

READINESS OF LIBRARY PRACTITIONERS TOWARDS THE USE OF ROBOTICS TECHNOLOGY IN PAKISTANI MEDICAL LIBRARIES

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ABSTRACT

This study aims to evaluate the current readiness in terms of infrastructure, policy frameworks, and human resources for the adoption of robotic technologies. It also aims to investigate the awareness among librarians regarding the benefits and challenges associated with robotics in library operations. The author used a quantitative approach and a structured questionnaire adapted from previous studies (Owolabi et al., 2022; Lund et al., 2020) to collect data from 48 medical libraries in Khyber Pakhtunkhwa, including 17 medical college libraries. The data was collected through Google Forms and analyzed using MS Excel 2010 and SPSS. The survey findings indicate that medical libraries in the region are facing significant challenges in integrating robotic technologies. According to the respondents, the challenges include the absence of clear policy frameworks (45.83% disagree), inadequate training for library staff (41.6% strongly disagree), and insufficient investment in professional development (77.08% strongly disagree). While most librarians are familiar with robotic technology, they only have moderate awareness of its specific applications and efficiency improvements. Other challenges mentioned include limited financial resources (66.66% agree), job insecurity (100% agree), and inadequate communication infrastructure (56.25% agree). Despite the high level of awareness about robotics, the readiness for adoption remains limited. This study emphasizes the importance of medical libraries in Pakistan upgrading their infrastructure, establishing clear policies, and investing in staff training to effectively incorporate robotic technologies, while also addressing financial and employment issues. These findings can provide guidance to libraries in overcoming obstacles and integrating robotics to enhance operational efficiency. This research offers a new regional viewpoint on the adoption of robotic technology in medical libraries in Khyber Pakhtunkhwa, Pakistan. It provides a thorough assessment of readiness that is currently missing in the literature. This sets a standard for future studies and offers practical recommendations for libraries in developing contexts.

Keywords: Medical libraries, robotic technologies, readiness assessment, infrastructure, policy framework, human development, Pakistan

INTRODUCTION

A medical library is established to assist healthcare professionals, students, and researchers in accessing information to improve, progress, and evaluate healthcare. These libraries are situated in hospitals, medical schools, research centers, and health association facilities (Haq & Ullah, 2014). Medical

libraries are essential for organizations involved in the rapidly expanding field of health sciences. They are distinct from general libraries in terms of their collection building services and functions, as they are required to play a vital role in delivering effective healthcare by providing current and relevant information (Matthews & Picken, 1979). "The medical

libraries are a center in which the medical knowledge would be stored systematically and to which the medical professional could apply for the most recent information on their subjects. The concept of ready access to a comprehensive store of recorded knowledge has constituted an idea towards which many have worked" (Ahmed, 1969). Medical libraries utilize robotic technologies to enhance their operations, improve services, and increase efficiency in order to effectively fulfill their mandate. Scholars have defined robotics as a subset of AI that is related to physical and motor tasks, along with machine learning (Abraham, 2019). "Robots are mechanical devices that automate tasks under direct human supervision or a predefined program and set of general guidelines, utilizing AI techniques" (Talaviya, Shah, Patel, Yagnik, & Shah, 2020).

A robot is closely related to AI, which means it is involved in perceptual, motor tasks, and machine learning (Tella, 2020). The term "robot" does not have a single universally accepted definition due to its various uses. However, a robot can be described as a "device that works on behalf of a human, automatically and continuously performing specific steps or procedures." Robots can be classified based on their roles, missions, and forms (Harada, 2017). In 2018, Kamble et al. identified various new technologies associated with the Fourth Industrial Revolution (4IR). These technologies include the Internet of Things (IoT), big data analytics, cloud computing, augmented reality, robotic systems, simulation prototypes, and 3D printing. This implies that the 4IR is defined by the convergence of technologies, blurring the boundaries between the physical, digital, and biological realms, collectively known as cyber-physical systems (Kamble, Gunasekaran, & Gawankar, 2018). A robot is a machine that can perform complex tasks through automated actions programmed by a computer. The use of robotics in libraries has numerous benefits and creates new opportunities in library operations, as libraries offer a growing array of digital services and resources that can be easily managed by robots. Many libraries, including academic institutions in both developed and developing countries, have implemented robotic technologies to streamline their work. This can be attributed to the ability of robotic technologies to move in various ways, such as scrambling, rolling, and climbing (Wang & Siau, 2019).

