI translation can help translate abstracts, user guides, research summaries and general library instructions.

Speech recognition and text-to-speech systems may further improve access for users with disabilities or those who prefer audio-based assistance.

In India, AI-supported translation may facilitate access to English-language academic resources for users who prefer Marathi, Hindi or other Indian languages. However, technical terminology, regional expressions and subject-specific meanings require careful validation.

12. Accessibility and Inclusive Library Services:

AI can improve access to information through speech-to-text, text-to-speech, image

description, document simplification and assistance with screen-reader-compatible content.

These capabilities may benefit users with visual, hearing, learning or mobility-related accessibility needs.

Libraries should assess AI tools with actual users and accessibility specialists rather than assuming that automation automatically produces inclusive services. Human assistance and alternative access methods should remain available.

13. Library Administration and Decision-Making: AI-supported analytics can assist administrators in understanding service demand, planning staffing requirements, monitoring system performance and identifying areas for improvement.

Dashboards may combine anonymized usage statistics, service requests and resource availability to support operational planning.

Administrative decisions should remain transparent and accountable. AI outputs must not be treated as unquestionable evidence, particularly when decisions affect staff, budgets, access rights or institutional priorities.

Benefits of AI Adoption in Libraries:

1. Operational Efficiency: AI can reduce repetitive work associated with metadata preparation, routine enquiries, document processing and selected administrative activities. This may allow librarians to devote more time to research assistance, information literacy and specialized user support.

2. Improved Access to Information: Natural-language processing, semantic retrieval and multilingual interfaces can make library collections easier to explore. These capabilities may be particularly useful for users who are unfamiliar with technical search terminology.

3. Enhanced User Experience: Conversational interfaces and recommendation tools can provide more convenient access to library resources. When properly designed, they can reduce the time required to identify relevant materials and understand library procedures.

4. Support for Research and Innovation: AI can help researchers explore large collections, identify related concepts and organize preliminary information. Libraries can strengthen their role as research partners by providing guidance on responsible AI use, research data management and scholarly communication.

5. Better Use of Institutional Resources: Data analysis may help libraries understand patterns of resource use, identify service gaps and plan acquisitions. These insights can support more informed decisions, especially when budgets are limited.

6. Improved Inclusion: Translation, speech technologies and accessibility tools can help broaden participation in library services. However, these benefits depend on language quality, accessibility testing and the availability of suitable infrastructure.

Challenges and Limitations of AI in LIS:

1. Financial Constraints: AI implementation may require software subscriptions, computing infrastructure, data storage, integration services, technical support and staff training. These costs can be difficult for small academic and public libraries to absorb.

Institutions should therefore evaluate total ownership costs and expected benefits before adopting a tool.

2. Inadequate Technological Infrastructure: Reliable internet connectivity, digitized collections, interoperable systems and adequate hardware are prerequisites for many AI

applications. Libraries with incomplete catalogue records or limited digital collections may need to strengthen these foundations first.

3. Data Privacy and Confidentiality: Libraries handle potentially sensitive information, including reading histories, reference queries, borrowing records and research interests. Sending such information to external AI platforms may expose users to unnecessary privacy risks.

Institutions should establish rules governing data collection, retention, access, deletion and third-party processing. Personal or confidential information should not be entered into public AI tools without appropriate authorization and safeguards.

4. Copyright and Intellectual Property: AI systems may process copyrighted publications or produce outputs that resemble protected material. Digitization, text and data processing, model training and content generation can raise legal questions that differ across jurisdictions and licensing arrangements.

Libraries should review applicable copyright law, license terms, institutional policies and rights-holder permissions before using protected resources in AI workflows.

5. Accuracy and Hallucinations: Generative AI may produce plausible but incorrect statements, fabricated citations, inaccurate summaries and incomplete answers. Such errors can mislead students and researchers.

AI-generated information should therefore be checked against original documents, authoritative databases and verified institutional sources. High-stakes decisions and formal research outputs require particularly careful validation.

6. Algorithmic Bias: AI systems may reflect biases present in training data, metadata or system design. As a result, some languages,

communities, authors and subject areas may be poorly represented.

