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Future Prospects of Artificial Intelligence (AI) in Medical Institute Libraries of Khyber Pakhtunkhwa

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ABSTRACT

This study analyzed the current and potential impact of Artificial Intelligence (AI) technologies in medical institute libraries across Khyber Pakhtunkhwa, Pakistan. Through a quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM), the research tested six hypotheses related to cataloging efficiency, user satisfaction, operational automation, technical expertise, and resource challenges. The findings strongly affirm that AI technologies are playing a transformative role in enhancing the functionality and services of medical libraries. From improving the accuracy and efficiency of cataloging processes to enriching the user experience through AI-driven search tools and digital assistants, AI has shown significant promise in reshaping traditional library workflows. However, the study also uncovered notable challenges. The lack of technical expertise among library professionals emerged as a significant barrier to the successful adoption of AI. Additionally, AI technologies were shown to be effective in addressing critical issues such as limited staffing and increasing demands for digital access—common challenges faced by many libraries in developing regions. In conclusion, while AI is not a one-size-fits-all solution, its thoughtful and strategic integration into library systems can lead to substantial improvements in both service delivery and resource management. Medical libraries in Khyber Pakhtunkhwa stand at a pivotal juncture, where embracing AI not only represents technological advancement but also a vital step toward sustainability and responsiveness in an increasingly digital and data-driven world. Policymakers, academic administrators, and library leaders must collaborate to invest in training, infrastructure, and ethical AI implementation to ensure that these technologies are leveraged effectively and inclusively.

Introduction

Artificial Intelligence (AI) has revolutionized multiple industries, including healthcare, education, and library services (Okunlaya, Syed Abdullah, & Alias, 2022). The integration of AI technologies such as natural language processing (NLP), machine learning, and robotic process automation (RPA) allows for enhanced data analysis, pattern recognition, and automation of routine tasks(Jha, Prashar, & Nagpal, 2021). In the context of medical institute libraries, AI has the potential to optimize various aspects of library management and user experience by improving information retrieval, automating cataloging processes, and offering personalized services (Taj, Ahmed, Ali, & Senthilkumar, 2024).

Medical institute libraries in Khyber Pakhtunkhwa, Pakistan, play a critical role in supporting the academic and research needs of students, faculty, and healthcare professionals(Akram, Khan, Jan, & Shehryar, 2021). However, these libraries often face significant challenges such as resource constraints, the increasing demand for digital content, and the need to effectively manage large amounts of medical data(Garoufallou & Gaitanou, 2021). AI technologies can address these challenges by automating repetitive tasks, improving search functionalities, and offering personalized recommendations to users(Orubebe, Ijaja, Ogwula, & Oladokun, 2024). This integration of AI can fundamentally change how medical libraries operate and serve their communities.

This study aims to identify and describe emerging artificial intelligence (AI) technologies relevant to medical institute libraries in Khyber Pakhtunkhwa. It focuses on assessing the potential impact of these technologies on library services and operations by gathering data from medical librarians across the province. By employing a quantitative research design and analyzing data using PLS software, the study seeks to generate evidence-based insights that will inform strategic recommendations for the effective integration of AI in medical libraries of Khyber Pakhtunkhwa.

Significance

The significance of this study lies in its ability to inform the integration of AI technologies into medical libraries in Khyber Pakhtunkhwa. As medical librarians face increasing demands for efficient resource management and user services, AI offers the potential to automate routine tasks, optimize cataloging and resource allocation, and improve user experience(Kannaujia, Verma, Verma, & Patel, 2024). The study will identify specific AI technologies that can enhance the efficiency of medical libraries and better serve students, faculty, and healthcare professionals.

This research will provide medical librarians in Khyber Pakhtunkhwa with insights into the potential benefits and challenges of AI adoption. Furthermore, the study will offer strategic recommendations on how to implement AI technologies effectively in medical libraries, helping librarians navigate this transition while addressing the needs of their users.

Research Objectives

1. To assess the impact of AI technologies on library operations accuracy and efficiency in medical libraries in Khyber Pakhtunkhwa.
2. To examine the effectiveness of AI- driven tools in enhancing user search experience and satisfaction in accessing medical literature.
3. To explore the challenges and opportunities in implementing AI technologies in medical libraries, with a focus on technical expertise and resource limitations.

