

KECERDASAN BUATAN DALAM LAYANAN PERPUSTAKAAN: TINJAUAN LITERATUR SISTEMATIS TENTANG TREN, TANTANGAN, DAN PELUANG

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ABSTRAK

Penelitian ini mengkaji implementasi Artificial Intelligence (AI) dalam layanan perpustakaan dengan menyoroti kesenjangan penelitian sebelumnya yang masih bersifat parsial dan belum memberikan sintesis komprehensif. Penelitian ini menggunakan pendekatan Systematic Literature Review (SLR) dengan mengumpulkan data dari Scopus, Web of Science, dan Google Scholar. Sebanyak 25 artikel yang dipublikasikan pada rentang tahun 2015–2025 dipilih melalui proses seleksi sistematis berdasarkan kriteria inklusi dan eksklusi. Data dianalisis menggunakan analisis tematik kualitatif untuk mengidentifikasi pola dan tema utama. Hasil penelitian menunjukkan bahwa AI telah banyak diterapkan dalam layanan perpustakaan, khususnya dalam otomatisasi operasional, peningkatan sistem temu kembali informasi, dan penyediaan layanan yang dipersonalisasi. Namun demikian, terdapat berbagai tantangan, seperti keterbatasan infrastruktur teknologi, rendahnya kompetensi digital pustakawan, keterbatasan pendanaan, serta isu etika seperti privasi data dan bias algoritma. Penelitian ini menyimpulkan bahwa AI memiliki potensi besar untuk mentransformasi layanan perpustakaan menjadi lebih efisien dan berorientasi pada pengguna, dengan syarat adanya dukungan strategis dalam pengembangan infrastruktur, peningkatan kapasitas, dan kebijakan yang mendukung.

Kata Kunci: Artificial Intelligence; Layanan Perpustakaan; Tinjauan Literatur Sistematis; Perpustakaan Digital; Temu Kembali Informasi

ARTIFICIAL INTELLIGENCE IN LIBRARY SERVICES: A SYSTEMATIC LITERATURE REVIEW OF TRENDS, CHALLENGES, AND OPPORTUNITIES

ABSTRACT

This study examines the implementation of Artificial Intelligence (AI) in library services by addressing the lack of comprehensive synthesis in previous studies, which tend to focus on specific technologies or contexts. Using a Systematic Literature Review (SLR) approach, data were collected from Scopus, Web of Science, and Google Scholar. A total of 25 articles published between 2015 and 2025 were selected through a systematic screening process based on predefined inclusion and exclusion criteria. Data were analyzed using qualitative thematic analysis to identify key patterns and themes. The findings reveal that AI has been widely implemented in library services, particularly in automating operations, improving information retrieval systems, and enabling personalized user services. However, several challenges remain, including limited technological infrastructure, low digital competencies among librarians, financial constraints, and ethical concerns such as data privacy and algorithmic bias. This study concludes that AI has strong potential to transform library services into more efficient and user-centered systems, although its successful implementation requires strategic efforts in infrastructure development, capacity building, and policy support.

Kata Kunci: Artificial Intelligence; Library Services; Systematic Literature Review; Digital Libraries; Information Retrieval



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A. INTRODUCTION

Artificial Intelligence (AI) has emerged as a transformative technology across multiple sectors, including education, business, and information management. In library services, the integration of AI has become an increasingly important area of research and practice, offering potential to enhance information access, improve service efficiency, and personalize user experiences (Cox et al., 2019; Asemi et al., 2021; Zhai et al., 2023). The advancement of machine learning, natural language processing, and recommendation systems has reshaped how libraries manage, organize, and deliver information, requiring them to adapt to increasingly digital and on-demand service environments.

The increasing volume of digital information and the growing complexity of user needs have positioned AI as an important technological component in modern library ecosystems. AI can support the automation of cataloging and classification, improve information retrieval, and facilitate real-time user services through chatbots and virtual assistants. These developments have expanded the role of libraries from conventional information providers toward more active facilitators of knowledge discovery and user-centered services. Consequently, AI adoption has become an important consideration for libraries seeking to respond to digital-native users and support lifelong learning (Liu & Li, 2020; Huang et al., 2022).