RELATED LITERATURE

There are multiple applications of robotic technologies in academic libraries, including autonomous self-reading robots, telepresence, chatbots, and humanoid robots for reference services and maintenance of circulation records in the library (Tella, 2020). Wood and Evans found that 56.3% of academic librarians acknowledged that the integration of robotics in academic libraries would revolutionize librarianship (Wood & Evans, 2018). The adoption of robotic technologies in academic libraries in developed countries has completely transformed user experience, making information more accessible, intuitive, and entertaining (Cotera, 2018). Many libraries in Singapore are utilizing robots to aid library staff in sorting returned books, conducting shelf reading, and transporting library materials (Liau, 2017). This indicates that the presence of robots in academic libraries provides librarians with more time to focus on other important library information service delivery tasks aimed at satisfying users (Liau, 2017). Robotic technologies can be utilized in academic libraries in Nigeria for tasks such as shelving, locating library materials, ensuring security, and responding to user inquiries (Tella, 2020). Various factors that can promote the adoption of robotic technologies in academic libraries include modular architecture, self-learning, and natural language processing (Gujral, Shivarama, & Choukimath, 2019). Robotics enhance library operations by optimizing collection analysis, visualization, and preservation, while reducing service delivery costs (Tella, 2020). Librarians will play a significant role in the future of robotics, and libraries are adapting to the use of this technology (Ali, Naeem, & Bhatti, 2020). The study found that librarians have not been responsive to implementing technology in libraries. Additionally, it revealed that a lack of knowledge and awareness about the benefits and cost savings of this technology makes it difficult for librarians and library administrators to adopt it. When library managers understand the importance of using technology to provide regular services, they will be more confident in adopting and applying AI (Adebayo, Ahmed, & Adeniran, 2018). The readiness of university libraries to apply robotic technologies depends on factors such as having sufficient data, the need for policy documents, deployment of necessary algorithms and software, and expert knowledge (Martínez-Plumed, Gómez, & Hernández-Orallo, 2021). A study was conducted on Indonesian university libraries to identify the necessary facilities

needed for the effective adoption of robotic technology. These include policy and procedure documents, the necessary skills to operate the technologies, and organizational resources, which encompass human resources and technological resources (Qomariyah, Mursidah, & Wahyun, 2020).

STATEMENT OF THE PROBLEM

The Scopus database for humanities and social sciences shows that no research has been published on the subject study. Furthermore, the existing literature does not address the readiness of medical libraries in Pakistan to adopt robotic technologies. This study examines the readiness of medical libraries in Pakistan for the adoption of robotics, focusing on infrastructure and human development, "How aware are the librarians of the potential benefits of robotics in library operations? Which services can be handled by the robot? What are the potential challenges that medical libraries may face in the adoption and use of robotic technologies?"

RESEARCH METHODS AND PROCEDURE

Many libraries have implemented automation in various library services, including acquisition, cataloging, and serials. However, the use of robotic technologies could reduce the need for human interaction in various library operations. Evaluating the readiness for the deployment of robots in medical libraries will provide valuable information on the current status of adopting robotic technologies. The subject study is based on (Owolabi et al., 2022) study titled "Readiness of academic librarians towards the use of robotic technologies in Nigerian university libraries". The study in question is a quantitative analysis limited to the medical libraries in Khyber Pakhtunkhwa Pakistan. The total population under consideration is 48, comprising of 17 medical college libraries (nine private and eight public). A questionnaire was designed on Google Forms based on earlier studies (Owolabi et al., 2022) (Lund, Oname, Tijani, & Agbaji, 2020). The questionnaire was divided in sections, each section addressing a specific variable. After completion, the questionnaire was shared with the peers for review and feedback, and the final version was forwarded to respondents via

email and WhatsApp. The data were analyzed and tabulated using MS Excel 2010 and SPSS.