Libraries should evaluate search quality and recommendation outcomes across different user groups, languages and disciplines. Alternative discovery methods should be available when AI-based systems fail.

7. Staff Training and Professional Readiness: Librarians may require additional competencies in AI literacy, data protection, prompt design, metadata evaluation, information verification and technology assessment.

Training should be continuous and practical. It should not be limited to learning how to use particular software, but should also address its limitations and ethical implications.

8. Dependence on External Vendors: Commercial AI services may change their pricing, discontinue features or restrict access to data and functionality. Libraries may also face difficulties transferring data between systems.

Institutions should consider interoperability, export options, vendor transparency, service continuity and the long-term preservation of institutional records.

9. Employment and Professional Identity: Automation may change the distribution of tasks within libraries. Some routine activities may require less manual intervention, while new responsibilities emerge in digital scholarship, AI literacy, data governance and system evaluation.

The appropriate response is to strengthen professional competencies and redesign workflows rather than assume that all library tasks can or should be automated.

10. Environmental Sustainability: AI services may consume substantial computing and energy resources, depending on the scale and design of the system. Libraries should consider the environmental costs of large-scale AI

applications and prefer proportionate, sustainable solutions where possible.

Ethical and Responsible Use of AI in Libraries:

Responsible AI implementation should be grounded in established library values and institutional accountability.

1. Transparency: Users should be informed when they are interacting with an AI system rather than a human librarian. Institutions should explain the purpose of the system, its major limitations and how users can obtain human assistance.

2. Privacy Protection: Libraries should follow data-minimization principles and avoid collecting unnecessary personal information. Where possible, systems should use anonymized data and clearly defined retention periods.

3. Human Oversight: AI should assist rather than replace professional judgement in complex reference work, collection decisions, copyright matters and institutional administration. Staff should have the authority and capability to correct automated outputs.

4. Fairness and Inclusion: AI services should be evaluated for accessibility, linguistic coverage and differential performance across user groups. Libraries should avoid adopting systems that systematically restrict access to information for particular communities.

5. Accountability: Institutions should assign responsibility for approving AI tools, reviewing their outputs, responding to errors and investigating complaints. Vendors' claims should not substitute for independent evaluation.

6. Academic Integrity: Libraries should educate users about plagiarism, fabricated citations, disclosure of AI assistance and the verification of research evidence. AI use should follow the applicable policies of the institution, journal or funding agency.

These principles are consistent with the human-centred approach advocated in UNESCO's guidance and the professional considerations outlined by IFLA. [2, 7]

Proposed Framework for Implementing AI in Academic Libraries:

A phased implementation strategy can help institutions adopt AI without making unnecessary investments or compromising service quality.

Phase I: Needs Assessment: The library should identify specific problems that AI might address. Possible priorities include frequently asked questions, metadata correction, digitization, multilingual assistance or improved discovery of institutional publications.

A baseline assessment should document existing workflows, staff time, service quality and user needs.

Phase II: Infrastructure and Readiness Assessment: Before selecting a tool, the institution should evaluate:

- Availability and quality of digitized data.
- Existing Library Management System and repository capabilities.
- Internet connectivity and hardware.
- Financial resources and recurring costs.
- Staff competencies and training requirements.
- Privacy, security, copyright and accessibility risks.

Phase III: Tool Selection: Tools should be evaluated against clearly defined criteria, including accuracy, usability, cost, interoperability, data protection, accessibility and vendor transparency.

Preference should be given to solutions that integrate with existing systems and allow the institution to retain control over its records.

Phase IV: Pilot Implementation: A limited pilot should be conducted before institution-wide deployment. For example, a library may introduce an AI-assisted FAQ service or test metadata extraction on a small collection of digitized documents.

The pilot should have defined success criteria, a named responsible officer and a procedure for reporting errors.

Phase V: Evaluation: The system should be evaluated using appropriate indicators, such as:

- Accuracy of generated metadata.
- Relevance of search results.
- Resolution rate of routine enquiries.
- Time required to complete selected tasks.
- User satisfaction and accessibility.
- Total implementation and maintenance cost.
- Frequency and severity of privacy or accuracy incidents.