However, the implementation of AI in library services is accompanied by a range of challenges. Limitations in technological infrastructure, insufficient funding, and inadequate digital competencies among librarians may hinder effective adoption, particularly in developing-country contexts. In addition, ethical concerns related to data privacy, algorithmic bias, transparency, and accountability raise important questions about the responsible use of AI in library environments (Vincent-Lamarre et al., 2020; Tammaro, 2021). These challenges indicate that the benefits of AI cannot be considered independently from the institutional, technological, human, and ethical conditions that shape its implementation.

In the Indonesian context, the adoption of AI in library services also needs to be considered in relation to differences in institutional capacity and digital infrastructure. While some academic libraries have begun exploring or implementing AI-supported systems, other libraries continue to rely largely on conventional or semi-digital services. Such differences may affect the extent to which libraries can utilize AI to improve service quality, information access, and user engagement. Therefore, understanding AI implementation requires consideration not only of the technologies being adopted but also of the opportunities and constraints associated with their implementation across different contexts.

Previous review studies have provided important foundations for understanding the relationship between AI and libraries, but they have emphasized different aspects of the field. Echedom and Okuonghae (2021), for example, examined the opportunities and challenges associated with transforming academic library operations through AI, with particular attention to the African context. Harisanty et al. (2023) conducted a systematic literature review of AI implementation in libraries and identified applications across technical services, library management, reference and information services, and information literacy. Meanwhile, Concha et al. (2024) systematically reviewed research on AI use in libraries during 2019–2023, focusing primarily on the characteristics and distribution of the research literature, including geographical distribution, language, institutions, journals, and publishers. Zondi et al. (2024) subsequently reviewed AI implementation in academic library services, emphasizing adoption drivers and implementation challenges such as expertise, infrastructure, financial constraints, and employment concerns. These studies demonstrate the growing body of evidence on AI in libraries, but they also reveal differences in analytical focus, scope, and contextual coverage.

More recent systematic reviews have further expanded this literature by examining particular dimensions of AI adoption. For example, recent research has categorized AI practices in academic libraries into areas such as technical services, reference and information services, administration and circulation, collection development, information literacy and user education, and professional development. Other reviews have concentrated specifically on AI-driven personalization, examining techniques such as natural language processing, recommendation systems, and machine learning in relation to user outcomes and ethical considerations. These developments indicate that the literature is becoming increasingly specialized around particular library types, service domains, technologies, or outcomes.

Despite these contributions, a broader integrative synthesis remains necessary. Existing reviews have generally concentrated on particular dimensions of AI implementation, such as specific geographical contexts, academic libraries, publication patterns, selected service areas, implementation barriers, or particular technological applications. Consequently, the literature remains dispersed across different analytical perspectives. What is still needed is a systematic synthesis that connects three interrelated dimensions of AI implementation emerging trends, implementation challenges, and potential opportunities across diverse library contexts. Such an approach is particularly relevant for understanding how technological developments interact with institutional readiness, human competencies, ethical considerations, and the potential transformation of library services.

Therefore, this study addresses the identified gap by conducting a Systematic Literature Review (SLR) of research on the implementation of AI in library services. Rather than focusing exclusively on a particular type of library, technology, geographical region, or service function, this review integrates evidence across the literature to examine how AI is being implemented, what major trends characterize its development, what challenges constrain its adoption, and what opportunities may emerge from its continued integration into library services. Particular attention is also given to evidence relevant to developing-country contexts, including Indonesia, where differences in infrastructure, funding, digital competencies, and institutional readiness may influence AI adoption.

