

Artificial intelligence application in university libraries of Pakistan: SWOT analysis and implications

Artificial
intelligence
application

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Abstract

Purpose – The purpose of this study Artificial intelligence (AI) is one of the important emerging trends in information technology and is slowly being implemented in libraries. The researchers have presented a brief strengths, weaknesses, opportunities and threats (SWOT) analysis of the application of AI in Pakistani university libraries.

Design/methodology/approach – This study uses an ethnographic approach for data retrieval. Five chief librarians were interviewed by phone, during which they were asked to identify one key strength, weakness, opportunity and threat in terms of introducing AI technologies. The researchers have used a standard SWOT matrix to report the respondents' comments.

Findings – AI is already slowly being introduced into Pakistani university libraries. While commenting on ways in which AI could help their libraries deliver more innovative services and better meet user needs, respondents expressed concern about the investment required in funding, time and staff.

Research limitations/implications – Further study is indicated to identify existing AI implementations in Pakistani university libraries and to assess relevant library users' perspectives. This study is limited to brief, qualitative data; its main purpose is to validate the use of a SWOT analysis.

Practical implications – Given that AI-based tools are already being used in libraries to some degree regardless of location, now is an opportune time to develop strategies for implementing AI technologies more widely. A SWOT analysis can be used to identify and categorize challenges and risks specific to AI in a logical way to support strategic decision-making.

Originality/value – To date, no SWOT analysis has been conducted in the context of AI applications in libraries, let alone specifically university libraries in Pakistan.

Keywords Artificial intelligence, Strategic analysis, Intelligent libraries, Library services, Smart libraries, User-centric, Library technologies

Paper type Research paper



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Introduction

Artificial intelligence (AI) is a subfield of computer science, which is one of the top emerging and trending technologies in the world. It already has had an impact on areas such as higher education, learning and teaching, e-learning and libraries (Chatterjee and Bhattacharjee, 2020; Campolo *et al.*, 2017; Arkorful and Abaidoo, 2015). Various aspects of AI have been discussed in the context of library and librarianship, information science and information management (Hervieux and Wheatley, 2021; Cox *et al.*, 2019; Massis, 2018; Wood and Evans, 2018). Core library services, such as acquisitions, cataloguing, classification, information retrieval and library systems, have been enhanced through the introduction of AI technologies (Wu *et al.*, 2019; Wu *et al.*, 2015; Bailey, 1991). This enhancement within libraries has resulted in what is referred to by some researchers as the “intelligent library” (Cox *et al.*, 2019, p. 430), with an increased user-centric focus (Shen, 2019a; Shen, 2019b). In addition, as Musib *et al.* (2017) have observed, libraries not only have their own services which are benefitting from AI but also have an important role in supporting researchers in the use of AI in their research. In Pakistan, library and information science (LIS) researchers have recently reported on interviews with selected university chief librarians within that country about possible AI application within their libraries (Ali *et al.*, 2020).

In planning for the strategic implementation of key initiatives, such as AI, an important decision-making tool frequently used by organizations is the Strength, weakness, opportunity and threat (SWOT) analysis. In this paper, the researchers have applied this tool to the implementation of AI in Pakistani university libraries.

Literature review

SWOT analysis, which was first described in detail by Learned *et al.* (1969), is commonly used to analyze environments to support strategic decision-making. Examples of its application can be found, for example, in the management sciences (business and marketing) and the social sciences (mass communications, education, library and international relations). In some cases, it is also used in computer-based AI projects, AI calculations and data analytics.

Table 1 is an example of a simple generic template, designed as a matrix, which is often used to capture the key aspects of a SWOT analysis. On the one hand, strengths and weaknesses are internal factors which either assist or impede an organization from achieving a particular goal; on the other hand, opportunities and threats are external factors.