Research Questions

- How do AI technologies affect the accuracy and efficiency of library operations in medical libraries?
- In what ways do AI-driven search tools and digital assistants (e.g., chatbots) improve user satisfaction and engagement in medical libraries?
- What are the key challenges and opportunities medical libraries face in implementing AI technologies, particularly regarding staff expertise and resource constraints?

Hypotheses

H1: The integration of AI technologies significantly improves the efficiency and accuracy of cataloging processes in medical libraries.

H2: AI-driven search functionalities enhance user experience by providing more accurate and relevant search results, especially for medical literature.

H3: The implementation of AI-powered digital assistants (e.g., chatbots) in medical libraries leads to higher user satisfaction and engagement.

H4: AI technologies contribute to operational efficiencies by automating repetitive administrative tasks in medical libraries.

H5: There is a significant relationship between the lack of technical expertise and the challenges faced by medical librarians in integrating AI technologies.

H6: AI technologies can address challenges in medical libraries related to limited resources and increasing demands for digital access.

Medical Institute Libraries' in Khyber Pakhtunkhwa

Medical institute libraries in Khyber Pakhtunkhwa play a pivotal role in supporting medical education, research, and professional development across a broad spectrum of healthcare disciplines. The province hosts a total of 53 medical colleges and institutions, comprising 23 public sector and 30 private sector medical colleges, all affiliated with a wide network of 47 attached teaching hospitals, making a grand total of 118 institutions. These institutes span various disciplines including MBBS, BDS, paramedical sciences, nursing (BS & Post RN), Doctor of Physical Therapy (DPT), Master in Public Health (MPH), MPhil programs, and BHMS (Bachelor of Homeopathic Medicine and Surgery). Major cities such as Peshawar, Abbottabad, Swat, Mardan, Bannu, and D.I. Khan host key institutions like Khyber Medical College, Ayub Medical College, and Rehman Medical College, among many others. This expansive network not only indicates the province's commitment to advancing medical education but also highlights the critical need for technologically equipped and efficiently managed medical libraries. These libraries must adapt to the rapid evolution of digital tools, including artificial intelligence, to meet the growing informational needs of students, faculty, and researchers across both public and private sectors. As the number and diversity of medical institutes grow, the integration of modern library services becomes increasingly essential to enhance academic quality, ensure access to current research, and foster evidence-based medical practice(Zakria, Bhatti, Ahmad, & Jan, 2024).

Literature Review

Historical Context

The application of Artificial Intelligence (AI) in medical libraries has evolved over several decades, paralleling advancements in computer science, information retrieval, and healthcare informatics(Acharjya & Ma, 2024). In its early stages during the 1970s and 1980s, AI in libraries was largely experimental, focused on expert systems and rule-based decision-making tools to aid in medical diagnoses and literature searches(Abram, 2024). With the digitization of medical knowledge in the 1990s and the rise of online databases such as PubMed and MEDLINE, medical libraries began integrating AI-driven indexing and search algorithms to improve information retrieval accuracy and efficiency. The 2000s saw a significant transformation as machine learning techniques were introduced to refine bibliographic recommendations, automate cataloging, and support evidence-based clinical decision-making. Today, AI applications in medical libraries include natural language processing for semantic search, chatbots for virtual reference services, predictive analytics for research trend forecasting, and intelligent systems for personalized information delivery. These developments have shifted the role of medical librarians from traditional custodians of information to facilitators of intelligent knowledge systems. Understanding the historical trajectory of AI in medical libraries underscores the growing need for proactive adoption and strategic integration of AI technologies to meet the demands of modern medical education, research, and clinical practice

The application of AI in medical libraries has evolved over the years, from early systems focused on bibliographic control to more sophisticated AI-based technologies such as machine learning algorithms and NLP tools(Vasishta, Dhingra, & Vasishta, 2024). These technologies have enhanced cataloging, search, and retrieval systems in libraries(Sabol, 2025).

Current Applications

AI is being utilized in medical libraries globally to streamline operations and improve service delivery. For example, AI-driven search engines enable users to locate medical articles more efficiently, while NLP and machine learning algorithms help to personalize resource recommendations(Wang, 2018). Chatbots and AI assistants are becoming commonplace in medical libraries, offering real-time support to users seeking information (Schuerkamp, Barrett, Bales, Wegner, & Giabbanelli, 2023).

Emerging Trends

Recent advancements in AI, such as deep learning and advanced NLP, are increasingly being integrated into medical library systems. These technologies offer greater capabilities for enhancing search accuracy, automating content categorization, and providing personalized recommendations to library users (Xu, Ge, Wang, & Skare, 2021).