The novelty of this study lies in its integrative analytical framework, which brings together the dimensions of trends, challenges, and opportunities within a single systematic synthesis of AI implementation in library services. While previous reviews have provided valuable insights into particular applications, contexts, implementation barriers, or research patterns, this study seeks to connect these dimensions to provide a more comprehensive understanding of the development of AI-enabled library services. This approach enables the study to move beyond simply identifying AI applications toward examining the broader conditions, constraints, and potential directions that characterize AI implementation across library contexts.

Accordingly, this study seeks to answer the following research question: How has Artificial Intelligence been implemented in library services, and what trends, challenges, and opportunities characterize its development? By addressing this question, the study is expected to contribute theoretically by consolidating and structuring fragmented findings in the existing literature, and practically by providing insights that may assist librarians, library managers, and researchers in understanding the implications and requirements of AI adoption in library services.

B. LITERATURE REVIEW

Artificial Intelligence (AI) has increasingly been integrated into library and information services as libraries respond to the growing volume of digital information and changing user expectations. The literature identifies several AI technologies that have been applied or explored in library environments, including machine learning, natural language processing (NLP), expert systems, recommendation systems, chatbots, virtual assistants, and, more recently, generative AI (Cox et al., 2019; Asemi et al., 2021; Zhai et al., 2023). These technologies serve different functions, ranging from automated cataloguing and classification to intelligent information retrieval, conversational assistance, recommendation, and content

generation. Recent reviews indicate that AI applications are distributed across technical services, reference and information services, collection development, administration, information literacy, and user education. This suggests that AI implementation in libraries is developing from isolated automation tasks toward broader support for both operational and user-facing services.

The objectives and benefits of AI implementation are closely related to the types of technology and library services involved. In technical services, AI is primarily used to automate repetitive activities and improve the efficiency of information organization and processing. In reference and information services, chatbots, virtual assistants, and NLP-based systems can facilitate real-time interaction and information retrieval. Recommendation systems and machine learning can also support personalized information discovery by responding to users' interests and information needs. Across these applications, the main expected benefits include improved operational efficiency, faster information access, enhanced service responsiveness, personalization, and support for data-informed decision-making. However, the literature suggests that these benefits depend on the availability of appropriate infrastructure, reliable data, institutional support, and competent human resources. Thus, the effectiveness of AI cannot be assessed solely from its technological capabilities.

AI adoption also presents technological, organizational, financial, and human-resource challenges. At the technological level, libraries may encounter inadequate infrastructure, system-integration difficulties, data-quality issues, and cybersecurity concerns. At the organizational level, limited funding, insufficient institutional policies, and lack of strategic planning may constrain implementation. Human-resource challenges include inadequate AI and digital competencies, resistance to technological change, and uncertainty regarding changing professional roles. Studies of academic libraries have similarly identified expertise, infrastructure, financial resources, and employment concerns as important barriers to implementation (Zondi et al., 2024). These findings indicate that AI adoption represents an organizational transformation process rather than merely the introduction of a new technological tool. Successful implementation therefore requires alignment between technology, organizational readiness, professional competencies, and institutional resources.

In addition to operational challenges, AI implementation raises important ethical considerations. The use of AI in libraries may involve the collection and processing of user data, automated decision-making, and the generation or recommendation of information. Consequently, issues of privacy, data protection, algorithmic bias, transparency, accountability, intellectual property, copyright, and misinformation require attention (Tammaro, 2021;

Vincent-Lamarre et al., 2020). These issues are particularly significant because libraries traditionally emphasize user privacy, equitable access to information, intellectual freedom, and trust. The literature therefore suggests that AI adoption should be accompanied by appropriate ethical guidelines, human oversight, transparency mechanisms, and policies for responsible data use. Recent research also indicates that ethical risks and professional implications remain important areas requiring further investigation in academic library contexts.

The implementation of AI is further influenced by differences between developed and developing contexts. Libraries in developed countries generally benefit from stronger digital infrastructure, greater access to technological expertise, and more established financial and institutional support, although they continue to face organizational and ethical challenges. In developing countries, barriers related to infrastructure, funding, digital competencies, and institutional readiness may be more pronounced. This does not mean that developing-country libraries are simply less capable of adopting AI; rather, the conditions and strategies required for implementation may differ according to available resources and institutional contexts. For Indonesia, this contextual dimension is important because libraries vary considerably in infrastructure, funding, technological capacity, and human resources. Consequently, findings from highly resourced library environments cannot automatically be generalized to Indonesian libraries without considering these contextual differences.

