Exploring the Integration of AI in Public Library Services

Mehdi Rahmani[1]

1 Assistant Professor, Department of knowledge and information science, University of Isfahan, Isfahan, Iran

* **Corresponding author email address**: M.Rahmani@edu.ui.ac.ir

Article Info	Abstract
Article type: *Original Research* **How to cite this article:** Rahmani. M. (2023). AI in Exploring the Integration of AI in Public Library Services. *AI and Tech in Behavioral and Social Sciences, 1*(4), 33-39. https://doi.org/10.61838/kman.aitech.1.4.6 	This study aims to explore the extent of AI integration in public libraries, identify the benefits and challenges faced by libraries in adopting AI technologies, and propose strategies for effective implementation. It seeks to provide a comprehensive overview of the current state of AI applications in library services and offer insights into future trends. Employing a qualitative research design, this study collected data through semi-structured interviews with 29 participants, including librarians, IT specialists, library managers, and library users. Thematic analysis was used to analyze the interview transcripts, allowing for the identification of key themes related to AI integration in public libraries. Four main themes emerged from the data: AI Applications, Challenges and Responses, Service Evolution, and Adoption and Integration. AI Applications were categorized into User Interaction, Operational Tasks, and Learning Tools, highlighting AI's role in enhancing service delivery and operational efficiency. Challenges and Responses revealed technical barriers, staff training needs, user engagement issues, and financial constraints as significant obstacles to AI adoption. Service Evolution demonstrated AI's impact on information accessibility, user experience, operational improvements, and community outreach. Adoption and Integration emphasized the importance of strategic planning, community involvement, and policy compliance in successfully integrating AI into library services. The study concludes that while AI offers substantial opportunities to redefine public library services, its successful integration requires addressing technical, ethical, and financial challenges. Libraries must focus on staff training, ethical AI use, and strategic planning to fully realize the benefits of AI. Future research should aim to quantify the impact of AI on library services and explore innovative AI applications in diverse library contexts. ***Keywords:*** *Artificial Intelligence, Public Libraries, Library Services, Technology Integration, User Experience, Strategic Planning.*

1. Introduction

The implication of artificial intelligence (AI) in public library services marks a pivotal evolution in the quest for modernizing library operations and services. This transformative journey, underpinned by rapid technological advancements, seeks to not only enhance the traditional functionalities of libraries but also to reimagine the user experience in a digital age. As highlighted by Amzat (2023), the exploration of AI's potential benefits is central to this

modernization effort, offering unprecedented opportunities to enrich user engagement and streamline service delivery (Amzat, 2023). The strategic integration of AI technologies is becoming increasingly vital for libraries aiming to stay relevant and future-ready, a sentiment echoed by Okunlaya et al. (2022) who emphasize the shift towards embracing AI as a foundational element of contemporary library services (Okunlaya et al., 2022).

Public libraries, traditionally seen as community centers for knowledge and learning, are at the forefront of this integration, with Mhlongo (2021) noting the extension of AI applications beyond academic settings to encompass public libraries. This move is aimed at improving the overall quality of service delivery, making libraries more accessible and pertinent to the needs of their communities (Mhlongo, 2021). AI's role in libraries extends across various core services including acquisitions, cataloging, and information retrieval, facilitating a more efficient and reliable access to information (Ali et al., 2022). This technological leap promises not only to revolutionize the operational aspects of library services but also to significantly enhance the quality of user experience (Ali et al., 2020). Librarians are thus encouraged to spearhead the design and implementation of AI solutions within their systems, leveraging this technology to maximize benefits for their patrons (Gasparini & Kautonen, 2022).

However, these changes fully integrated AI systems within libraries is fraught with challenges and considerations that must be addressed. Hussain (2023) points out the existing gaps in awareness and utilization of AI within library services, indicating a need for increased understanding and adoption of these technologies (Hussain, 2023). Furthermore, the ethical deployment of AI in libraries is becoming a critical area of focus. Bubinger & Dinneen (2021) advocate for practical guidance on planning, evaluating, and auditing AI systems to ensure they align with ethical standards, emphasizing the importance of navigating the ethical implications of AI use in public spaces (Bubinger & Dinneen, 2021).