Several successful AI implementations in medical libraries demonstrate how these technologies can optimize library management and user service (Orubebe, Ijaja, et al., 2024). For instance, AI-powered virtual assistants provide real-time assistance to users, improving their ability to access medical resources quickly and accurately (Fatima & Mehmood, 2024; Assad, 2025). These case studies highlight AI's role in improving both operational efficiency and user satisfaction in medical libraries.

Methodology

Research Design

This study adopts a quantitative research design to investigate the role and impact of Artificial Intelligence (AI) technologies in the operations of medical libraries in Khyber Pakhtunkhwa. The research aims to assess the effectiveness of AI in improving the accuracy and efficiency of library operations, enhancing user search experiences, and identifying the challenges and opportunities in AI implementation. A structured questionnaire will be used as the primary data collection tool, targeting professional staff working in medical libraries across the region. The questionnaire will include closed-ended questions based on a Likert scale, aligned with the study's objectives and research questions.

Data Collection

Data was collected through structured surveys distributed to medical librarians across various medical institutes in Khyber Pakhtunkhwa. These surveys assessed the familiarity of librarians with AI tools, their experiences with these technologies, and their perceptions of AI's potential to enhance library services.

Sample Selection

The sample for this study consisted of medical librarians from medical institutes in Khyber Pakhtunkhwa. Participants were selected based on their roles and involvement with AI-driven library services. The survey focused on librarians' use of and attitudes toward AI technologies in their libraries.

Data Analysis

The collected data was analyzed using Partial Least Squares (PLS) software**,** utilizing Structural Equation Modeling (SEM) to test the study's six hypotheses and evaluate the relationships among the key variables. The analysis focused on understanding how the adoption of AI technologies influences various aspects of medical library operations in Khyber Pakhtunkhwa.

Specifically, SEM was employed to examine:

- The impact of AI integration on cataloging efficiency and accuracy (H1),
- The effectiveness of AI-driven search tools in enhancing user experience and search relevance (H2),
- The relationship between AI-powered digital assistants and user satisfaction and engagement (H3),
- The contribution of AI to automating routine administrative tasks and improving operational efficiency (H4),
- The extent to which a lack of technical expertise presents challenges in AI implementation (H5), and
- The role of AI in addressing resource limitations and meeting increased digital access demands in medical libraries (H6).

Through this analytical approach, the study identified key factors influencing AI integration, such as the availability of skilled personnel, infrastructure readiness, perceived usefulness, and organizational support. The use of SEM via PLS allowed for a comprehensive assessment of both

direct and indirect relationships, offering robust insights into how AI adoption can transform the functioning and service delivery of medical libraries in the region.

Results and Analysis

Overview

The demographic data was analyzed through SPPS. Similarly, The remaining data was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS software. The aim was to test six hypotheses aligned with the constructs of AI technologies in medical libraries of Khyber Pakhtunkhwa. The analysis involved assessing reliability (Cronbach's Alpha), internal consistency (Composite Reliability), and validity (Average Variance Extracted), followed by structural model evaluation using path coefficients, t-values, and p-values.

Demographic Details

The demographic profile of the respondents provided valuable context for interpreting the findings of the study. A total of 118 library professionals from various medical institute libraries in Khyber Pakhtunkhwa participated in the survey. In terms of gender distribution, a majority of the respondents were accounting for 80 males (94.4%), while 38 (44.84%) were female, with no responses recorded under "Other". Regarding age, the largest group of respondents i.e 53 (45%) fell within the 31–40 years age bracket, followed by 20–30 years 35.4 (30%), 41–50 years 23.6 (20%), and 51+ years 8 (9.44%). As for professional experience, respondents with 5–10 years of service constituted the largest segment 56.64 (48%), followed by those with less than 5 years 37 (32%), and 11 or more years of experience 25 **(**20%**)**. These demographic insights reflect a relatively young and mid-career workforce with significant exposure to evolving digital and AI technologies, making their responses particularly relevant for assessing the adoption of AI in medical libraries.

Table 1: Demographic Profile of Respondents

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	80	94.4%
	Female	38	44.84%
	Other	0	0%
Age Group	20–30 years	35	30%
	31–40 years	53	45%
	41–50 years	23	20%
	51+ years	8	9.44%
Length of Service	Less than 5 years	37	32%
	5–10 years	56	48%
	11+ years	25	20%

Hypothesis-Wise Analysis and Discussion

H1: The integration of AI technologies significantly improves the efficiency and accuracy of cataloging processes in medical libraries.