Overall, the literature demonstrates that AI implementation in libraries is a multidimensional phenomenon involving the interaction of technology, services, objectives, benefits, challenges, ethics, and institutional context. Previous studies and reviews have provided valuable insights into particular technologies, library services, geographical contexts, implementation barriers, and ethical concerns. However, these findings remain distributed across different analytical dimensions. A more integrative synthesis is therefore needed to connect what AI technologies are being implemented, which library services they support, what objectives and benefits they provide, what technological and organizational challenges arise, what ethical issues accompany their use, and how implementation differs across developed and developing contexts. This study addresses this need through a Systematic Literature Review (SLR) that synthesizes these interconnected dimensions to provide a structured understanding of the development and implementation of AI in library services.

C. METHOD

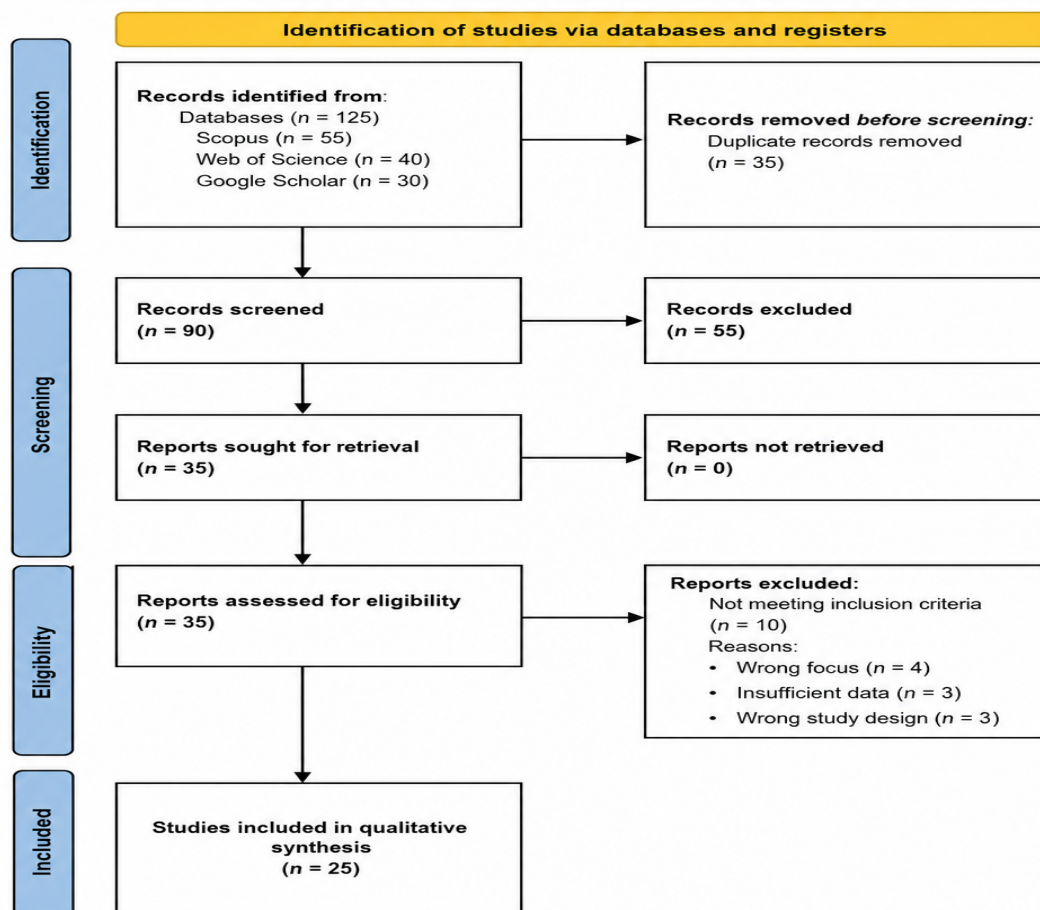
This study employed a Systematic Literature Review (SLR) to examine the implementation of Artificial Intelligence (AI) in library services. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework

