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Artificial Intelligence and the Future of Library Services: A Critical Review of Opportunities and Ethical Challenges

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Abstract

Artificial intelligence (AI) is reshaping library and information services across academic, public, and special library settings. Drawing on studies of reference chatbots, automated cataloging and metadata generation, information literacy instruction, and professional ethics, the review identifies four recurring themes: AI-enabled discovery and virtual reference services, AI-assisted cataloging and collection management, AI's role in reshaping information literacy pedagogy, and the ethical, privacy, and workforce concerns associated with AI adoption. The review finds that although AI offers measurable efficiency gains and expanded access to information, unresolved questions about algorithmic bias, data privacy, transparency, and professional deskilling persist across the literature. The paper concludes that libraries must adopt AI deliberately and ethically, guided by enduring professional values of intellectual freedom, privacy, and equitable access, and it outlines directions for future research, including longitudinal studies of AI's impact on library labor, user trust, and information equity.

Keywords: artificial intelligence, academic libraries, library services, chatbots, information literacy, library ethics, generative AI

Introduction

Libraries in a Changing Information Landscape

Libraries have historically functioned as custodians of recorded knowledge and as intermediaries between users and information resources. Over the past two decades, however, the proliferation of digital content, the rise of networked information environments, and shifting user expectations have compelled libraries to reconsider their traditional service models. Users increasingly expect instant, personalized, and conversational access to information, a pattern that mirrors broader trends in e-commerce and digital platforms. Within this environment, artificial intelligence has emerged as one of the most consequential technological forces influencing how libraries acquire, organize, and deliver information. As Witt (2021) observed, libraries worldwide have entered a period in which digital transformation and emerging technologies are reshaping professional practice, institutional priorities, and the expectations placed upon library staff.



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This transformation is not confined to any single type of library. Academic libraries have been at the forefront of experimentation with AI because of their close proximity to research communities and computing infrastructure, but public and special libraries are increasingly following suit as vendors embed AI features directly into integrated library systems, discovery layers, and digital repository platforms. The result is that even libraries with limited technical capacity are encountering AI indirectly, through the commercial products they license, rather than through deliberate, in-house adoption decisions. This dynamic raises important questions about who controls the design and governance of AI systems used in libraries and whether library values are adequately represented in the procurement process (IFLA, 2020).

The Emergence of Artificial Intelligence as a Transformative Technology

Artificial intelligence, broadly defined as computational systems capable of performing tasks that typically require human cognition, has advanced rapidly since the mid-2010s through developments in machine learning, natural language processing, and deep neural networks. Frey and Osborne (2017) demonstrated early on that a substantial proportion of occupational tasks, including many information-intensive tasks performed by professionals, were susceptible to automation, a finding that has since informed debates about AI's implications for knowledge-work professions such as librarianship. The release of large language models and generative AI systems, most notably ChatGPT in late 2022, accelerated public and institutional engagement with AI far beyond earlier expert systems and rule-based chatbots (Rudolph et al., 2023). These developments have prompted libraries to examine both the opportunities AI presents for enhancing service delivery and the risks it poses to professional norms and user rights.

It is useful to distinguish between two broad categories of AI relevant to library practice. The first, sometimes termed analytical or predictive AI, encompasses machine learning systems trained to classify, cluster, or predict outcomes from structured or semi-structured data, such as automated subject classification or circulation forecasting. The second, generative AI, encompasses systems capable of producing novel text, images, or other content in response to natural language prompts. While both categories have been present in library discourse for some time, the literature reviewed in this paper indicates that generative AI has attracted disproportionately intense attention since 2022 because of its direct visibility to end users and its capacity to simulate human-like conversation, a feature with immediate implications for reference and instructional services (Rudolph et al., 2023).

AI Applications Across the Library Sector

AI technologies have been piloted and implemented across nearly every functional area of library operations. In public-facing services, AI-powered chatbots and virtual assistants now support reference inquiries, resource discovery, and after-hours user support (Nawaz & Saldeen, 2020; Sahu, 2021). In technical services, machine learning and natural language processing tools



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assist with metadata generation, automated subject classification, and large-scale digitization workflows (Khan et al., 2023; Kumar & Ramesh, 2020). In instructional contexts, librarians have begun incorporating generative AI into information literacy teaching, both as a subject of critical evaluation and as a tool for demonstrating source verification and academic integrity (Cox & Tzoc, 2023; Perkins, 2023). Collectively, these applications illustrate that AI is not a single, isolated intervention but a diffuse set of technologies embedded across the library's core functions.