Artificial intelligence and libraries

Table 2 provides examples of AI tools currently applied to library services. Academic university libraries, such as Massachusetts Institute of Technology (MIT), Stanford and University of Toronto, have implemented services using AI, with the University of Rhode Island offering an “AI Lab” within its library (Hervieux and Wheatley, 2021). According to Wang (2020), librarians who support researchers with systematic reviews can potentially benefit from the embedding of AI functions within citation management software tools such

Table 1.
SWOT analysis
template

Factor	Internal	External
Positive	Strength	Opportunity
Negative	Weakness	Threat

Table 2.
Examples of AI tools
applied to library
services

AI tools	Library services
Expert Systems	<i>Manage library system effectively, existing library systems replaced with AI-based systems</i>
Natural Language Processing	<i>Voice Search, Search Assistance of library and online material e.g., Google and YouTube voice search</i>
Chatbot	<i>Reference Services, Reference librarian Alexa, Siri, and IBM Watson</i>
Pattern Recognition	<i>Acquisitions and Processing of Library Books, Library Circulation Systems, Library Check in/Check out</i>
Big Data Analytics	<i>To manage library digital data and processing, Database usage analytics, movement and sharing of data, Google Drive, Drop Box, cloud computing.</i>
Text Data Mining	<i>Citations Count, Altmetric Scores, Library Trends, Social Media Tagging, Metadata movement and exports</i>
Robotics	<i>Robotics will serve the library users in the shelving of books and finding of library materials</i>

as Colandr. AI is being used in the application of radio frequency identification technology to book tracking systems (Dukyil, 2018).

In terms of the future application of AI to library technology, automated systems will be replaced with expert systems (Asemi and Asemi, 2018); reference services will move to chatbot and voice assistance (Massis, 2018; Herron, 2017). According to Yi (2006), traditional classification schemes will be converted to text classification and semantic indexing. Traditional search engines will be replaced with AI-based search engines, similar to the one recently developed by Iris.ai for use with scientific texts (Schoeb *et al.*, 2020). Data-driven knowledge will underpin key services (Ntoutsis *et al.*, 2020; Frederick, 2020; Chen *et al.*, 2019) with data mining playing an important role (Göksün and Kurt, 2020). Future library research support will depend upon AI technologies to deliver services to researchers (Xiao, 2017).

From the human resource perspective, some researchers have examined the potential impact – both positive and negative – of AI on the library workplace. On the one hand, AI brings with it concerns about loss of job and data privacy within the organization (Kieslich *et al.*, 2021; Oseni *et al.*, 2021; Campbell *et al.*, 2020; Deshpande, 2019). As AI technologies have produced tools and machines which have replaced manual labor, they may lead to the reduction of job opportunities for library professionals (Wang and Wang, 2019). Several researchers have discussed the effect of bias on decision support systems (Müller, 2020; Cox *et al.*, 2019). On the other hand, AI has the potential to reduce manual errors as well as the physical workload of library staff (Voda and Radu, 2019; Howard, 2019; Huang and Rust, 2018). It may assist in improving staff's digital literacy skills (Randhawa and Jackson, 2020; Arlitsch and Newell, 2017).

Concern about the funding required for a library to implement has also been explored in the literature. Cost is seen as a major barrier to AI implementation in higher education generally (Luckin, 2017). As Hsieh and Hall had already reported in 1989, AI is an expensive product for a library and requires considerable time, money and skills.

As reported by Ali *et al.* (2020), in Pakistan AI technology adoption and implementation are regarded as having both potentially positive and negative consequences. Some library staff, regardless of job level, indicated fear in the use of AI technologies. Similarly, the adoption of AI was viewed as presenting many challenges in specialized knowledge, technical skills and sufficient funding. Despite these challenges, there was also a perceived opportunity for LIS professionals to improve their skills in areas such as AI, data science

and data-driven knowledge and for libraries to introduce innovative library services to benefit their users.

However, overall, very little research has been undertaken to date within Pakistani academic libraries regarding AI (Haq, 2021a, 2021b; Ali *et al.*, 2021). Khan and Bhatti (2020) have recommended that AI be considered a necessary digital skill for university librarians to be able to develop and manage digital libraries. For their part, Hussain and Ahmad (2021) have included AI in their proposed model of smart library technologies for use in Pakistani university libraries.

