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Efficacy and barriers in using Artificial Intelligence in Libraries: A survey of university librarians

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Abstract

AI has emerged as a groundbreaking technology in the contemporary online era and is changing academic libraries, where it makes them more efficient and effective to acquire information and deliver customer-oriented services. The current study focuses on the application of Artificial Intelligence (AI) in the Pakistani university libraries with particular focus on the perceptions of university librarians about the efficacy of AI and the challenges associated with its application. A quantitative research methodology is adopted in the study, where a structured questionnaire was adopted. The data from 160 librarians in both the public and the private sector libraries in the universities were collected through convenient sampling. The descriptive (frequencies, percentages, mean scores, and standard deviation)) and inferential statistics (correlation and t-test) were used for data analysis. The findings indicate that the librarians strongly agreed about the effectiveness of AI in libraries and hence they favor the use of AI in libraries. Respondents also faced certain significant barriers which include the lack of training, financial issues, bad infrastructure, and weak institutional support. Correlation analysis reveals that perceptions of AI effectiveness have positive correlation with each other. Demographic factors have also affected the opinion of respondents about the challenges of AI. In conclusion of this paper, it is recommended that AI in Pakistan should be

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incorporated under a strategic plan, infrastructure investments, and training of the staff professionally.

Keywords: Artificial Intelligence (AI), University Libraries, Librarians Perception, AI Expertise, Library Automation, Information Retrieval, Digital Libraries

Background of the Study

Artificial Intelligence is a field of computer science that deals with the design of machines that could carry out the functions usually carried out by the intelligence of a human being like learning, reasoning, making decisions and recognizing patterns. With time, AI has become one of the most spreading areas of technology and has impacted a variety of professional areas, such as higher education, e-learning, as well as library services (Campolo et al., 2017; Arkorful and Abaidoo, 2015). The libraries have always been changing and aligning with the technology to enhance access to information and the changing needs of the users. Earlier forms of automation improved acquisitions, cataloguing, circulation, indexing, and retrieval systems. With the rise of AI, these traditional forms of automation have become more intelligent, enabling libraries to provide more efficient, accurate, and personalized services (Bailey, 1991; Wu et al., 2015; Wu et al., 2019). As a result, the concept of the "intelligent library" has emerged, emphasizing a library environment that is smart, responsive, and highly user-centered (Cox et al., 2019; Shen, 2019a; Shen, 2019b).

AI contributes to university libraries in several important ways. It automates routine and repetitive tasks such as cataloguing, classification, metadata generation, and sorting of information resources. Machine learning tools help reduce human error and improve processing speed, allowing libraries to manage collections more efficiently (Ahluwalia et al., 2020). AI-powered chatbots and virtual assistants also improve user interaction by providing twenty-four-hour support, responding to common queries, and guiding users toward appropriate information resources (Anagnostopoulos, 2018; Clark et al., 2018). Moreover, AI can be used to assist libraries in predictive analytics, i.e., by examining

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usage and user behavior patterns to guide administrators with informed choices during collection development and service planning (Cummings et al., 2018). It also aids in the digitization and preservation of the library resources by using the features of text recognition, image recognition, and optical character recognition to allow access to the archival materials to the researchers (Hendrikse et al., 2019). A personalized recommendation system enhances the user experience; that is, it will recommend relevant books, articles, and digital materials based on the interests of the user and the history of his or her borrowing (Ozili, 2020).

The AI application in university libraries is at its infancy in Pakistan. Recent research suggests that the use of AI-based applications is limited to speech technologies, Google Assistant-based search, RFID systems, and intelligent data analysis (Ali et al., 2020). However, regardless of this increased significance of AI, several university libraries in Pakistan still encounter the challenges of poor technological infrastructure, untrained personnel, insufficient budget allocation, and inadequate institutional preparedness. These problems render the need to study the current state of AI implementation in Pakistani university libraries and to investigate the opportunities of its future evolution.

The study is required due to the increased size of the role of AI in academic libraries and the lack of empirical studies about its application and challenges in its use in Pakistan. The university library services must be quick, pertinent and effective in a digitalized academic realm that is becoming more and more digital. The existing systems are no longer considered fit to support the requirement of the current users who require the time sensitive access, the intelligent search service and the customized services. Although the area of international scholarship provides much debate on AI in libraries, minimal research has been carried out on the specific Pakistani universities. It is needed to analyze the existing state of affairs concerning the introduction of AI and the librarian attitudes and the factors that define its use in the Pakistani university libraries. The study is important because it can enable librarians, university administrators, and policymakers to

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know more about the practical implementation of AI and where it may be enhanced in a strategic manner. It can also be involved in future infrastructure planning, employee training and digitalization of academic libraries. It can help to comprehend the potential limitations of AI usage and aid in making the decisions regarding the infrastructure development and financing, policy creation, and capacity building of the staff. The results can also make institutions upgrade to better and more advanced library systems.