to ensure a systematic and transparent study selection process. The literature search was conducted on 10 January 2026 using Scopus, Web of Science, and Google Scholar, covering publications from 2015 to 2025. The search was limited to English-language, peer-reviewed journal articles.

The search strategy combined keywords related to AI and library services using the Boolean operators AND and OR. The general search string was: ("Artificial Intelligence" OR AI OR "machine learning" OR "natural language processing" OR chatbot OR "generative AI") AND ("library service" OR "academic library" OR "digital library" OR "library and information services"). In Scopus, the search was conducted using TITLE-ABS-KEY, while Web of Science used the TS (Topic) field. Google Scholar was searched using combinations of "Artificial Intelligence" AND "library services", "Artificial Intelligence" AND "digital library", and "machine learning" AND "library services". The search was filtered by publication year (2015–2025), English language, and journal article type.

Studies were included if they were peer-reviewed journal articles published between 2015 and 2025, written in English, focused on AI application or implementation in library services, and had accessible full texts. Studies were excluded if they were non-journal publications, unrelated to AI in library services, duplicates, unavailable in full text, or lacked sufficient methodological or substantive information. The records retrieved from the three databases were merged and duplicates were removed before screening.

The study selection followed four PRISMA stages: identification, screening, eligibility, and inclusion. A total of 125 records were identified, and 35 duplicates were removed, leaving 90 records for screening. After title and abstract screening, 55 records were excluded because they did not meet the research focus or eligibility criteria. The remaining 35 articles underwent full-text assessment, of which 10 were excluded because of limited relevance or insufficient methodological and substantive information. Finally, 25 articles were included in the qualitative synthesis, as presented in the PRISMA flow diagram (Figure 1).



Note. This PRISMA 2020 flow diagram shows the process of identification, screening, eligibility assessment, and inclusion of studies for the systematic review.

Figure 1. Prisma 2020 Flow Diagram of The Study Selection Process

The methodological quality of the included studies was assessed using five criteria: clarity of research objectives, appropriateness of research method, adequacy and relevance of data sources, clarity of data analysis, and consistency between findings and conclusions. Each criterion was scored 1 when fulfilled and 0 when not fulfilled. Articles achieving at least 3 of 5 points were considered methodologically adequate for synthesis.

Data were extracted using a structured extraction table covering author and publication year, country/context, research objective, method, AI technology, library service, implementation objectives, benefits, challenges, ethical considerations, and major findings. The extracted data were coded thematically. Initial codes were compared and grouped according to conceptual similarities, with themes determined through recurring patterns across the included studies and their relevance to the research question. The final synthesis focused on six themes: AI technologies and implementation trends; library services; objectives and benefits; implementation challenges; ethical considerations; and developed versus developing contexts.

A qualitative narrative and thematic synthesis was used because the included studies varied in research design, context, technology, and service type

D. RESULT AND DISCUSSION

The results of this systematic review are based on the analysis of 25 selected articles focusing on the implementation of Artificial Intelligence (AI) in library services. The findings were synthesized thematically based on the focus areas and key findings presented in Table 1. The synthesis identified several recurring themes, including AI applications in automation and information organization, information retrieval, recommendation and personalization, chatbots and virtual assistants, user engagement, digital transformation, ethical issues, infrastructure, digital competence, and implementation in developing countries, particularly Indonesia. Because several studies addressed more than one aspect of AI implementation, the thematic categories were not mutually exclusive.