Beyond these three areas, emerging applications include AI-assisted collection development, in which predictive analytics inform acquisition decisions based on anticipated demand, and AI-supported accessibility services, in which automated transcription, translation, and image description tools expand access for patrons with disabilities. Administrative functions such as space usage analytics and resource allocation are also beginning to incorporate machine learning forecasting. Although these applications remain less extensively documented in the peer-reviewed literature than reference and cataloging use cases, their inclusion in vendor product roadmaps suggests that the scope of AI's footprint in libraries will likely continue to widen in the near term (Ma, 2024).

Scope and Structure of This Review

This review focuses on peer-reviewed and professionally published literature addressing the application of AI in library and information services, with particular attention to academic libraries, where most empirical and conceptual work has concentrated. The review is organized into two principal sections. The literature review section examines four thematic areas: AI in reference and user services, AI in cataloging and collection management, AI's role in information literacy instruction, and the ethical, legal, and workforce implications of AI adoption. The review concludes by synthesizing the state of the field, identifying persistent gaps, and proposing directions for future research and professional practice.

Literature Review

Artificial Intelligence in Reference, Discovery, and User Services

A substantial body of literature examines AI-driven chatbots and virtual reference assistants as the most visible library application of AI. Nawaz and Saldeen (2020) analyzed the integration of AI chatbots into academic library reference services and concluded that such tools enhance user engagement, particularly among younger, digitally native patrons who prefer asynchronous and conversational modes of interaction over traditional in-person reference encounters. Similarly, Sahu (2021) reviewed chatbot deployments in academic libraries and identified benefits including twenty-four-hour availability, reduced wait times, and consistent handling of routine, repetitive queries such as circulation policies and database access instructions. Adetayo (2023) extended this line of inquiry by examining the implications of ChatGPT specifically, noting that



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generative AI chatbots can support reference inquiries, website navigation, and even preliminary research assistance, while cautioning that such systems function best as complements to, rather than replacements for, professional librarians.

Bansode (2024) further argued that AI-powered chatbots are reshaping the scope of specialized reference and research support by enabling personalized recommendation of resources based on user history and stated interests. However, several authors caution that the apparent fluency of generative AI systems can mask significant limitations. Rudolph et al. (2023) observed that large language models frequently produce plausible but factually incorrect responses, a phenomenon commonly termed hallucination, which carries particular risk in reference contexts where accuracy and source verification are paramount. This tension between the efficiency gains of AI-mediated reference services and the persistent risk of misinformation constitutes a recurring concern throughout the literature.

A related theme within this body of work concerns the design of triage systems that route routine queries to AI chatbots while escalating complex or ambiguous questions to human staff. Sahu (2021) noted that the success of such hybrid models depends heavily on the accuracy of the initial classification step, since misrouted complex queries can leave patrons with unsatisfactory automated responses to questions that genuinely require professional judgment. Studies in this area generally recommend maintaining a visible and easily accessible pathway to human assistance alongside any AI-driven reference tool, both to preserve user trust and to ensure that vulnerable or underserved patrons are not disproportionately funneled toward automated, lower-fidelity support channels. Table 1 summarizes representative AI applications identified across the reviewed reference and discovery literature.

Application Area	Example Technology	AI	Reported Benefit	Representative Source
Virtual reference chatbots	Rule-based and generative conversational agents		24/7 availability; reduced routine query load	Nawaz & Saldeen (2020)
Research assistance chatbots	Large language models (e.g., ChatGPT)		Preliminary research guidance; website navigation	Adetayo (2023)



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Application Area	Example Technology	AI	Reported Benefit	Representative Source
Personalized resource discovery	Recommendation algorithms		Tailored suggestions based on user history	Bansode (2024)
After-hours support	Natural language processing chatbots		Continuous access to basic library information	Sahu (2021)

AI in Cataloging, Metadata, and Collection Management

A second major stream of literature addresses AI applications in technical services, particularly cataloging, metadata creation, and collection management. Kumar and Ramesh (2020) reviewed early applications of AI in library services and found that machine learning algorithms were increasingly used to automate subject classification and reduce the time required for original cataloging. Khan et al. (2023) examined automated metadata extraction using natural language processing techniques in digital repositories, reporting that such tools improved consistency in metadata fields while substantially reducing manual labor associated with large-scale digitization projects. Lynch (2023) evaluated AI-backed information management systems in academic libraries using the information systems success model and found that user satisfaction with AI-assisted discovery tools depended heavily on the perceived accuracy and transparency of the underlying algorithms.