Research Questions

The study seeks to answer the following research questions:

1. What are librarians' perceptions regarding the effectiveness and usefulness of AI in university library services?
2. What barriers do librarians face in developing and applying AI-related skills in university libraries?
3. Is there any impact of demographic variables on effectiveness and barriers of using AI in university libraries?

Literature review

Benefits of using AI in University Libraries

The artificial intelligence (AI) can be described as a various set of computer systems that replicate the functions of complex human cognition that traditionally entails the reasoning, learning, language analysis, pattern-recognition, and decision making (Russell and Norvig, 2016). With the history of university libraries being founded on the knowledge management (in custodial form) AI is not only revolutionizing the back-office processes (cataloguing, metadata creation, resource indexing) but also the front-of-rest processes (reference assistance, user search, personalized recommendations). The conceptual understanding of AI in academic libraries is an ecosystem of combined computational technologies which may expand the work of the human and enhance the discovery, in addition as intelligent decision-supporting both the librarian and the client (Azimi et al., 2022; Shahzad & Iqbal, 2023).

The most common benefits that have been mentioned in the literature are the increased efficiency, expedited service delivery, enhanced information retrieval, individualization

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of user experiences, and the 24/7 service availability. Robotics can minimize time and labor spent on repetitive tasks in indexing, metadata generation, and perfunctory process of query responses so that librarians can have more time to spend in the more advanced level of academic and teaching support. According to bibliometric evidence, researchers are also starting to relate AI in academic libraries to a better user experience, automation of routine tasks, and better decision-making in library management. On the service level, AI is appreciated as it has the potential to assist libraries in delivering quicker and more helpful responses, making more pertinent suggestions, and offering smarter discovery experiences that are harmonized with the expectations of the modern user (Cox, 2023; Islam et al., 2025).

These general claims are also supported by the literature published from Pakistan. AI has already been linked to increased access and efficiency in the work of university libraries. Similarly, the SWOT analysis study found that librarians viewed AI as a means of providing more innovative services and service better to the user. Collectively, these studies point to the fact that the perceived value of AI is not only in the automation, but also in the possibility of modernizing the library services and turning them into more user-friendly ones. Asim et al. (2023) and Ali et al. (2024) demonstrate that the community primarily emphasizes the importance of the research topic in question prove that the community itself attaches the primary importance to the research topic in question.

Barriers to AI Adoption in University Libraries

Although Artificial Intelligence (AI) can be used to transform the university library, it encounters many obstacles, both organizational and human-oriented. The studies always highlight the idea that the presence of technological capability is not enough to ensure successful AI integration, as the presence of the institutional readiness, professional skills of the personnel, policy frameworks, and long-term investment are all essential in determining the outcomes of the adoptions (Ayinde et al., 2026; Huang, 2024; Jan, Khan,

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and Khan, 2024). The knowledge of these barriers is critical to coming up with effective strategic plans to ensure that the advantages of AI are greater and the risks reduced.

One of the most mentioned barriers to AI adoption is the lack of funds. Funding limitations were cited in almost 48 percent of studies reviewed by Ayinde et al. (2026) as one of the main barriers to the implementation of AI systems in academic libraries. Such limitations are lack of finances to fund hardware, software licenses and cloud-based artificial intelligence services. The acquisition of modern AI technologies like machine learning systems, neural network-based data cataloging tools, or natural language processing tools is frequently restricted by the financing constraints, since these systems demand significant investments both to be acquired and maintained (Huang, 2024). Equally, Jan, Khan, and Khan (2024) have found that the size and the financial capability of a university in Pakistan has direct effect on the readiness to adopt AI. Greater institutions that have higher financial and technological capabilities can implement AI-enabled systems more easily, but smaller universities cannot even implement simple automation. These results indicate that adoption of AI is not a technical task only, but also an economic and institutional one, which entails planning over the long term and budget investment.