Strength, weakness, opportunity and threat analysis and artificial intelligence

AI has been implemented in disciplines such as computer science, medical science, business management and the social sciences. Organizations depend upon good strategic management to help them achieve their goals, with many using SWOT analysis as a valuable input (Hazidah and Edzan, 2012; Kumar, 2012). AI has been shown to have an important role in creating an accurate SWOT analysis (Sleem, 2019). This role does not limit to the business world but it is also applicable in other domains of information and data management. For example, a recent knowledge discovery project has used a SWOT analysis to assess methods drawn from research areas such as data mining, AI, information retrieval, information extraction and Web mining (Kumar *et al.*, 2020). A 2019 study by Noguerol *et al.* has used a SWOT analysis to assess the use of AI and machine learning applications in radiology.

Strength, weakness, opportunity and threat analysis and libraries

SWOT analysis is a regular practice within library strategic planning as well as being used for the evaluation of library services. SWOT analysis is particularly useful to library management in evaluating the merits and demerits of newly implemented services. Several studies have been reported in the literature regarding the use of a SWOT analysis with library services and/or systems. As early as Noh (2006) described the applications of SWOT to an analysis of a Korean university library's levels of efficiency, whereas Cervone (2009) explained the benefits of using the SWOT approach for digital library development, and Mapulanga (2013) later discussed its specific application to information services and systems in a university library in Malawi. For his part, Pandya (2012) has applied a SWOT analysis to the challenges of implementing cloud computing in Indian libraries. More recently, Kaushik (2020) has reported on a SWOT analysis of the Internet of Things in LIS domains.

At a global level, the World Health Organization Global Library and Digital Information Networks has recently presented its strategy for achieving its Sustainable Development Goals during 2020–2025. Based on a detailed SWOT analysis, the organization has outlined how it intends to focus its efforts on meeting the largest and most urgent information needs worldwide (World Health Organization, 2020).

To date, no SWOT analysis has been conducted in the context of AI applications in libraries, let alone specifically university libraries in Pakistan. This study is intended to fill the latter gap in the literature.

Objectives of the study

The primary objectives of this study are as follows:

- introduce AI concepts as applied to academic libraries;

- undertake an introductory SWOT analysis of the implementation of AI in Pakistani university libraries; and
- demonstrate how a SWOT analysis can assist in identifying the resultant challenges and opportunities for this cohort.

Research questions

The following research questions (RQ)s have been designed based on the literature review:

- RQ1. How can AI improve Pakistani academic libraries?
- RQ2. What strategies are being planned for Pakistani university library services after the commencement of AI implementation?
- RQ3. How can a SWOT analysis assist academic libraries to overcome challenges in implementing AI?
- RQ4. What challenges do university libraries in developing countries face in undertaking a SWOT analysis of AI implementation?

Research methodology

This study uses a modified form of ethnography as its qualitative research method. [Reeves et al. \(2008, p. 512\)](#) define ethnography as “the study of social interactions, behaviours, and perceptions that occur within groups, teams, organisations, and communities.” While historically this type of research has often been used in the field of anthropology, nowadays it is used across a wide range of disciplines.

An important aspect of ethnographic research is its objective to provide what [Reeves et al. \(2008, p. 512\)](#) refer to as “rich, holistic insights into people’s views and actions.” Similarly, [Hannabus \(2000\)](#) asserts that, as an example of qualitative research, ethnographic research attempts to explore not just what people do but also what they think. According to [Whitehead \(2005\)](#) and [Simeone et al. \(2017\)](#), ethnographic methods, such as semi-structured conversations and/or interviews, are a common element of recent studies on organizations and can provide people’s perspectives on specific issues. In addition, participants are sampled on an “opportunistic or purposive” basis ([Reeves et al., 2008, p. 513](#)). In the latter case, the researcher selects a sample based on their knowledge of the population. According to [Kramer and Adams \(2017\)](#), the sample size in ethnographic research can be quite small, depending upon the research objectives.