More recent work has extended these findings to fully integrated library information management systems. Ma (2024) proposed a machine learning–based framework for library information management that combined automated classification, predictive resource allocation, and integrated metadata workflows, arguing that such systems could meaningfully reduce backlog in cataloging departments. Across this literature, a consistent finding is that AI tools perform well on well-represented, high-volume categories of material but continue to struggle with rare, multilingual, or highly specialized content, a limitation that has implications for equitable representation of diverse collections.

A further consideration raised across this literature is the question of human oversight within AI-assisted technical services workflows. Lynch (2023) emphasized that user satisfaction with AI-generated metadata correlated strongly with the presence of a visible human review stage, suggesting that fully automated cataloging pipelines without librarian verification risk both quality degradation and diminished institutional trust in the resulting records. Khan et al. (2023)



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similarly recommended a staged implementation approach in which AI-generated metadata is initially treated as a draft requiring cataloger approval, with full automation reserved for narrowly scoped, high-confidence categories of material. This cautious, human-in-the-loop approach appears throughout the technical services literature as a pragmatic middle ground between full automation and continued reliance on exclusively manual workflows. Table 2 contrasts traditional cataloging workflows with AI-assisted approaches as characterized in the reviewed literature.

Process Dimension	Traditional Cataloging Workflow	AI-Assisted Cataloging Workflow
Metadata creation	Manual, librarian-authored records	Automated extraction with librarian review (Khan et al., 2023)
Subject classification	Manual assignment based on classification schemes	Predictive classification using trained models (Kumar & Ramesh, 2020)
Processing speed	Limited by staff capacity	Substantially increased throughput (Ma, 2024)
Consistency across records	Variable, dependent on cataloger judgment	More consistent, though prone to systematic errors (Lynch, 2023)
Handling of rare or niche materials	Handled through specialist expertise	Comparatively weaker performance, requiring human oversight

Artificial Intelligence and Information Literacy Instruction

The emergence of generative AI has prompted a reexamination of information literacy instruction within academic libraries. Cox and Tzoc (2023) argued that the disruptive potential of ChatGPT requires librarians to proactively evaluate the tool's functionality and to develop instructional services that help students critically assess AI-generated content rather than treating generative AI purely as a threat to academic integrity. This perspective is echoed by Perkins (2023), who examined academic integrity considerations associated with large language models and concluded that instructional interventions emphasizing critical evaluation, rather than prohibition, are more likely to produce durable information literacy competencies among students.



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Long and Magerko (2020) contributed a foundational framework for AI literacy, identifying core competencies such as understanding how AI systems make decisions, recognizing the role of training data in shaping outputs, and evaluating the ethical implications of AI-generated content. This framework has since been adapted by library instruction librarians seeking to integrate AI literacy into existing information literacy curricula grounded in frameworks such as the Association of College and Research Libraries' Framework for Information Literacy. Steiger (2024) synthesized this emerging body of work and concluded that AI simultaneously offers opportunities to enrich library instruction, for example by demonstrating source evaluation using AI-generated citations that may be fabricated or inaccurate, while also introducing new risks related to plagiarism and the erosion of independent research skills among students. Rudolph et al. (2023) similarly cautioned that overreliance on generative AI for academic tasks could undermine the development of critical thinking skills that information literacy instruction has traditionally sought to cultivate, reinforcing the argument that librarians occupy a pivotal role in mediating students' engagement with these tools.

Several authors have proposed specific pedagogical strategies for embedding AI literacy into existing instruction sessions. Cox and Tzoc (2023) recommended structured exercises in which students prompt a generative AI tool for citations on a given topic and then attempt to verify each citation against library databases, an activity that concretely demonstrates the risk of AI hallucination while reinforcing traditional source verification skills. Perkins (2023) similarly advocated for transparency-based approaches in which instructors openly discuss both the capabilities and limitations of generative AI rather than treating its use as inherently prohibited, arguing that this approach better prepares students for a professional landscape in which AI tools are likely to remain a persistent feature of information work. Taken together, this literature suggests that library instruction is shifting from a primarily defensive posture, focused on preventing misuse, toward a more integrative posture that treats AI competency itself as a core information literacy outcome.