Weakness in terms of technological infrastructure is another major obstacle. The adoption of AI should have dependable IT systems, high-speed servers, cloud computing systems, and integrated library management systems with the capacity to accommodate AI processes. Asim et al. (2023) emphasized that many libraries of Pakistani universities experience disjointed technological infrastructure, and the inclusion of AI solutions is complicated and subject to breakdown. A study conducted by Huang (2024) also highlighted that in Taiwan, academic libraries had insufficient technical facilities in order to adopt advanced AI technologies, including predictive analytics engines, machine-learning-based recommendation systems and automated metadata generators. Poor

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bandwidth, old hardware and poor software environments lower reliability of the systems and hinder experimentation and innovation.

Human factors are also important even in cases where there are the funding and the technology. The use of AI systems will involve digitally literate staff that has data analytics and knowledge of machine learning algorithms (Ayinde et al., 2026). Most university libraries have librarians and do not have the specialized skills to set up, track, and assess AI applications (Asim et al., 2023). Ayinde et al. (2026) have determined retraining and professional development as an essential part of AI adoption in the systematic review. In the absence of sufficient staffing, AI tools might be underutilized, mismanaged or applied in a manner that does not bring the planned benefits. As Huang (2024) points out, the problem of skill gaps should not be limited to technical knowledge, but should also include the knowledge of the ethical use of AI, data privacy, and the skills to leverage AI-driven recommendations according to the requirements of an academic research project.

The successful implementation of AI requires the presence of high-quality information, which also creates other issues with data management and security. Jan et al. (2024) discovered that the issues of data privacy, security, and adherence to institutional policies are often a major concern in the implementation of AI systems by Pakistani university libraries. Lack of standard data governance systems has turned AI implementation into a dangerous undertaking especially in situations where patron or student data or proprietary research data are involved. The integrity of data is of essential importance as well: AI algorithms are based on clean, structured and correctly labeled data to perform optimally. The use of AI applications can be less effective due to inconsistency of cataloging, incomplete metadata and poor record keeping, and the potential to automate and provide personalized recommendations is curtailed (Asim et al., 2023).

Institutional preparedness is not just about infrastructure and expertise but also about strategic planning and governance as well as policy alignment. Those libraries that lack a

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well-defined approach to the integration of AI can introduce technology here and there, which contributes to the disruption of the workflow and the emergence of redundancy (Ayinde et al., 2026). Ethical risks related to policy gaps include algorithmic bias when facilitating a recommendation system, unequal access, and automated analytics used to make administrative decisions (Huang, 2024).

The role of organization culture also has its role. The unwillingness of personnel to change, the fear of being replaced by AI, or uncertainty in its efficiency can become the barriers to adoption. These human and cultural barriers emphasize the need to handle change management programs, lifelong education, and decision-making efforts (Jan et al., 2024).

Research methodology

The research takes a quantitative approach. Quantitative research is appropriate in situations where the researcher aims at gathering numerical data and statistically analyzing them in a bid to establish patterns, relationships and trends. The research design is descriptive and correlation survey research. The descriptive design can be employed when the goal is to describe the current situation, conditions, practices and perceptions with regards to a certain phenomenon. The descriptive design of the study is used to investigate the opinion of librarians about the effectiveness of AI application in university libraries. The survey approach is only appropriate since the researcher can directly gather information by administering a questionnaire on the respondents. It is also an effective means of obtaining information of a relatively large sample in a restricted period.

One of the most popular techniques of the quantitative research is a survey that is usually employed in the studies of social sciences, library and information science studies. It enables the researcher to get the answers of the participants that relate to their opinions, attitudes, experiences, and practices. In this study, data collection will be done through the survey approach among librarians working within university libraries. The

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questionnaire was structured in such a manner that it collected data on effectiveness of AI and existing obstacles in its adoption.

Population and sampling

The population of the study was the library professionals working in the university libraries. The target population consists of university librarians working in government and private sector university libraries.

The current research employed non-probability sampling technique for selection of participants. The convenience sampling method suits a situation where the respondents are selected according to their availability and readiness to be involved. In academic circles, this method is common when the researcher has fewer time and resources. This method is appropriate in the current research since librarians in the respective university libraries can be approached to collect the necessary data easily. In spite of the fact that convenient sampling can challenge the generalizability of the results, it can still be applied in exploratory and descriptive research in which the objective is to gain useful and timely answers to questions by the appropriate respondents.

Data Collection and analysis Procedure

The data was gathered through questionnaires that have been printed or online, depending on the accessibility of the respondents. The concerned university authorities and library administration permission in the first place. Upon receiving the consent, the researcher will contact the chosen respondents and tell them about the objective of the study. The respondents were informed that their participation was voluntary and the information they give will be utilized for academic purpose only. The questionnaires was administered and the participants were given ample time to complete the questionnaires. When online distribution is involved, the questionnaire link was distributed via email or other channels of communication.