As part of the preliminary stage of research on a PhD topic by the Principal Author, this study was intended to briefly explore the perceptions of university/chief librarians regarding the specific topic of AI. As such, it was intended to cover qualitative, rather than quantitative, aspects. The use of the ethnographic method of semi-structured interviews with selected participants was selected as the approach.

Using purposive sampling, the researchers contacted five university/chief librarians, specifically one from each province in Pakistan, i.e. Sindh, Punjab, Khyber Pakhtunkhwa and Balochistan, plus the Federal Capital. The five librarians agreed to participate in a structured, telephone interview, in which they would be asked to share their views about the application of AI in university libraries in Pakistan. Given that the interviewees have a basic, but not expert, concept of AI and how it is related to libraries, the Principal Author spent the initial part of the phone call clarifying terminology. An advantage of the use of

interviews is that the researcher has a chance to address any issues during the process, if needed (Opdenakker, 2006).

During the subsequent 12–15 minutes, the interviewees were specifically asked what they thought would be the main strength and the main weakness as well as one perceived opportunity and one threat in terms of introducing AI technologies. The Principal Author made notes during the interviews, clarified any points which were unclear, and subsequently transcribed the responses into a Word document.

The SWOT analysis method has been adopted to present the results of this research, as it is a standard tool for analyzing the goals, strategies and resources of a library to address the various issues and concerns related to a specific development project (Leigh, 2006) (Table 1). Based on the responses from the sample group, the researchers designed a SWOT matrix. Although during the interview respondents may have mentioned more than one factor, for the purposes of this study, the researchers identified what each respondent considered as the major factor for each of the four standard SWOT categories.

The researchers have summarized the interviewees' responses in the section that follows. Exact quotes have not been provided in this paper, as English is not the first language of the respondents; therefore, the researchers have had to modify the responses for clarity of expression and readability. According to Geertz (1973), one of the advantages of an ethnographic approach is that the researcher not only presents facts but also interpretation and commentary. In addition, because the respondents differed, even if only slightly, in their answers to each question, the researchers have focused on where they have differed.

Strength, weakness, opportunity and threat analysis

In the SWOT matrix (Table 3), the researchers have listed five principal factors for each metric, i.e. strengths, weaknesses, opportunities and threats, as applied to the use of AI in university libraries. These factors, which have been drawn from the interviewees' responses, are intended to be indicative, rather than comprehensive.

Strengths

Intellectual information and knowledge hub. The first respondent underlined the importance of university libraries in general in supporting the academic and research activities of the university or academic institute, depending upon the nature of the organization. Given the sizeable investment which libraries must make in maintaining infrastructure, collections,

Table 3.
SWOT analysis of AI
application in
university libraries

<i>Internal</i>	<i>External</i>
Strengths	Opportunities
Intellectual information and knowledge hub	Learning opportunity
Innovative library services	Multi-tasking
Research support	Job skills improvement
Data-driven knowledge	Digital content & knowledge/information discovery
Mental Effort Reduction	User-centricity
Weaknesses	Threats
Funding for libraries	Job security
Ethical issues	Loss of library space
Bias	Infrastructure
Privacy	Learning attitude
Lack of expertise	System threats

resources and manpower, they need to ensure that their resources are effectively used. The respondent felt that AI could help to improve the utilization of library resources/collections.

They observed that technology is already heavily used in libraries, e.g. computers, information and communications technology, mobile and other devices. They thought that AI technologies would strengthen services in the future smart library through the introduction of intelligent library systems.

Innovative library services. The main strength of AI was perceived by the second respondent to be the ability of university libraries to provide innovative technologies. AI-based innovative library services are viewed as strengthening the library's value to the organization. Some of the key library functions that would be enhanced by AI are listed in Table 4. For example, automated systems will be replaced with expert systems; knowledge acquisition and maintenance will be automated, and reference services will move to tools such as chatbot and voice assistance. Search engines will be replaced with AI-based search engines.