Ethical, Legal, and Workforce Considerations

A fourth and increasingly prominent theme in the literature concerns the ethical, legal, and workforce implications of AI adoption in libraries. The International Federation of Library Associations and Institutions (IFLA, 2020) issued a formal statement urging libraries to procure and implement AI technologies in a manner consistent with human rights, intellectual freedom, and established library ethics, explicitly cautioning against the uncritical adoption of AI systems whose training data or decision-making processes are not transparent. Jobin et al. (2019) conducted a broader analysis of global AI ethics guidelines and identified recurring principles, including transparency, fairness, accountability, and privacy, that have since been adapted by



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library professional bodies to address sector-specific concerns such as patron confidentiality and collection bias.

Privacy remains a particularly acute concern given libraries' long-standing professional commitment to protecting patron confidentiality. Because many AI-powered discovery and recommendation tools rely on the collection and analysis of user behavior data, several authors have argued that such systems create tension between the personalization benefits of AI and the profession's ethical obligation to minimize data retention (IFLA, 2020; Jobin et al., 2019). Algorithmic bias represents a related concern, as machine learning models trained on historical library catalogs may reproduce or amplify existing biases in subject classification and collection representation, potentially marginalizing underrepresented authors, languages, or perspectives (Lee, 2023).

Workforce implications constitute the final major concern raised across the literature. Frey and Osborne (2017) provided an influential early estimate of occupational automation risk, and subsequent library-specific research has applied similar reasoning to cataloging, circulation, and reference roles. Vinuesa et al. (2020) situated these workforce concerns within the broader context of AI's societal impact, noting that while AI can advance sustainable development goals related to education and access to information, it can simultaneously exacerbate inequality if deployment is not accompanied by deliberate workforce retraining and inclusive governance structures. Within libraries, this suggests that AI adoption should be accompanied by investment in staff training, particularly in data literacy, prompt engineering, and algorithmic evaluation skills, rather than viewed solely as a mechanism for reducing staffing levels.

Legal considerations, while less extensively theorized than privacy and bias in the reviewed literature, are nonetheless raised in connection with intellectual property and licensing. Because many generative AI systems are trained on large corpora that may include copyrighted material without explicit authorization from rights holders, libraries face uncertainty about their own potential liability when recommending or embedding such tools within official services. IFLA (2020) explicitly recommends that libraries procure technologies that adhere to legal and ethical requirements, a recommendation that in practice requires libraries to develop internal vetting procedures for AI vendors, a capacity that many institutions, particularly smaller public libraries, may currently lack. Table 3 summarizes the principal ethical challenges identified in the literature alongside corresponding mitigation strategies proposed by reviewed authors.

Ethical Challenge	Description	Proposed Mitigation Strategy
Patron privacy	AI personalization relies on collection of user behavior data	Data minimization and transparent retention policies (IFLA, 2020)



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Ethical Challenge	Description	Proposed Mitigation Strategy
Algorithmic bias	Models trained on historical records may reproduce collection bias	Bias auditing and diverse training data review (Lee, 2023)
Transparency and accountability	Proprietary AI systems often function as opaque black boxes	Preference for auditable, transparent systems (Jobin et al., 2019)
Workforce displacement	Automation of cataloging and reference tasks may reduce staffing needs	Staff retraining and redefinition of professional roles (Vinuesa et al., 2020)
Academic integrity	Generative AI may facilitate plagiarism or fabricated citations	Instruction emphasizing critical evaluation over prohibition (Perkins, 2023)

Conclusion

This review has examined the expanding role of artificial intelligence across four core areas of library practice: reference and user services, cataloguing and collection management, information literacy instruction, and the ethical and workforce dimensions of AI adoption. The reviewed literature demonstrates that AI technologies, ranging from rule-based chatbots to generative large language models, offer meaningful efficiency gains, including reduced response times in reference services, faster metadata creation, and expanded capacity for large-scale digitisation. At the same time, the literature consistently identifies unresolved risks associated with algorithmic bias, patron privacy, transparency, and the potential erosion of professional expertise.

A central conclusion emerging from this review is that AI adoption in libraries is neither uniformly beneficial nor uniformly harmful; rather, its impact depends substantially on how thoughtfully libraries govern its implementation. Studies examining reference chatbots and cataloguing automation converge on the finding that AI performs best as a complement to human expertise rather than a wholesale replacement for it. Similarly, literature on information literacy instruction suggests that libraries are uniquely positioned to help patrons and students develop the critical evaluation skills necessary to navigate an information environment increasingly mediated by generative AI. This positions librarians not as passive adopters of AI technology but as active mediators between AI systems and the communities' libraries serve. The review also reveals that the ethical frameworks guiding AI adoption in libraries remain in relatively early stages of development. While professional bodies have articulated high-level principles,



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translating these principles into specific, actionable procurement and implementation guidelines remains an ongoing challenge for individual institutions.