The collected data was processed and analyzed through the Statistical Package of the Social Sciences (SPSS), which is commonly presented as a method of statistical analysis

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and data visualization on the research of the social sciences. The descriptive statistics were utilized as the major form of analysis, and it gave a clear picture of the data collected. These statistical tools were used in the presentation of a general demographic profile of the respondents and their responses to the questionnaire questions. The tables were used systematically to present the results in an attempt to make the results more understandable. Besides the descriptive analysis, the inferential statistical methods were used to verify the hypotheses of the study and to investigate the relationship between necessary variables. It was done by using Pearson Correlation and Independent Samples T-Test.

Results

Demographic Information of Respondents

Table 1 presents the gender distribution of the respondents included in the study. The results indicate that out of a total of 160 participants, 93 respondents (58%) were male**,** **while** 67 respondents (42%) were female

With respect to age, the respondents were aged 31-40 years with 67 people (42%) in this age bracket which means that most of the librarians are in their mid-career range. This is followed by the 20-30 years' age group which has 61 respondents (38%) which demonstrates that a large percentage of young professionals are joining the field. Conversely, the 41 year to 50 years' age bracket had a balance of 32 respondents (20%) which is a smaller yet mature group of the population. The fact that there were no respondents older than 50 years indicates that there were not many senior professionals represented in this study.

With respect to the educational qualifications of the respondents, most of them (48%) had an MPhil degree, with 32% having BS/MLIS and 20% having PhD. This indicates that most respondents have advanced academic qualifications.

Most librarians had 1–5 years of experience (42%)**,** followed by 6–10 years (30%)**,** while 28% had more than 10 years of experience. This indicates that the majority of participants

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are early to mid-career professionals, which may influence their familiarity and engagement with AI technologies in libraries.

Most of the respondents were employees of government university libraries (104 respondents, 65%), whereas 56 respondents (35%), were employees of private university libraries.

Table 1: Demographic detail of respondents

Gender	**Frequency**	**Percentage**
Male	93	58%
Female	67	42%
Type of library		
Government	104	65%
Private	56	35%
Age Group		
20–30	61	38%
31–40	67	42%
41–50	32	20%
Qualification		
BS/MLIS	51	32%
MPhil	77	48%
PhD	32	20%
Experience		
1–5 years	67	42%
6–10 years	48	30%
More than 10 years	45	28%
Total	**160**	**100%**

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Efficacy of Artificial Intelligence (AI) for libraries

Respondents were asked about the efficacy of AI in libraries. They agreed or strongly agreed that AI is very effective for library operations. The respondents consider AI effective in finding and accessing information (M=4.43). AI can be used for managing digital library (M=4.40) and also help library information systems to work better (M=4.20).

Table 2: Efficacy of artificial intelligence for libraries

Statements	Mean	SD
AI makes it easier to find and access information.	4.43	.738
AI technologies are helpful for managing digital libraries.	4.40	.783
AI can make library systems work better overall.	4.20	.693
AI is an important for university libraries in Pakistan.	4.13	.643
AI reduces mistakes in handling and managing data.	3.89	.908

Scale (5=Strongly agree, 4= Agree, 3=Undecided, 2=Disagree, 1=Strongly disagree)

Barriers in using AI in libraries

Respondents were asked about the barriers they experienced for the use of AI in libraries. They agreed or strongly agreed about the barriers they experienced. The main barrier they experienced was insufficient technology expertise that hinder them in the effective use of AI in libraries (M=4.21). They were not provided sufficient human resource development opportunities (M=4.15). They also have fear about the use of AI, insufficient finances and lack of opportunities to experience AI in libraries.

Table 3: Barriers in building expertise about AI use in libraries

Statements	Mean	SD
Insufficient technological expertise hinders me in the use of AI	4.21	.926

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Insufficient human resource development opportunities hinders	4.15	.709
Fear of complexity of AI	4.11	.969
Insufficient finances hinders the use of AI	3.95	.901
Lack of opportunities to experience AI adoption	3.83	.814

4.4. Impact of demographic factors on the effectiveness of using AI in libraries

- Independent Sample t-test was used to examine the impact of gender on effectiveness of AI for university libraries. Effectiveness of using AI in university libraries is not affected significantly by gender but values of mean show that male has considered AI more effective for university libraries as compared to female.
- Independent Sample t-test was used to examine the impact of sector of libraries on effectiveness of AI for university libraries. Effectiveness of using AI in university libraries is affected significantly by sector. Mean values show that government sector librarians considered AI more effective for university libraries as compared to private sector librarians.
- Pearson correlation was used to examine the relationships of age, experience and education with effectiveness of using AI in university libraries. Opinion about the effectiveness of using AI in libraries is negatively correlated with age, experience and education. Increase in education, age and experience respondents consider the use of AI less effective. The results for experience were statistically significant.