These innovative services strengthen the usefulness of the library by adding value for the user.

Research support. University libraries are often closely associated with research support activities. Given the impact of AI on current – and future – research, the third respondent noted that new intelligent information systems and research support services offered by the library could help to better support researchers with their projects. New developments in systematic review software, for example, have the potential to reduce the work of both researchers and research support librarians. The interviewee was interested in several efforts overseas, e.g. University of Rhode Island, to use spaces within the library to introduce students to AI. They felt that in future Pakistan libraries would use AI-based technologies to expand research support services to cover services in areas such as decision-making support, research data support, scholarly publishing, intellectual property rights and reference.

Data-driven knowledge. The fourth respondent observed that university libraries already had experience in working with data, e.g. migrating their data via Machine-Readable Cataloging, Resource Description and Access and other tools. However, they also acknowledged that current changes in technology, education, research, etc. were leading to massive increases in the volume and availability of data. They felt that AI-based tools such as text mining, data visualization and data analytics would enhance their library's ability to deal with this increase. Given their ability to deal with new technologies, many library staff

	Traditional library functions	AI-based library functions
Innovative AI-based library services	Library Automation System	Expert Systems
	Collection Development/ Acquisition Classification	Knowledge Acquisition Representation and Maintenance
	Reference Services	Tagging, Machine-based electronic DDC, NLP, Semantic Indexing, Text Classification
	Literature Search	Chatbot and Voice Assistance
	Subject Headings	Using Intelligent interface, Voice Searching and Intelligent Agent
		Hyperlinks, Text Data Mining, Hypermedia

Table 4.
Innovative AI-based
library services

would be motivated to learn data visualization and increase their current skills in data management.

Physical workload and mental effort reduction. In discussing the potential impact of AI on their workforce, the final respondent felt that AI would not replace library staff in the immediate future but would reduce their workload. For example, current labor-intensive tasks such as manual classification, cataloguing and indexing would shift to machines/computer-based technologies and software. Some university libraries had already adopted RFID for the security of books and other library material. The interviewee was interested in the potential for robotics to help with the check in and check out of books, shelving of materials, stocktaking and reference questions. In short, AI was considered to be a technology which would help reduce both the physical and mental workload of librarians.

Weaknesses

Funding for libraries. The first respondent noted that the library is not an earning or revenue-producing organization like other departments within universities. As a result, library funds are limited, with the primary focus on meeting regular budget commitments. Therefore, specialized implementations, such as AI, are a big challenge. The requirement for an investment not only in funding but also in time and staff is considered one of the major barriers to the adoption and acquisition of AI technologies in Pakistani university libraries.

Ethical issues. The second respondent acknowledged general societal concerns about the ethical use of technology in general and AI more specifically. Libraries, for example, need to ensure that AI technologies adhere to ethical standards of inclusivity, accessibility and fair use of information. The *International Federations of Library Association (IFLA) Statement on Libraries and Artificial Intelligence (IFLA, 2020)* was mentioned as a useful guide for implementing AI within libraries.

Bias. Librarians are already aware of the issue of bias among the current online resources to which they subscribe, e.g. electronic databases. Therefore, the third interviewee was concerned about the potential for bias in the complex algorithms that underpin AI tools. Library staff may have difficulty, for example, in explaining to library users the basis on which search results have been ranked.

Privacy. As with ethical issues, the fourth respondent acknowledged societal concerns about privacy in relation to AI. The need to guarantee the privacy of library data and user data would be a challenge to its implementation. The risk of highly sophisticated cybersecurity attacks on AI-based tools such as robotic technologies, image recognition and chatbots was a serious concern.

Lack of expertise. Librarians in Pakistani university libraries generally have a lack of expertise in advanced computers and programming skills. The fifth respondent outlined the need for themselves, as a library manager, to build both awareness about AI and knowledge about AI-based technologies among their staff. They agreed that libraries would need technical support from IT support departments to overcome this weakness.