Table 1. Summary of Selected Studies on AI in Library Services

No	Author(s)	Year	Focus Area	Method	Key Findings
1	Cox et al.	2019	AI in academic libraries	Qualitative	AI enhances service efficiency and user engagement
2	Asemi et al.	2021	AI applications	Review	AI improves cataloging and classification
3	Zhai et al.	2023	Intelligent systems	Experimental	Improves retrieval accuracy
4	Liu & Li	2020	Digital libraries	Case study	Supports personalized services
5	Huang et al.	2022	Chatbots	Mixed-method	Improves real-time interaction
6	Tammaro	2021	Ethical issues	Conceptual	Raises concerns about privacy and transparency
7	Vincent-Lamarre et al.	2020	Algorithmic bias	Quantitative	Bias affects equitable information access
8	Kim et al.	2022	Recommendation systems	Experimental	Enhances user satisfaction
9	Zhang et al.	2021	Machine learning	Review	Improves data organization
10	Wang et al.	2020	Automation	Case study	Reduces manual workload
11	Chen et al.	2021	Information retrieval	Experimental	Increases search precision
12	Garcia et al.	2022	Smart libraries	Qualitative	Supports smart service environments
13	Singh & Kumar	2021	Digital transformation	Review	Accelerates innovation
14	Park et al.	2023	User behavior	Mixed-method	Influences engagement patterns
15	Brown et al.	2020	Virtual assistants	Case study	Enhances user support
16	Ahmed et al.	2022	Big data & AI	Quantitative	Improves decision-making
17	Lee et al.	2021	AI integration	Review	Identifies integration

					challenges	
18	Rahman et al.	2024	Developing countries	Qualitative	Infrastructure adoption	limits
19	Siregar et al.	2021	Indonesia libraries	Qualitative	Limited AI adoption	
20	Putri & Nugroho	2022	Digital library Indonesia	Case study	Partial implementation	
21	Hidayat et al.	2020	Automation Indonesia	Quantitative	Early-stage development	
22	Pratama & Wibowo	2023	AI readiness	Survey	Low digital competence	
23	Lestari et al.	2021	User services Indonesia	Mixed-method	Improves satisfaction	
24	Santoso & Ramadhan	2022	Information literacy	Qualitative	Supports literacy programs	
25	Yusuf et al.	2024	AI challenges Indonesia	Review	Ethical barriers	and technical

Sumber: Authors' synthesis

Trends in the Implementation of AI in Library Services

The analysis indicates that AI has been implemented in both operational and user-oriented library services. Automation and information organization were among the recurring themes, appearing in four studies. Asemi et al. (2021) reported that AI can support cataloging and classification, while Zhang et al. (2021) examined the use of machine learning to improve data organization. Wang et al. (2020) highlighted the role of automation in reducing manual workload, and Hidayat et al. (2020) described automation in Indonesian libraries as being at an early stage of development.

These findings indicate that automation remains an important area of AI implementation because libraries handle large amounts of information and repetitive activities. AI-based systems can assist with tasks that require the processing and organization of large volumes of data, potentially allowing library staff to devote more attention to other service activities.

Information retrieval was identified in two studies. Zhai et al. (2023) reported improvements in retrieval accuracy through intelligent systems, while Chen et al. (2021) found that AI could improve search precision. These findings suggest that AI is increasingly being applied to improve the process through which users locate relevant information. The use of intelligent retrieval systems can support more efficient access to library resources, particularly when users need to search large and diverse collections.

Another trend is the development of personalized and interactive services. Two studies specifically discussed recommendation and personalization. Liu and Li (2020) reported the use of AI to support personalized services, while Kim et al. (2022) examined recommendation systems and their contribution to user satisfaction. In addition, two studies focused on chatbots

and virtual assistants. Huang et al. (2022) found that chatbots can improve real-time interaction, while Brown et al. (2020) reported that virtual assistants enhance user support.

The findings therefore indicate a movement from AI as a tool for internal library operations toward AI as a technology for user-centered services. AI is being used not only to automate routine activities but also to support information discovery, personalization, and interaction with users.