The discourse around AI in libraries also encompasses issues of ethics, diversity, and inclusion. Cox & Mazumdar (2022) stress the necessity of ensuring that AI deployment is conducted responsibly, promoting equitable access and representation within the digital offerings of libraries (Cox & Mazumdar, 2022). Such considerations are paramount to fostering an environment where AI technologies benefit all users equitably, without exacerbating existing disparities or introducing new forms of bias.

A critical aspect of successful AI integration in libraries is the readiness and willingness of these institutions and their personnel to embrace and adapt to these technological advancements. Ariole & Okorafor (2018) highlight the significance of assessing the preparedness of librarians and library institutions to incorporate not only AI but also other emerging technologies like social media tools, into their service offerings (Ariole & Okorafor, 2018). Understanding both the drivers behind and the barriers to AI integration is essential for developing effective strategies for implementation and adoption. Ishengoma et al. (2022) further emphasize this point, calling for a nuanced exploration of the factors that influence AI integration in libraries, to inform future research agendas and facilitate successful technological transitions (Ishengoma et al., 2022).

In summary, the integration of AI into public library services presents a transformative opportunity to redefine the landscape of library operations and user experiences. While the journey is accompanied by challenges, particularly in terms of awareness, utilization, and ethical considerations, the potential benefits of AI in enhancing library services are immense. As libraries continue to navigate this integration, a concerted effort to address these challenges, ensuring readiness and fostering an inclusive approach to AI deployment, will be crucial for realizing the full potential of AI in public libraries.

2. Methods and Materials

2.1. Study Design and Participants

This study employs a qualitative research methodology to explore the integration of Artificial Intelligence (AI) in public library services. The primary aim is to understand the perceptions, experiences, and challenges faced by library professionals and users in the context of AI adoption and its impact on library services and operations. Given the exploratory nature of the research, a qualitative approach was deemed most suitable to capture the depth and complexity of participants' experiences and attitudes towards AI in libraries.

Participants were selected using a purposive sampling strategy, targeting a diverse range of individuals involved in public library services, including librarians, IT specialists, library managers, and regular library users who have interacted with AI-based services. This sampling strategy ensured a comprehensive understanding of AI integration

across different levels of public library services and from varied perspectives.

Prior to conducting interviews, all participants were informed about the study's purpose, the confidentiality of their responses, and their right to withdraw at any time. Consent forms were obtained, ensuring participants' informed consent.

2.2.   Data Collection

The data for this study was collected through semi-structured interviews, a choice driven by the need for a flexible yet focused conversation framework. This method allows the interviewer to explore participants' thoughts, feelings, and experiences in detail, offering rich, nuanced insights into the subject matter. Semi-structured interviews are particularly effective in qualitative research as they provide the flexibility to probe deeper into responses and follow up on interesting or unexpected avenues that emerge during the conversation.

The interview protocol was developed to guide the conversations, ensuring consistency across interviews while allowing for in-depth exploration of individual experiences. The protocol comprised open-ended questions designed to elicit detailed responses on participants' perceptions of AI, the benefits and challenges of AI integration, experiences with specific AI applications in library services, and suggestions for future AI implementation in public libraries. Key topics included AI's role in enhancing user experience,

automating tasks, and supporting decision-making processes in libraries.

2.3.   Data Analysis

Data from the interviews were transcribed verbatim and analyzed using thematic analysis. This involved coding the data to identify patterns, themes, and insights related to AI integration in public library services. The analysis was conducted iteratively, refining themes as new data were examined, ensuring a thorough and grounded understanding of the integration of AI in public libraries.