It is also evident that the depth and rigour of the existing literature vary considerably across the four thematic areas examined in this review. Studies of reference chatbots and cataloguing automation tend to include at least modest empirical evaluation, whereas discussions of workforce and ethical implications remain comparatively more conceptual and normative in nature. This imbalance suggests that while the profession has articulated a reasonably clear vision of what responsible AI adoption should look like in principle, empirical evidence documenting how these principles translate into day-to-day institutional practice remains underdeveloped. Addressing this gap will require closer collaboration between library and information science researchers, practising librarians, and the vendors who design the AI systems libraries increasingly rely upon.

Future Research Directions

Building on the themes identified in this review, several directions for future research and professional practice merit attention. First, longitudinal studies are needed to assess the sustained impact of AI-powered reference and discovery tools on user satisfaction, information-seeking behaviour, and trust over time. The majority of existing studies rely on cross-sectional surveys or short-term pilot evaluations, making it difficult to determine whether the observed benefits and concerns remain consistent over extended periods. Longitudinal research could provide a clearer understanding of how users adapt to AI-enabled library services and whether their expectations, levels of trust, and patterns of information-seeking change as familiarity with these technologies increases.

Second, further empirical research should examine the workforce implications of AI adoption directly within library settings, moving beyond general occupational automation estimates towards library-specific analyses of how cataloguing, reference, collection management, and instructional roles are being redefined in practice. Such research should investigate changes in librarians' responsibilities, required competencies, workload, professional autonomy, and opportunities for continuing professional development. Understanding these changes would help library institutions develop appropriate workforce strategies and ensure that technological innovation complements rather than undermines professional expertise.

Third, future work should prioritise the development of standardised, empirically validated frameworks for auditing algorithmic bias in library-specific AI applications. Although ethical principles surrounding fairness, transparency, accountability, and inclusiveness have received increasing attention, libraries require practical assessment tools that can be applied during the procurement, testing, deployment, and evaluation of AI systems. Such frameworks should enable institutions to systematically assess whether AI technologies produce discriminatory outcomes,



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reproduce existing biases, or disadvantage particular user groups. They should also establish measurable criteria for transparency, explainability, data governance, and accountability.

Fourth, additional research is needed on the integration of AI literacy into information literacy curricula, particularly through comparative studies examining which instructional approaches most effectively develop durable critical-thinking skills among diverse student and user populations. Research could evaluate practical activities involving the critical assessment of AI-generated information, verification of AI-generated citations, identification of hallucinated content, evaluation of source credibility, and responsible use of generative AI. This would help libraries develop evidence-based approaches to preparing users for an information environment increasingly shaped by artificial intelligence.

Finally, given the rapid pace of generative AI development, future research should adopt more agile and iterative methodologies capable of keeping pace with technological change. Potential approaches include ongoing professional surveys, living systematic reviews, repeated institutional assessments, and cross-institutional data-sharing initiatives. Such approaches would allow the library and information science field to generate cumulative and timely evidence to guide ethical and effective AI adoption, rather than relying solely on retrospective analyses of technologies that may already be superseded by the time findings are published. Pursuing these directions collaboratively across academic, public, and special library sectors will help ensure that AI is harnessed to advance the profession's enduring commitments to equitable access, intellectual freedom, information integrity, and user privacy.

Future work would also benefit from greater attention to under-resourced library contexts, including small public libraries and libraries in the Global South, where budgetary and infrastructural constraints may shape AI adoption very differently from well-funded academic research libraries. Much of the existing literature originates from institutions with comparatively strong technical capacity, and it remains unclear whether the benefits and risks identified in this body of work generalise to settings with fewer resources for AI vetting, staff training, infrastructure development, or vendor negotiation. Comparative research across institutional types and geographic regions would therefore help determine how contextual factors influence the effectiveness, affordability, and ethical implications of AI adoption.

Greater geographical and institutional diversity in future research would also help ensure that emerging professional guidance on AI adoption reflects the full diversity of the library sector rather than primarily representing the experiences of its most technologically advanced institutions. Research involving rural libraries, community libraries, small public libraries, developing-country institutions, and libraries serving marginalised or digitally excluded populations could provide important insights into issues of accessibility, digital inequality, technological dependency, and resource allocation. Such evidence would support the



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development of more inclusive AI strategies that recognise differences in institutional capacity while maintaining core professional commitments to equitable access, user autonomy, privacy, and intellectual freedom.

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