Table 4: Impact of demographic factors on effectiveness of AI use in university libraries

Demographic factors	**Test used**	**Mean/Pearson correlation**	**Sig.**
Gender			
Male	Independent-Sample T Test	4.14	.116
Female		4.32	
Type of library			
Government	Independent-Sample T Test	4.34	**.038**
Private		4.08	
Education	Pearson correlation	-.072	.521

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Age	Pearson correlation	-.155	.166
Experience	Pearson correlation	**-.189***	**.051**

Impact of demographic factors on barriers in using AI in libraries

- Independent Sample t-test was used to examine the impact of gender on barriers in using AI for university libraries. "Barriers in using AI" is not affected significantly by gender but values of mean show that females felt more barriers as compared to male.
- Independent Sample t-test was used to examine the impact of sector of libraries on using AI in university libraries. "Barriers in using AI in university libraries" is not affected significantly by sector. Mean values show that government sector librarians considered less barriers in the use of AI as compared to private sector university librarians.
- Pearson correlation was used to examine the relationships of age, experience and education with barriers in using AI for university libraries. Opinion about the barriers in using AI is positively correlated with age, experience and education but results are not statistically significant. Increase in education, age and experience respondents felt higher barriers in using AI in university libraries.

Table 5: Impact of demographic factors on barriers in using AI in university libraries

Demographic factors	**Test used**	**Mean/Pearson correlation**	**Sig.**
Gender			
Male	Independent-Sample T Test	4.01	.372
Female		4.10	
Type of library			
Government	Independent-Sample T Test	3.98	.351
Private		4.10	
Education	Pearson correlation	.101	.355
Age	Pearson correlation	.048	.670
Experience	Pearson correlation	.126	.261

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Findings

The results show that librarians have a very favorable attitude to AI in library systems. A majority of the respondents responded that AI plays a major role in enhancing efficiency of library operations. The field of AI was believed to have significant application in improving the search of information, managing digital library, and generally improving the overall efficiency of the system. The mean scores of statements regarding AI effectiveness are rather high, which proves that librarians see the AI as a significant tool that modern libraries in Pakistan use. Such an optimistic outlook is an indication that librarians are willing to embrace AI technologies.

Although the perception was positive, a number of obstacles were found to impede effective application of AI to the university libraries. Lack of technological knowledge of the librarians was cited as the greatest obstacle. Lack of professional development programs and lack of proper training opportunities was also noted by the respondents. Another significant problem that impacted the implementation of AI technologies was financial constraints. Also among the challenges were fear of complexity and lack of real-life exposure to AI tools. These obstacles show that librarians would like to use AI but institutional and technical constraints do not allow them to do so.

Conclusion

It is concluded that Artificial Intelligence has immense possibilities to reform university libraries by enhancing efficiency, accuracy, and satisfaction. The perception of AI is mostly positive among librarians in Pakistan, and they acknowledge the significance of AI in the contemporary library services. Nevertheless, the adoption of AI is at its infancy because of a number of obstacles. Technical incompetence, inadequate training, financial resources, and less exposure to AI applications are among the key factors. Even though librarians have the basic knowledge of AI applications, there is observable deficit of advanced skills that would be used to ensure proper implementation. Librarians are already greatly interested in learning AI, and this is why the institutions can invest in

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training and development. To sum it up, AI should be incorporated into the university libraries successfully with the help of a combination of efficient human resources, institutional support, technological infrastructure, and strategic planning. There should be a continuous improvement in the professional development to enable librarians to be abreast with new technologies. The government and university administrations are to set aside enough funds to adopt AI technologies. Digital infrastructure must be invested in to be successfully implemented. The libraries are advised to start pilot projects to launch the use of AI-based systems that include chatbots, recommendation systems, and automated cataloging. Experience will enable the librarians to become more confident and less resistant to change. Libraries are encouraged to work with IT specialists, software developers and research centers in coming up with new AI applications. National and international cooperation should be promoted.

Sensitization exercises must be held to inform librarians on the use and value of AI. This will contribute to decreasing fear and raising the level of acceptance of new technologies. To make sure that AI has been implemented systematically in academic libraries, higher education authorities must come up with policies and guidelines on how AI can be integrated in the libraries.

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