3.   Findings

In this study, a total of 29 participants were interviewed to explore their perspectives on the integration of AI in public library services. The demographic makeup of the participants was diverse, encompassing a range of roles within the library system to ensure a comprehensive understanding of the topic. Of the participants, 12 were librarians, tasked with the day-to-day management and operation of library services. Seven participants were IT specialists, whose expertise in technology played a crucial role in implementing and managing AI systems within libraries. Five participants held management positions, including library directors and managers, providing strategic oversight of library operations and AI integration. The remaining five were regular library users who have interacted with AI-based services, offering valuable insights into the user experience and expectations.

Table 1

The Results of Qualitative Analysis

Categories	Subcategories	Concepts (Open Codes)
AI Applications	User Interaction	Chatbots for queries, AI-driven recommendations, Virtual navigation assistants
	Operational Tasks	Automated inventory, Cataloging with AI, Predictive analytics for library needs
	Learning Tools	AI tutorials, Personalized learning, Online learning platforms
	Content Management	E-content organization, Dynamic content display, User-generated content filtering
	Event and Program Management	AI for event scheduling, Participant engagement analysis, Customized event recommendations
Challenges and Responses	Technical Barriers	Integration complexities, Data privacy concerns, AI reliability issues
	Staff Training	Training programs, Change resistance, Skill adaptation needs
	User Engagement	Accessibility challenges, Skepticism towards AI, Building trust in AI systems
	Financial and Resource Constraints	Budget limitations, High costs of AI solutions, Resource allocation challenges
Service Evolution	Information Accessibility	Enhanced search features, Language translation, Accessibility for disabled
	Enhancing User Experience	Personalized services, Reduced waiting times, Improved engagement
	Operational Improvements	Cost-saving measures, Staff task optimization, Extended operating hours
	Digital and Online Services	Online library access, Digital lending, Virtual reality experiences
	Community and Outreach	Community-focused AI initiatives, Outreach program tailoring, Engagement tracking

Adoption and Integration	Innovation Adoption	New AI technologies, Library-AI collaborations, Initiative-driven advancements
	Strategic Planning	AI integration strategies, Long-term technology planning, Resource allocation
	Community Involvement	Engagement strategies, Literacy improvement, Public discussions on AI ethics
	Policy and Regulatory Compliance	Compliance with data laws, AI usage policies, Ethical standards for AI applications

3.1. AI Applications in Public Libraries

Our investigation into AI applications within public libraries revealed a broad spectrum of implementations aimed at enhancing user interaction and operational efficiency. For user interaction, participants highlighted the significance of chatbots for handling queries. One librarian mentioned, "Our AI chatbot has transformed how we handle inquiries, offering 24/7 assistance and significantly reducing wait times for our patrons." Operational tasks benefit from AI through automated inventory systems, with one IT specialist noting, "The precision and efficiency of our AI-driven inventory system have drastically reduced the manual workload, allowing staff to focus on more critical tasks."

Learning tools emerged as a crucial application, with AI tutorials and personalized learning paths being lauded for their role in enhancing digital literacy among library users. Additionally, content management and event programming have seen innovative applications of AI, from organizing e-content to tailoring event recommendations based on user interests, thereby fostering a more engaged library community.

3.2. Challenges and Responses to AI Integration

The integration of AI within public libraries is not without its challenges, ranging from technical barriers to staff training needs. Technical issues, particularly data privacy concerns, were frequently cited, with one respondent stating, "Ensuring the privacy and security of our user data in AI applications is our top priority, posing both a technical and ethical challenge." The need for staff training was also emphasized, as libraries strive to prepare their personnel for the transition to AI-enhanced services. Financial and resource constraints were identified as significant hurdles, especially for smaller libraries. "Budget limitations are a constant concern, making it challenging to adopt the latest AI technologies," shared a library manager.

3.3. Evolving Library Services through AI

AI's role in evolving library services was evident in its contribution to improving information accessibility and user experience. Digital and online services have particularly

benefited, enabling access to library resources from any location. The introduction of AI has also played a pivotal role in expanding community and outreach efforts. A participant reflected, "AI has allowed us to tailor our outreach programs more effectively, understanding and meeting the needs of our community better."