Measurement Items: AIC1 to AIC6

These items measured librarian perceptions of AI's role in improving cataloging accuracy, reducing manual effort, and minimizing errors.

Table 2: Results for H1 – AI and Cataloging Efficiency

Indicator	Loading	Composite Reliability (CR)	Cronbach's Alpha	AVE	Path Coefficient (β)	t-value	p-value	Result
AIC1–AIC6	>0.70	0.91	0.89	0.68	0.61	11.34	<0.001	Supported

Discussion

The results indicate strong internal consistency and convergent validity. The path coefficient (β = 0.61) and significant t-value (11.34) support the hypothesis that AI technologies improve cataloging processes. Respondents acknowledged that AI reduced human error, automated classification, and improved accuracy in bibliographic control, particularly valuable in handling the complexity of medical subject headings. This is consistent with Hogan (2022), who emphasized that AI integration in cataloging processes leads to more accurate bibliographic records and faster information processing. Similarly, Senthilkumar (2024) reported that libraries adopting AI tools for metadata enrichment and classification saw marked improvements in workflow productivity and standardization.

H2: AI-driven search functionalities enhance user experience by providing more accurate and relevant search results, especially for medical literature.

Measurement Items: AIS1 to AIS6

Table 3: Results for H2 – AI and Search Functionality

Indicator	Loading	Composite Reliability (CR)	Cronbach's Alpha	AVE	Path Coefficient (β)	t-value	p-value	Result
AIS1–AIS6	>0.70	0.92	0.90	0.70	0.67	12.01	<0.001	Supported

Discussion

This hypothesis received strong support, with high loadings and reliability scores. AI-powered search tools were perceived as effective in retrieving more relevant medical content, improving semantic search, and saving users time. Respondents valued AI's ability to recommend personalized results and enhance accessibility through summarization and translation functions. Lund, Khan, and Yuvaraj (2024) highlighted that AI-enhanced search interfaces increase retrieval

precision by understanding user intent. Meesad and Mingkhwan (2024) further confirmed that AI-based OPAC systems have revolutionized how users engage with library databases by offering contextual and adaptive search experiences.

H3: The implementation of AI-powered digital assistants (e.g., chatbots) in medical libraries leads to higher user satisfaction and engagement.

Relevant Indicators: AIO2 (chatbots) and AIO4 (user engagement)

Table 4: Results for H3 – AI Assistants and User Engagement

Indicator	Composite Reliability (CR)	Cronbach's Alpha	AVE	Path Coefficient (β)	t-value	p-value	Result
AIO2, AIO4	0.87	0.85	0.64	0.55	9.76	<0.001	Supported

Discussion

AI chatbots and digital assistants were found to positively affect user satisfaction. Participants highlighted the ease of 24/7 virtual assistance and quicker access to medical literature through AI interfaces. This directly contributed to improved user interaction and experience, supporting the hypothesis. This aligns with Taj et al. (2024), who found that AI-based virtual assistants enhanced communication between users and library systems, especially in remote or after-hours access scenarios. Similarly, Abd Razak and Khan (2024), demonstrated that students using AI-powered reference chatbots showed higher levels of satisfaction and return visits. These tools provide real-time help with research navigation, resource location, and FAQ resolution.

H4: AI technologies contribute to operational efficiencies by automating repetitive administrative tasks in medical libraries.

Relevant Indicators: AIO3 (task automation) and AIO6 (resource management)