Benefits of AI Implementation

The selected studies indicate several benefits associated with AI implementation in library services. User engagement and satisfaction were identified in four studies. Cox et al. (2019) associated AI implementation with improved user engagement, while Kim et al. (2022) reported enhanced user satisfaction through recommendation systems. Park et al. (2023) examined the influence of AI on user engagement patterns, and Lestari et al. (2021) reported improvements in user satisfaction in Indonesian library services.

These findings suggest that the benefits of AI are not limited to operational efficiency. AI can also influence the way users interact with library services. Recommendation systems can provide more personalized access to information, while chatbots and virtual assistants can provide faster responses to routine user needs. Intelligent information retrieval can also reduce the effort required to identify relevant information.

AI was also associated with broader digital transformation. Garcia et al. (2022) discussed AI in smart library environments, while Singh and Kumar (2021) examined AI in relation to digital transformation and innovation. Furthermore, Ahmed et al. (2022) identified the contribution of big data and AI to decision-making, while Santoso and Ramadhan (2022) reported the use of AI to support information literacy programs.

Taken together, these findings indicate three broad areas of benefit: improved operational efficiency, enhanced user services, and support for organizational development. Automation and information organization contribute to operational efficiency; retrieval, recommendation systems, chatbots, and virtual assistants support user services; while smart library initiatives, digital transformation, and data-supported decision-making contribute to organizational development.

Challenges of AI Adoption

Although the selected studies demonstrate various benefits, they also identify several challenges that may limit AI adoption. Infrastructure and system integration were discussed in three studies. Lee et al. (2021) identified integration challenges, Rahman et al. (2024)

highlighted infrastructure limitations in developing countries, and Yusuf et al. (2024) reported technical barriers to AI implementation in Indonesia.

These findings indicate that successful AI implementation depends on more than the availability of AI technologies. Libraries need adequate technological infrastructure and systems that can be integrated with existing library platforms. Where infrastructure is limited, AI implementation may remain partial or develop gradually.

Digital competence and AI readiness also represent an important concern. Pratama and Wibowo (2023) identified low digital competence as a factor affecting AI readiness. This finding highlights the importance of human resources in AI implementation. Library staff need appropriate knowledge and skills to operate AI-based systems, understand their limitations, and integrate them into existing services.

The findings from developing-country and Indonesian contexts provide further evidence of these challenges. Seven of the 25 selected studies specifically addressed developing countries or Indonesia. Rahman et al. (2024) examined AI implementation in developing countries, while Siregar et al. (2021), Putri and Nugroho (2022), Hidayat et al. (2020), Pratama and Wibowo (2023), Lestari et al. (2021), and Yusuf et al. (2024) discussed various aspects of AI implementation in Indonesia.

The presence of these seven studies (28%) demonstrates that contextual factors are an important part of understanding AI adoption. The literature does not suggest that AI implementation occurs at the same level across all library environments. Instead, implementation is influenced by infrastructure, technological readiness, staff competence, and the existing level of digital transformation.

Ethical Issues in AI-Based Library Services

Ethical issues were identified in three of the selected studies. Tammaro (2021) discussed concerns related to privacy and transparency, while Vincent-Lamarre et al. (2020) examined algorithmic bias and its implications for equitable information access. Yusuf et al. (2024) also identified ethical barriers in the context of AI implementation in Indonesia.

These findings demonstrate that the implementation of AI in libraries involves not only technological and operational considerations but also ethical responsibilities. Libraries manage information and interact directly with users; therefore, the use of AI requires careful consideration of privacy, transparency, fairness, and accountability.

Algorithmic bias is particularly important because AI systems may influence how information is retrieved, recommended, or presented to users. If the data or algorithms used by an AI system contain biases, the resulting services may affect the accessibility and representation

of information. Similarly, systems that process user data require appropriate attention to privacy and responsible data management.

Therefore, ethical considerations need to be incorporated into AI implementation from the planning and design stages. Libraries need to understand how AI systems process data, how automated outputs are generated, and how users are informed about the use of AI in library services.