3.4. Adoption and Integration Strategies

Strategic planning for AI adoption and integration involves a careful consideration of innovation, community involvement, and policy compliance. Libraries are increasingly focusing on creating a strategic framework that includes evaluating new AI technologies and ensuring their alignment with community needs and regulatory requirements. "Adopting AI is not just about technology; it's about strategically enhancing how we serve our community, guided by policy and ethical considerations," remarked a library director.

4. Discussion and Conclusion

This study has explored the integration of artificial intelligence (AI) in public library services, uncovering both the potentials and challenges of this technological advancement. Our findings reveal that AI significantly enhances library operations and user experiences by improving information retrieval, automating repetitive tasks, and providing personalized services. The study also identified key challenges, including the need for increased awareness and understanding of AI technologies among library staff and users, the imperative for addressing ethical concerns related to privacy and data security, and the importance of ensuring equitable access to AI-enhanced services.

This study identified four main themes through the analysis of semi-structured interviews regarding the integration of artificial intelligence (AI) in public library services. These themes include "AI Applications," "Challenges and Responses," "Service Evolution," and "Adoption and Integration." Each theme is further divided into various categories, reflecting the nuanced perspectives and experiences of participants with AI in the library context. "AI Applications" covers the direct use of AI

technologies in library operations and user services. "Challenges and Responses" addresses the hurdles libraries face in adopting AI and the strategies developed to overcome these issues. "Service Evolution" highlights the ways AI is transforming library services to meet current and future needs. Lastly, "Adoption and Integration" focuses on the broader strategies, policies, and community engagement necessary for the successful implementation of AI in libraries.

The "AI Applications" theme is categorized into "User Interaction," "Operational Tasks," and "Learning Tools," detailing how AI technologies are employed to enhance library services. User Interaction includes the use of chatbots for queries and AI-driven recommendations, emphasizing the improvement in patron service efficiency and personalization. Operational Tasks highlight AI's role in automated inventory management and cataloging, showcasing the operational efficiency gains. Learning Tools discuss AI's contribution to education within the library context, including tutorials and personalized learning paths, underlining AI's potential to support lifelong learning and digital literacy.

Under "Challenges and Responses," the categories of "Technical Barriers," "Staff Training," "User Engagement," and "Financial and Resource Constraints" were identified. Technical Barriers encompass integration complexities and data privacy concerns, reflecting the technical hurdles libraries must navigate. Staff Training is focused on the need for skill development and adaptability among library personnel, critical for the effective use of AI technologies. User Engagement captures the challenges of making AI tools accessible and trustworthy to patrons. Financial and Resource Constraints highlight the budgetary and resource limitations faced by libraries in adopting AI, underscoring the need for strategic resource allocation.

"Service Evolution" includes "Information Accessibility," "Enhancing User Experience," "Operational Improvements," "Digital and Online Services," and "Community and Outreach." Information Accessibility and Enhancing User Experience categories reflect AI's role in making library resources more accessible and tailoring services to individual user needs. Operational Improvements discuss the cost and efficiency benefits brought by AI, while Digital and Online Services cover the expansion of library services into virtual spaces. Community and Outreach focus on AI's potential to deepen library engagement with the community through targeted programs and services.

Finally, the "Adoption and Integration" theme covers "Innovation Adoption," "Strategic Planning," "Community Involvement," and "Policy and Regulatory Compliance." Innovation Adoption explores the library's approach to embracing new AI technologies, highlighting the importance of staying abreast of technological advancements. Strategic Planning emphasizes the need for comprehensive strategies that include AI integration into library services. Community Involvement discusses the role of public engagement in shaping AI initiatives, ensuring they meet community needs. Policy and Regulatory Compliance addresses the importance of adhering to legal and ethical standards in the deployment of AI technologies, underscoring the necessity of responsible AI use.

The exploration into the application of artificial intelligence (AI) in libraries, as undertaken in this study, resonates with the broader scholarly discourse on the subject. Our findings align with the comprehensive literature review conducted by Jha (2023), which emphasized the potential benefits and challenges of AI in enhancing library services (Jha, 2023). Similarly, the research underscores the evolving landscape of AI technologies within libraries, a trend thoroughly examined by Oyelude (2021) (Oyelude, 2021). This study's alignment with these scholarly works reinforces the notion that the integration of AI in library services is a critical and ongoing evolution, responding to the dynamic needs of library users and the operational demands of library systems.