Results should be compared with the baseline wherever reliable measurements are available.

Phase VI: Staff Development and User Education

Library staff should receive training in AI literacy, data governance, verification and tool evaluation. Users should receive clear guidance on how to interpret AI-generated information and when to seek human assistance.

Phase VII: Institutional Policy and Continuous Improvement

The library should develop an AI-use policy covering approved tools, data handling, human oversight, output verification, copyright, incident reporting and periodic review.

Systems should be updated, modified or discontinued when evidence indicates that they are inaccurate, unsafe, ineffective or financially unsustainable.

Practical Implementation in Indian Academic Libraries:

Indian academic libraries operate in diverse institutional settings, including universities, government colleges, professional institutions and research organizations. Their priorities and capacities differ according to funding, infrastructure, language requirements and user populations.

For government and agricultural colleges, an incremental approach may be particularly appropriate.

1. AI-Enabled Library Websites: Libraries can develop structured FAQ pages and searchable guidance covering library membership, borrowing rules, access to electronic resources, reference services and institutional publications. An AI interface can be added after the underlying information has been verified and organized.

2. Institutional Repository Enhancement: Academic libraries can use AI-assisted metadata extraction and classification to improve the discoverability of research articles, theses, dissertations, extension publications, technical reports and educational materials.

Repository records should retain appropriate bibliographic details and rights information.

3. Agricultural Information Services: Libraries serving agricultural universities and colleges may use AI-assisted search to help students and researchers discover literature on crop science, agricultural entomology, plant pathology, soil science, horticulture and agricultural extension.

For example, a student researching biological control of insect pests could use a conversational search interface to identify relevant keywords, locate subject databases and retrieve verified publications.

AI-generated summaries should be treated as preliminary guides. Scientific

recommendations concerning pesticides, crop protection or other technical matters must be checked against reliable research and official guidance.

4. Multilingual User Support: Marathi-, Hindi- and English-language guidance can help users understand library procedures and locate relevant resources. AI translation may reduce the time required to prepare multilingual instructions, but technical terminology should be reviewed by knowledgeable staff.

5. Affordable and Sustainable Adoption: Libraries with limited budgets can begin with existing software features, open-source tools, small-scale digitization projects and staff training. They should assess licensing terms, security and maintenance requirements before adopting open-source or commercial systems.

A library should not invest in an expensive AI platform merely because the technology is new. Adoption should be based on demonstrated institutional needs and measurable service improvements.

Future Directions of AI in Library and Information Science:

1. Conversational and Semantic Discovery: Future discovery systems may combine natural-language interfaces with catalogue records, scholarly databases and institutional repositories. This could enable users to ask complex research questions and navigate related publications more effectively.

The reliability of such services will depend on transparent source attribution, access controls and accurate retrieval.

2. Retrieval-Augmented Generation: Retrieval-Augmented Generation (RAG) combines a language model with an information retrieval process that supplies relevant documents to the model before it generates an answer.

In libraries, a carefully designed RAG system could answer questions using approved catalogue records, institutional regulations or selected full-text collections. It may improve traceability when responses include links to the supporting documents.

However, RAG does not eliminate errors. Retrieved sources must be authoritative, current and relevant, and generated answers still require evaluation.

3. AI-Enhanced Research Data Services: Libraries may increasingly support research data discovery, metadata management, data documentation, preservation planning and responsible reuse. Librarians with data-management expertise can contribute to institutional AI governance and research integrity.

4. Intelligent Digital Preservation: AI may support the identification of duplicate files, damaged digital objects, missing metadata and preservation risks. Further research is needed to establish reliable workflows that combine automated detection with established digital preservation practices.

5. AI Literacy as a Core Library Service: AI literacy is likely to become an important component of information literacy programmes. Libraries can help users understand how AI systems produce answers, why outputs may be biased or inaccurate, and how to evaluate generated content.

6. Evidence-Based Evaluation: Future studies should move beyond descriptions of possible applications and evaluate actual outcomes. Research designs may include controlled experiments, user studies, longitudinal assessments, cost-benefit analysis and comparative evaluations of traditional and AI-supported services.