RESULTS AND DISCUSSIONS

The table presents responses regarding the readiness of medical libraries in terms of infrastructure, policy framework, and human development for implementing robotic technologies. The policy framework for robotic technologies indicates that a majority of respondents either disagree (45.83%) or are neutral (43.75%) about the presence of a clear policy framework for robotic technologies in their libraries, with no respondents strongly agreeing. This study results as the Owolabi, the author said that Majority of the respondents (60%) admitted that their lack of digital infrastructure is related to adoption of AI technologies. In total, 28% of the respondents claimed that they do not have any policy framework that will guide the adoption of robotic technologies in academic libraries in Nigeria, and 12% agreed that they have adequate human capacity that can operate the technologies (Owolabi et al., 2022). The results of this study support Tella's (2020) findings, which highlighted that many African countries lack the essential facilities and policies needed to promote the access and use of robotic technologies, even though there is a presence of skilled human resources capable of utilizing these technologies (Tella, 2020). Highest proportions of respondents are neutral (43.75%) or agree (43.75%), with a small percentage strongly agreeing (2.08%) with the Support for Innovation and New Technologies. A significant number of respondents strongly disagree (41.6%) or disagree (25%) that library staff is adequately trained for robotic technologies. Only a small percentage of respondents agree or strongly agree on staff preparedness. The majority of respondents strongly disagree (77.08%) that their library invests in continuous professional development related to new technologies, with no respondents agreeing or strongly agree. For Strategy for Human Resource Development responses are more balanced, with equal percentages of respondents agreeing (35.41%) and being neutral (35.41%) about the strategy for human resource development. A quarter of respondents strongly agree.

S. No.	Readiness of medical libraries in terms of infrastructure, Policy framework and human development	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
01	The library has a clear policy framework for the implementation of robotic technologies	4(8.3%)	22(45.83%)	21(43.75%)	1(2.08%)	0(00%)
02	The library’s policies support innovation and the adoption of new technologies	2(4.16%)	3(6.25%)	21(43.75%)	21(43.75%)	1(2.08%)
03	The library staff is adequately trained to handle robotic technologies	20(41.6%)	12(25%)	07(14.58%)	02(4.16%)	07(14.58%)
04	The library invests in continuous professional development for staff regarding new technologies	37(77.08%)	05(10.41%)	06(12.5%)	00(0%)	00(0%)
05	The library has a strategy for human resource development to support technological advancements	00(0%)	02(4.16%)	17(35.41%)	17(35.41%)	12(25%)
Total (%age)		63 (12%)	00(12%)	0(12%)	0%	00(12%)

Most of the respondents agrees or strongly agrees that robotic technologies can effectively handle automated shelving systems, indicating strong support for this application. For book retrieval, half of the respondents are neutral, while a significant portion disagrees, suggesting uncertainty or skepticism about the feasibility of robotic technology for this service. The responses are mixed regarding document digitization. There is a notable percentage of disagreement, with some respondents agreeing but few strongly agreeing that robotics can handle this task. A majority of the respondents strongly disagrees that robotic technologies are suitable for managing circulation

systems. The remaining respondents are mostly neutral or only somewhat agreeable, indicating significant reservations about this application. Nearly 90% of respondents strongly agree that robotic technologies can effectively handle library security, reflecting overwhelming support for this application. The data indicates strong interest for robotic technologies in automated shelving and library security, while there is significant uncertainty or neutrality regarding their use for book retrieval and circulation systems. Document digitization shows a mixed response, with some support but also notable disagreement.

S. No.	Available Services which can be handled by robotic technologies in medical libraries	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
01	Automated Shelving Systems	00	00	7(14.58%)	20(41.6%)	21(43.75%)
02	Book Retrieval	12(25%)	12(25%)	24(50%)	00(0%)	00(0%)
03	Document Digitization	09(18.75%)	17(35.41%)	04(8.3%)	17(35.41%)	01(2.8%)
04	Circulation system	00(90%)	05(10.41%)	29(60.41%)	10(20.83%)	04(8.33%)
05	Library Security	00(0%)	00(0%)	05(10.41%)	00(0%)	43(89.58%)
Total (%age)		00(12%)	00(12%)	0(12%)	0%	00(12%)