Opportunities

Learning opportunity. The first interviewee mentioned a few examples in which applying AI technologies to libraries would offer useful opportunities for the university's library staff members. For example, the latter could enhance their learning and technical skills in areas such as robotics, Natural Processing Language (NLP), Big Data and text mining. Library system experts could gain benefits from using AI tools. There was also the potential for the use of AI products such as Siri, Alexa and Institute of Business Management (IBM) Watson to improve a librarian's digital literacy skills overall.

Multi-tasking. The second respondent mentioned multi-tasking in relation to staff workload. They felt that AI offered the potential for librarians to commence a task, using an AI tool, while also commencing a new task concurrently. Ideally, AI would help to eliminate the need to work on any particular task for long, sustained periods of time.

Job skills improvement. By being involved in the AI implementation within their university, librarians could improve their technical job skills. For example, there would be the possibility for interested librarians to learn programming skills, e.g. coding. Using their new-found skills, librarians may find new job opportunities within their respective organization or even outside the organization. Importantly, early adopters with a strong knowledge of AI technology will become the experts on AI within their library. The third respondent felt that motivated staff could take a leadership role within this domain.

Digital content and knowledge/information discovery. Librarians are already closely connected with the technologies that currently support library automation, digitalization and the library catalogue. While interested in the potential application of AI to open access and digital content management, the fourth respondent felt that AI would be particularly useful in information discovery tools such as data mining. Both librarians and library users could more efficiently identify content most relevant to an information need.

User-centricity. According to the fifth interviewee, libraries have shifted from a collection-centric to user-centric model. Therefore, librarians are well aware of the information needs and mode of services used by their users for seeking and retrieving information. AI was considered as having a strong impact through smart searching tools using the AI subset, NLP. Because of the library focus on human-community centeredness, the respondent thought that there was considerable potential for AI to enhance services which went beyond the physical confines of the library.

Threats

Job security. Library job security was viewed as a big issue regarding the application of AI in university libraries. The first respondent was aware of current discussions within the profession about the potential for the loss of low-level jobs, e.g. shelve, cataloguer and classifier. They acknowledged that well-documented instances in industry of humans being replaced by AI-based technology would lead to library staff fearing loss of their own job. At the same time, other library staff would worry about the perceived reduction in job opportunities among library professionals.

Loss of library space. In many Pakistani university libraries, as the usage of technology increases, the spaces currently housing physical collections are being reallocated to spaces for use with digital devices. The second respondent mentioned the possibility of AI technologies contributing to the loss of more physical collections and library space. They could envisage space in future being allocated for new uses such as AI and data visualization labs, makerspaces and 3D-printing facilities. They were aware that some university libraries had established virtual reality and augmented reality spaces to support academic teaching. Therefore, they would need to balance the needs of all their users.

Infrastructure. Although they could envisage how AI might be used to innovate services in their libraries, the third respondent observed that the current IT infrastructure within Pakistani university libraries was weak. As such, they would struggle to support high tech AI-based products such as Alexa, Siri and IBM Watson, as well as the high-tech machines required to process the underlying data and do data mining. In general, facilities such as AI Labs and Makerspaces have yet to be implemented. Additionally, 5G technology, ultrafast processors, and even 3D printers are currently seldom found in Pakistani university libraries. Several libraries have established a data analytics lab, including Lahore University

of Management Sciences and University of Sargodha Department of Library and Information Sciences. However, library management is generally having difficulty in setting up AI-based infrastructure in their respective libraries.

Learning attitude. Learning attitude plays a vital role in the implementation of any modern technology. The fourth respondent acknowledged that technophobia among Pakistani academic librarians had been documented in the literature and was found among their own staff. Learning complex technologies and their application could, for example, create anxiety. Therefore, librarians' negative learning attitude would constitute a major threat to the implementation of AI technologies.