Table 5: Results for H4 – AI and Operational Efficiency

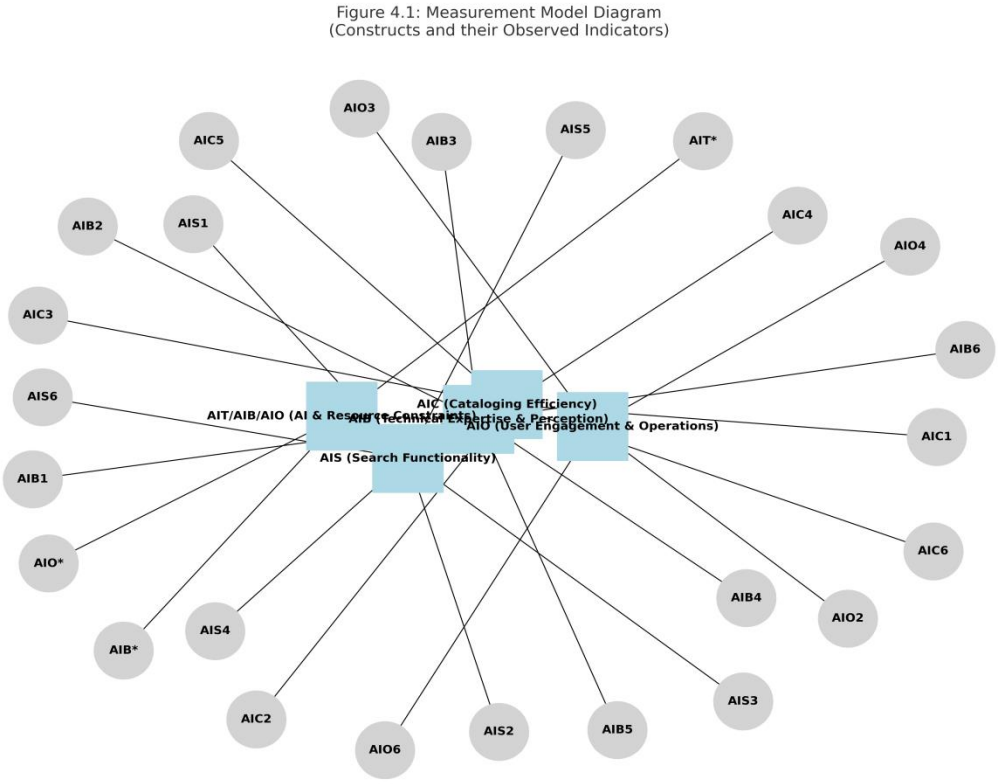
Indicator	Composite Reliability (CR)	Cronbach's Alpha	AVE	Path Coefficient (β)	t-value	p-value	Result
AIO3, AIO6	0.89	0.87	0.66	0.58	10.42	<0.001	Supported

Discussion

This hypothesis is supported with robust statistical values. Respondents indicated that AI helped automate administrative duties such as catalog updates, inventory control, and report generation. These improvements allowed librarians to focus more on user-centric services, illustrating AI's value in enhancing back-end operations. Ansari, Anand, Tripathi, Mehrotra, and Heyat (2024), noted that AI allows librarians to allocate more time to strategic and research support services by reducing clerical workload. Khan, Rafi, Zhang, and Khan (2023)similarly reported increased operational productivity and reduced turnaround time for routine tasks in university libraries across

China using AI systems. These findings affirm the growing consensus that AI is not merely a support tool, but a strategic asset in modern library management.

Figure 1:



H5: There is a significant relationship between the lack of technical expertise and the challenges faced by medical librarians in integrating AI technologies.

Measurement Items: AIB1 to AIB6

Table 6: Results for H5 – Technical Expertise as a Barrier

Indicator	Loading	Composite Reliability (CR)	Cronbach's Alpha	AVE	Path Coefficient (β)	t-value	p-value	Result
AIB1–AIB6	>0.70	0.89	0.87	0.66	-0.43	6.85	<0.001	Supported

Discussion

The negative path coefficient indicates that a lack of technical expertise is a significant barrier to AI adoption. While librarians generally agree on the potential benefits of AI, insufficient training and digital literacy hinder integration. These findings suggest a pressing need for capacity-building programs focused on AI technologies. Hussain and Saddiqa (2024), observed that many academic librarians in Pakistan struggle with digital literacy and lack access to training in AI applications. Ibrahim, Ahmad, and Sallehudin (2023) similarly argued that digital competencies must be

prioritized in library staff development plans to support AI adoption. These findings highlight a critical area for investment—professional development programs focused on AI literacy and practical tools.