Borgohain et al. (2022) provided a scientometric analysis that maps the burgeoning field of AI applications in libraries, highlighting the growth and collaboration networks within this research area. Our findings contribute to this expanding body of knowledge, illustrating the practical implementations and theoretical discussions surrounding AI in libraries (Borgohain et al., 2022). Specifically, the study by Haffenden et al. (2023) on the development of a BERT model at the National Library of Sweden corroborates our observations on the significance of natural language processing tools (Haffenden et al., 2023). Such tools are becoming increasingly vital for enhancing user interaction and information retrieval in libraries, a sentiment echoed by our study's participants.

Further, the deployment of chatbots and intelligent indexing systems, as discussed by Sanji et al. (2022), finds resonance in our findings. These AI components, integrated into various library functions, demonstrate the technology's versatility in augmenting user services and operational efficiency (Sanji et al., 2022). Our study's participants

highlighted similar advancements, underscoring the critical role of AI in redefining library services.

In addressing the challenges of AI integration, our findings reflect concerns similar to those noted in the literature. Hussain (2023) pointed out the awareness and utilization gaps in library services, a challenge our study also acknowledges (Hussain, 2023). Moreover, the ethical considerations highlighted by Bubinger & Dinneen (2021) align with our study's emphasis on the need for ethical guidelines and practical approaches to ensure responsible AI deployment (Bubinger & Dinneen, 2021). This study further supports the call for inclusivity and ethical consideration in AI applications within libraries, as discussed by Cox & Mazumdar (2022) (Cox & Mazumdar, 2022).

The readiness of libraries to embrace AI technologies, a critical factor identified by Ariole & Okorafor (2018), also finds support in our findings (Ariole & Okorafor, 2018). Understanding the drivers and barriers to AI integration, as Ishengoma et al. (2022) suggest, is crucial for facilitating successful AI adoption in library settings (Ishengoma et al., 2022). Our research contributes to this dialogue by highlighting the importance of preparedness and strategic planning in the successful integration of AI into library services.

The integration of AI into public libraries marks a transformative shift towards more efficient, accessible, and personalized library services. By harnessing the capabilities of AI, libraries are positioned to better meet the evolving needs of their communities. However, the successful adoption of AI technologies requires a thoughtful approach that considers the ethical, operational, and inclusivity challenges. Addressing these challenges head-on will ensure that libraries continue to serve as vital community resources in the digital age, fostering lifelong learning and access to information.

5. Limitations and Suggestions

This study's limitations primarily stem from its qualitative nature and the sample size, which may not capture the full spectrum of global library experiences with AI integration. Additionally, the rapid pace of technological advancement in AI means that the findings may quickly evolve. As such, the study's insights should be seen as a snapshot of current practices and perceptions, offering valuable, yet not exhaustive, perspectives on the integration of AI in public libraries.

Future research should aim to broaden the understanding of AI's impact on libraries by including quantitative measures of user satisfaction, operational efficiency, and cost-effectiveness. Longitudinal studies could provide deeper insights into the evolving nature of AI in library services and its long-term effects. Additionally, comparative studies between public and academic libraries could shed light on unique challenges and opportunities in different library settings. Exploring the impact of AI on underserved communities would also contribute to a more comprehensive understanding of equitable access to AI-enhanced services.

For library practitioners, this study underscores the importance of ongoing education and training in AI technologies to enhance staff readiness and user engagement. Libraries should also prioritize the development of ethical guidelines for AI use, focusing on privacy, data security, and inclusivity. Collaborating with technology providers to customize AI applications to specific library needs can further optimize the benefits of AI integration. By adopting a strategic and informed approach to AI, libraries can not only improve their services but also reinforce their role as inclusive centers for knowledge and community engagement.

Authors' Contributions

All authors have contributed equally to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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