Research should also examine the experiences of smaller institutions, multilingual communities and libraries operating with limited financial and technical resources.

Major Findings and Discussion:

The literature reviewed for this paper indicates that AI has applications across multiple dimensions of LIS, including technical processing, information retrieval, reference services, digital preservation, research support and administration.

Three broad conclusions emerge.

First, the practical value of AI depends on the task. Automated metadata suggestions may be useful for large digitization projects, while a conversational interface may be more appropriate for routine reference queries. Not every library activity requires an AI-based solution.

Second, institutional readiness is as important as technical capability. Funding, data quality, staff training, interoperability and privacy governance influence whether AI tools can be introduced successfully and maintained over time. Recent reviews of academic libraries similarly identify funding and professional development as important adoption concerns. [1, 5]

Third, AI should be evaluated according to library service outcomes rather than novelty. An application is valuable when it demonstrably improves access, accuracy, accessibility or operational efficiency without introducing disproportionate risks.

The discussion also highlights the continuing importance of librarians' professional judgement. AI can generate metadata, suggest search terms and summarize documents, but librarians remain responsible for interpreting

user needs, evaluating sources, protecting confidentiality and maintaining equitable access.

Because the present study is based on existing literature rather than primary data, these conclusions represent a thematic synthesis. They should not be interpreted as proof that all AI tools improve library performance or that the same implementation model will be suitable for every institution.

Recommendations:

Based on the review, the following recommendations are proposed:

1. **Develop an institutional AI policy:** Define permitted uses, privacy safeguards, copyright responsibilities, verification procedures and accountability arrangements.
2. **Begin with clearly defined needs:** Select applications that address documented service problems rather than adopting AI solely for technological advancement.
3. **Strengthen digital infrastructure:** Improve catalogue quality, metadata standards, digitization workflows, repository accessibility and system interoperability.
4. **Invest in professional development:** Organize practical training in AI literacy, prompt design, information verification, privacy and data management.
5. **Preserve human oversight:** Require librarian review for significant decisions and provide users with access to human assistance.
6. **Protect user confidentiality:** Minimize personal data collection and carefully evaluate third-party AI services before sharing institutional or user information.
7. **Evaluate performance regularly:** Monitor accuracy, relevance, accessibility,

user satisfaction, cost and the frequency of errors.

8. **Promote inclusive services:** Test tools across languages, subject areas and accessibility requirements, particularly where users have different levels of digital literacy.
9. **Encourage institutional collaboration:** Libraries, universities, professional associations and technology providers should share training resources, implementation experiences and evaluation methods.
10. **Promote further empirical research:** Conduct studies measuring the actual impact of AI on service quality, staff workloads, user satisfaction and institutional expenditure.

Conclusion:

Artificial Intelligence is creating significant opportunities for the transformation of Library and Information Science. Its applications in automated cataloguing, metadata generation, semantic information retrieval, virtual reference services, digital preservation, research support, collection management and user education can help libraries respond to the growing complexity of information environments.

Nevertheless, the benefits of AI are not automatic. Financial limitations, inadequate infrastructure, data privacy concerns, copyright questions, algorithmic bias, inaccurate outputs and insufficient staff training may restrict its effective implementation. Libraries must therefore adopt AI through careful planning, transparent governance and continuous evaluation.

The most appropriate approach is to position AI as a supportive technology within a

professionally managed information environment. Librarians should retain responsibility for source evaluation, ethical decision-making, user confidentiality and equitable access. AI systems should be introduced only when their benefits can be demonstrated and their risks appropriately managed.

For academic libraries in India, including institutions with limited resources, a phased approach beginning with user assistance, digital repository enhancement, metadata support and information-literacy training may offer a practical starting point. Collaboration, staff development and evidence-based evaluation will be essential to long-term success.

Ultimately, the future of AI in LIS will depend not simply on the sophistication of technological tools, but on the ability of libraries to use them responsibly in support of education, research, lifelong learning and the public's right to reliable information.

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