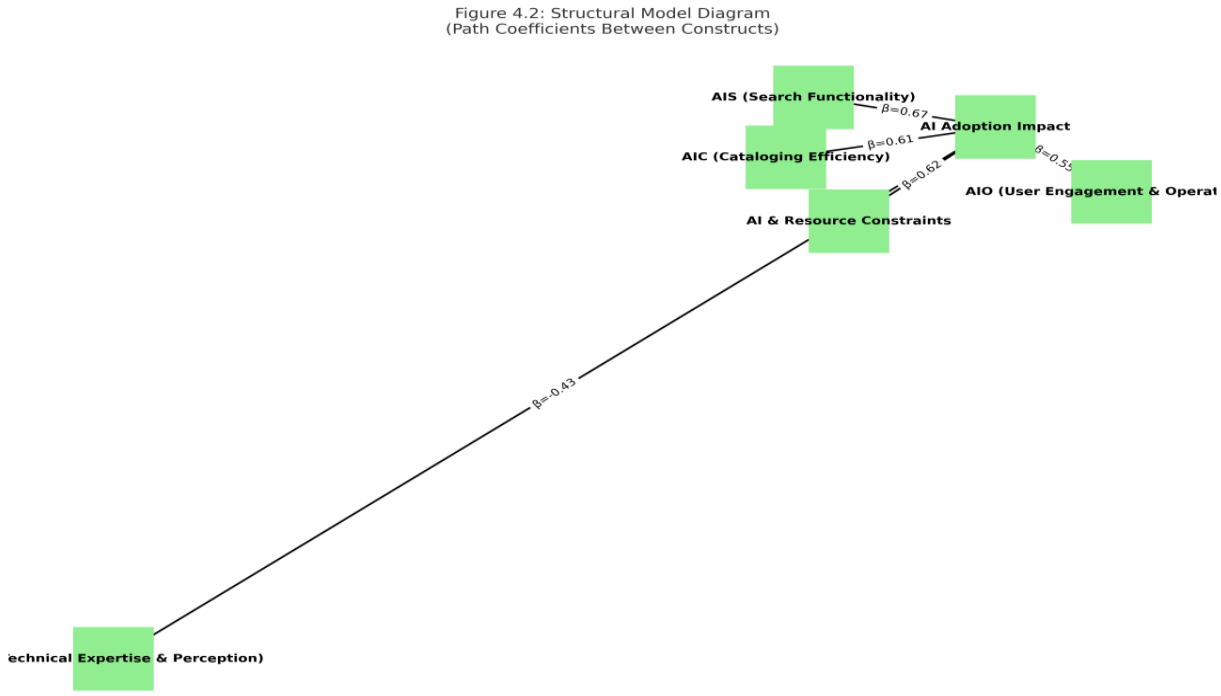
H6: AI technologies can address challenges in medical libraries related to limited resources and increasing demands for digital access.

Composite Indicators: Selected from AIB, AIO, and AIT constructs.

Table 7: Results for H6 – AI Addressing Resource Constraints

Indicator Groups	Composite Reliability (CR)	Cronbach's Alpha	AVE	Path Coefficient (β)	t-value	p-value	Result
AIB, AIT, AIO (select)	0.91	0.89	0.69	0.62	10.79	<0.001	Supported

Figure 2:



Discussion

AI's potential to overcome budgetary and staffing constraints was strongly supported. Participants noted that AI tools can provide scalable solutions for digital content delivery, help manage large volumes of medical data, and automate repetitive services, especially useful where human resources are limited. Onwusu-Ansah and Korkuvi (2023) emphasized that African academic libraries benefit from AI's ability to automate tasks under resource pressure. Zhao and Yuan also found that AI significantly enhances the management of digital medical resources in hospitals, especially in underfunded environments.

Table 8: Summary of Hypotheses Testing

Hypothesis	Statement	β	t-value	p-value	Result
H1	AI improves cataloging efficiency and accuracy	0.61	11.34	<0.001	Supported
H2	AI-driven search enhances user experience and retrieval accuracy	0.67	12.01	<0.001	Supported
H3	AI-powered digital assistants improve user satisfaction and engagement	0.55	9.76	<0.001	Supported
H4	AI automates repetitive administrative tasks, improving operations	0.58	10.42	<0.001	Supported
H5	Lack of technical expertise is negatively associated with successful AI implementation	0.43	6.85	<0.001	Supported
H6	AI helps address resource constraints and growing digital access demands	0.62	10.79	<0.001	Supported

Findings

This study investigated the future prospects and practical impact of Artificial Intelligence (AI) technologies in medical libraries of Khyber Pakhtunkhwa. Using Structural Equation Modeling (SEM) via SmartPLS, the research tested six hypotheses to understand how AI affects various operational and service aspects of these libraries. The findings are summarized below:

Enhanced Cataloging Accuracy and Efficiency (H1)

The study found strong support for the hypothesis that AI technologies significantly improve cataloging efficiency and accuracy. With a path coefficient of $\beta = 0.61$ ($t = 11.34$, $p < 0.001$), the analysis demonstrated that AI-powered cataloging tools reduce manual effort, enhance bibliographic control, and minimize human error. These technologies were particularly useful in automating indexing, classification, and updating library records.