AI Implementation in Developing Countries and Indonesia

The findings show that developing-country contexts require particular attention in discussions of AI implementation. Seven studies in the review focused specifically on developing countries or Indonesia, representing 28% of the selected literature. These studies generally describe AI implementation as limited, partial, early-stage, or constrained by infrastructure, technical readiness, and digital competence.

In the Indonesian context, Siregar et al. (2021) reported limited AI adoption in libraries, while Putri and Nugroho (2022) described partial implementation in digital libraries. Hidayat et al. (2020) characterized automation as being at an early stage, and Pratama and Wibowo (2023) identified low digital competence as an issue related to AI readiness. At the same time, Lestari et al. (2021) reported positive user outcomes, indicating that AI-based services can provide benefits even when implementation remains developing.

This combination of opportunities and limitations suggests that AI adoption in Indonesia should be considered within the specific conditions of each library. The implementation of AI requires alignment between technological capabilities, human resources, existing library systems, and user needs. Consequently, models of AI implementation developed in highly digitalized library environments may require adaptation before being applied to contexts with different levels of infrastructure and readiness.

Opportunities for Future Development

Despite the challenges, the findings indicate several opportunities for the future development of AI in library services. The use of AI for personalized services, information retrieval, recommendation systems, chatbots, and virtual assistants provides opportunities to develop more responsive and user-centered services.

AI can also support the broader transformation of libraries. The studies on smart libraries, digital transformation, information literacy, and decision support demonstrate that AI can contribute to functions beyond traditional library operations. This suggests that future AI

implementation may increasingly involve the integration of AI into multiple areas of library management and user services rather than focusing on a single application.

However, future development should be accompanied by improvements in staff competencies and technological readiness. The findings indicate that AI adoption cannot rely solely on acquiring new technologies. Training, system integration, infrastructure development, and ethical governance are also necessary to ensure that AI applications are appropriately implemented.

Overall, the synthesis of the 25 selected studies demonstrates that AI implementation in library services is developing across three interconnected dimensions: operational efficiency, user-centered services, and organizational transformation. Automation and information organization demonstrate the operational dimension, while information retrieval, recommendation systems, chatbots, virtual assistants, and user engagement reflect the development of user-centered services. Smart libraries, digital transformation, big data, and decision support demonstrate the broader organizational dimension.

At the same time, the findings show that AI implementation is accompanied by infrastructure, integration, competence, and ethical challenges. These challenges are particularly relevant in developing-country contexts, where technological and organizational readiness may differ from that of more digitally developed environments.

Therefore, the implementation of AI in library services should not be viewed simply as the adoption of new technology. It represents a broader process involving technological infrastructure, human resources, service design, user needs, and ethical considerations. The findings suggest that the future development of AI in libraries will depend on the ability of library institutions to balance technological innovation with responsible and context-sensitive implementation.

In relation to the research question, the review demonstrates that AI implementation in library services is characterized by increasing use of automation, intelligent information retrieval, personalization, conversational systems, and digital transformation. The main challenges concern infrastructure, system integration, digital competence, and ethical issues, while the main opportunities involve improving efficiency, enhancing user-centered services, supporting information literacy, and strengthening the broader digital transformation of libraries.

E. CONCLUSION

This study concludes that the implementation of Artificial Intelligence (AI) has significantly transformed library services into more efficient, adaptive, and user-centered systems. AI is primarily applied in automating core operations, enhancing information retrieval, and enabling

personalized services. However, its adoption remains constrained by infrastructural limitations, low digital competencies among librarians, financial challenges, and ethical concerns such as data privacy and algorithmic bias, particularly in developing countries.

These findings imply that successful AI implementation requires not only technological readiness but also institutional support and human resource development. Therefore, it is essential to strengthen infrastructure, enhance librarians' competencies, and establish supportive policies and ethical frameworks to ensure sustainable AI adoption. Future research should focus on empirical studies and the long-term impact of AI on library services, especially in developing country contexts.

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