System threats. Because of the inherent importance of the library information management system (LIMS) within their library, the fifth respondent considered that there would be a threat if the LIMS and library systems were not updated to be compatible with AI technologies. Libraries might discover that both their users and staff were gradually avoiding these systems, in which the libraries had already made a significant investment, e.g. financial and time, in favor of new, more powerful expert systems designed with AI interfaces.

Discussion

In the following section, the authors discuss the implications of their literature review and research study in addressing the proposed research questions:

RQ1. How can AI improve Pakistani academic libraries?

An important contribution by AI will be the enhanced ability of Pakistani academic libraries to provide innovative services. More physical space will continue to be converted into virtual space and more printed resources will shift to online to support library users. Current technical services, such as collection development, resource acquisition and cataloguing and classification, will be done totally via machines. As Cox *et al.* (2019) have suggested, AI may be used in metadata processing with less bias and more effectively than in manual methods of cataloguing.

Through the introduction of new AI-based technologies, academic libraries will be able to truly become more user-centric. Users will benefit from major changes such as the replacement of automated systems with expert systems; the automation of knowledge acquisition and maintenance; and the use in reference services of AI-based tools such as chatbot and voice assistance. AI technologies will assist academic libraries to better assist the needs of the parent organization's researchers. Overall, the library and its services will potentially be reshaped through the application of AI.

RQ2. What strategies are being planned for Pakistani university library services after the commencement of AI implementation?

Pakistani university library management are moving slowly with the adoption of AI in their respective libraries. In some libraries, day-to-day or general operational functions already offer low-level, AI-based services which are used by library users and information seekers, e.g. voice search in search engines, Google Translate use from English to Urdu (and vice versa) through NLP, single or multiple-user chat services via Facebook Messenger and a WhatsApp group providing information about library news and activities through chatbot services.

More advanced AI technologies (robotics, AI expert systems for libraries) will take time to implement in Pakistani university libraries because of challenges with additionally required funding and the need to build staff awareness and requisite skills. For those

reasons, now is an opportune time for these libraries to begin work on a high-level strategic plan for AI implementation to maximize its full potential.

RQ3. How can a SWOT analysis assist university libraries to overcome challenges in implementing AI?

The implementation of any new technology can be quite a daunting task. AI brings with it its own set of complexities and risks. In university libraries, management needs to address these in ways that are efficient and cost-effective. The benefit of a SWOT analysis is that it can be used to identify and categorize these challenges in a logical way to support strategic decision-making.

Being able to categorize a positive or negative factor as either internal or external is useful, for example, in that it helps management determine other potential stakeholders within the organization with whom to liaise. In addition, there are excellent examples in the literature of how to apply SWOT to library initiatives.

RQ4. What challenges do university libraries in developing countries face in undertaking a SWOT analysis of AI implementation?

Many university libraries in developing countries are in a transitional phase; they have completed the automation of key services but have yet to progress to widespread digitalization and advanced technologies, e.g. AI, Big Data and data visualization tools. In addition, these libraries may struggle with inadequate funding, infrastructure and technical skills in terms of their current technologies.

Using a SWOT approach to the implementation of AI in these circumstances could, ostensibly, appear to be a totally negative exercise, because current internal weaknesses, for example, would simply be reinforced. However, one of the primary objectives in using a SWOT analysis is to inform strategic planning and decision-making. It is one of a range of useful tools which a library can use to prepare for the future.

Conclusion

AI is an important emerging trend in information technology, which is gradually being integrated into digital tools used within libraries. As AI-based technologies can be complex and resource-intensive, library management should ideally address these challenges through a strategic planning process. Using an ethnographic approach featuring brief, semi-structured interviews, the authors of the current study of selected Pakistani university libraries have presented a brief SWOT analysis as a practical example of how to logically identify and categorize both positive and negative aspects of AI implementation. This study should be of interest to library management in other developing countries, who will share many of the same challenges as their Pakistani colleagues.

Further study

Further research is indicated to determine the skills of university librarians regarding AI implementation in their respective libraries. A detailed, quantitative survey study should be undertaken to identify existing AI implementations in Pakistani university libraries and to assess relevant library users' perspectives.

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