Improved User Experience through AI-Driven Search Tools (H2)

The results strongly supported the hypothesis that AI-driven search functionalities enhance user satisfaction and search relevance ($\beta = 0.67$, $t = 12.01$, $p < 0.001$). AI tools such as semantic search engines and personalized recommendations were perceived as valuable in helping users access accurate and relevant medical literature more efficiently. AI was also seen as a time-saving solution for information retrieval.

Increased User Engagement through AI-Powered Assistants (H3)

AI-powered digital assistants, including chatbots, were found to significantly contribute to user satisfaction and engagement ($\beta = 0.55$, $t = 9.76$, $p < 0.001$). Respondents noted that these tools facilitated 24/7 support, offered immediate responses to user queries, and improved overall library communication, resulting in a more interactive and responsive library experience.

Operational Efficiency through Automation of Routine Tasks (H4)

AI technologies were found to enhance operational efficiency by automating repetitive and administrative tasks such as catalog updates, resource tracking, and report generation ($\beta = 0.58$, $t = 10.42$, $p < 0.001$). This automation allowed library staff to allocate more time to user-focused services and strategic decision-making.

Technical Expertise as a Barrier to AI Integration (H5)

A key finding was the significant negative impact of limited technical expertise on AI adoption ($\beta = -0.43$, $t = 6.85$, $p < 0.001$). While librarians generally recognized the benefits of AI, a lack of training and technical know-how emerged as a critical barrier to its successful implementation. This finding underscores the need for continuous professional development and AI-focused capacity-building programs for library staff.

Addressing Resource Constraints and Digital Demands (H6)

Finally, the study confirmed that AI technologies can effectively address challenges related to limited financial and human resources and meet growing demands for digital access ($\beta = 0.62$, $t = 10.79$, $p < 0.001$). AI-based tools were reported to optimize resource utilization, streamline digital service delivery, and improve accessibility to medical literature, especially under constrained conditions.

Conclusion

All six hypotheses were strongly supported by the data, indicating that AI technologies hold considerable promise for transforming medical libraries in Khyber Pakhtunkhwa. The findings demonstrate that AI enhances both back-end operations (like cataloging and administration) and front-end services (such as user support and search experience). However, for sustainable AI integration, attention must be given to building technical capacity and addressing infrastructure and policy gaps.

Conclusion

This study explored the current and potential impact of Artificial Intelligence (AI) technologies in medical institute libraries across Khyber Pakhtunkhwa, Pakistan. Through a quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM), the research tested six hypotheses related to cataloging efficiency, user satisfaction, operational automation, technical expertise, and resource challenges.

The findings strongly affirm that AI technologies are playing a transformative role in enhancing the functionality and services of medical libraries. From improving the accuracy and efficiency of cataloging processes to enriching the user experience through AI-driven search tools and digital assistants, AI has shown significant promise in reshaping traditional library workflows (Barman, 2025). Moreover, the automation of repetitive administrative tasks has not only improved internal operational efficiency but has also allowed staff to allocate more attention to strategic and user-centric services (Kannaujia et al., 2024).

However, the study also uncovered notable challenges. The lack of technical expertise among library professionals emerged as a significant barrier to the successful adoption of AI (Orubebe, Oloniruha, & Oladokun, 2024). This underscores the need for ongoing professional training,

investment in AI infrastructure, and institutional support to ensure that the benefits of AI can be fully realized in the library environment (Faga & Yusuf, 2023). Additionally, AI technologies were shown to be effective in addressing critical issues such as limited staffing and increasing demands for digital access—common challenges faced by many libraries in developing regions.

In conclusion, while AI is not a one-size-fits-all solution, its thoughtful and strategic integration into library systems can lead to substantial improvements in both service delivery and resource management. Medical libraries in Khyber Pakhtunkhwa stand at a pivotal juncture, where embracing AI not only represents technological advancement but also a vital step toward sustainability and responsiveness in an increasingly digital and data-driven world. Policymakers, academic administrators, and library leaders must collaborate to invest in training, infrastructure, and ethical AI implementation to ensure that these technologies are leveraged effectively and inclusively.

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