Majority of librarians are very aware 30(62.5%) of the concept of using robotics in library operations, with a significant portion moderately aware 6(12.5%). No respondents reported being not at all or slightly aware. Awareness of the potential benefits of robotics is more varied. While a quarter of respondents are not at all aware, a significant portion is slightly or moderately aware. Only a

small percentage is very aware, and no one is extremely aware. A majority of librarians are slightly aware that robotics can improve library efficiency, with a smaller group moderately aware 15 (31.25%) and very or extremely aware of this benefit. Most librarians are not at all aware of the specific tasks that robots can perform, such as library automation. A small percentage are slightly

aware, with very few moderately aware. Awareness of the role of robotics in modernizing library services is mixed, with a significant number of librarians slightly or moderately aware, and a smaller percentage very aware. There is very limited awareness about the role of robotics in executing high-quality services, with most respondents not at all aware. Awareness about the promotion of library services through robotics is

mainly slight, with some librarians moderately and very aware. Medical librarians generally show a high level of awareness regarding the concept of robotics and their potential benefits, there is significant variability in their awareness of specific tasks, efficiency improvements, and other aspects of robotics. The data highlights a need for increased education and information about the full range of benefits that robotics can offer in library.

S. No.	Awareness of medical librarian about the Benefits of robotics in library operations	Not at all aware	Slightly aware	Moderately aware	Very aware	Extremely aware
01	How familiar are you with the concept of using robotics in library operations	00	00	12(25%)	30(62.5%)	6(12.5%)
02	How aware are you of the potential benefits that robotics can bring to library services	12(25%)	15(31.25%)	15(31.25%)	6(12.5%)	00
03	To what extent do you aware that robotics can improve the efficiency of library operations	00	31(64.58%)	15(31.25%)	2(4.16%)	00
04	Do you aware about the specific tasks that robots can perform in libraries e.g Library Automation	35(72.92%)	12(25%)	01(2.8%)	00	00
05	Modernization of library services	12(25%)	18(37.5%)	13(27.08%)	15(31.25%)	00
06	High-quality services execution	45(93.75%)	00	02(4.16%)	01(2.8%)	00
06	Promotion of the library services	00	26(54.16%)	10(20.83%)	12(25%)	00
Total (%age)		00(12%)	00(12%)	00(12%)	00(12%)	00(12%)

The table details responses on potential challenges faced when adopting robotic technologies in medical libraries. A majority of respondents agree that limited monetary resources are a significant challenge to adopting robotic technologies, with a smaller percentage strongly agreeing 32(66.66%). There is a considerable portion that remains neutral on this issue 14(29.16%). Most respondents are neutral about the challenge of fluctuating power availability 41(85.41%), indicating that it may not be a significant concern for many. A small

percentage agrees that it could be a challenge, with no one strongly agreeing. All respondents agree that employment insecurity is a challenge when adopting robotic technologies 48(100%), highlighting it as a universal concern without any disagreement or neutrality. The majority of respondents agree that inadequate communication infrastructure is a challenge 27(56.25%), with some strongly agreeing 5(10.41%). A significant portion is neutral, suggesting variability in the impact of this challenge.

S. No.	Potential challenges while adopting robotic technologies	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
01	Limited monetary resources	00	00	14(29.16%)	32(66.66%)	2(4.16%)
02	Fluctuating power availability	00	00	41(85.41%)	7(14.58%)	00
03	Employment insecurity	00	00	00	48(100%)	00
04	Inadequate communication infrastructure	00	00	16(33.33%)	27(56.25%)	5(10.41%)
Total (%age)		00(12%)	00(12%)	00(12%)	00(12%)	00(12%)

Conclusion

The study found that medical libraries in Khyber Pakhtunkhwa Pakistan, are facing significant

barriers in adopting robotic technologies. The main issues include inadequate infrastructure, lack of clear policy frameworks, and insufficient training

for staff. Although there is general awareness about the concept and potential benefits of robotics, this awareness has not translated into readiness for adoption due to challenges such as limited financial resources and employment insecurity. The data shows strong support for using robots for automated shelving and library security, but there is uncertainty about their effectiveness in other areas such as book retrieval and circulation systems. The study also emphasizes the need for improved education and policy development to better integrate robotic technologies into medical libraries.

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