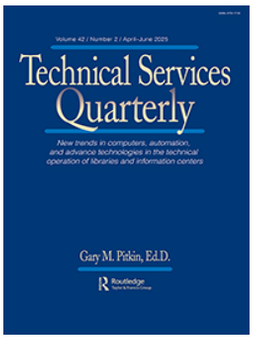

Technical Services Quarterly

ISSN: 0731-7131 (Print) 1555-3337 (Online) Journal homepage: www.tandfonline.com/journals/wtsq20

Librarian acceptance of artificial intelligence in academic libraries of Islamabad: An application of the technology acceptance model

Abid Hussain & Asad Khan

To cite this article: Abid Hussain & Asad Khan (28 May 2025): Librarian acceptance of artificial intelligence in academic libraries of Islamabad: An application of the technology acceptance model, Technical Services Quarterly, DOI: 10.1080/07317131.2025.2512280

To link to this article: https://doi.org/10.1080/07317131.2025.2512280

Published online: 28 May 2025.

TECHNICAL SERVICES QUARTERLY
https://doi.org/10.1080/07317131.2025.2512280

Routledge
Taylor & Francis Group

Librarian acceptance of artificial intelligence in academic libraries of Islamabad: An application of the technology acceptance model

Abid Hussain[a] and Asad Khan[b]

[a]Deputy Director Library, Institute of Strategic Studies, Islamabad; [b]Department of Library & Information Science, University of Peshawar

ABSTRACT

This study explores academic librarians' intentions to adopt Artificial Intelligence (AI) in Islamabad's academic libraries using the Technology Acceptance Model (TAM). Data from 212 librarians were analyzed using SPSS, AMOS, and ADANCO. Findings support TAM, showing perceived interactivity and usefulness significantly influence attitudes toward AI, while perceived ease of use has minimal impact. Attitude and satisfaction strongly affect intention to use AI. However, unclear perceptions suggest more awareness is needed. This is the first study in Islamabad applying TAM with these tools, offering practical insights for AI adoption in academic libraries.

KEYWORDS

Artificial intelligence; academic libraries; TAM model; academic librarians; Islamabad

Introduction

In the era of emerging technologies, artificial intelligence in academic libraries is developing rapidly. Concurrent with these trends, academic libraries are moving toward the latest technology to provide a convenient way for users to approach library services (Gürsen et al., 2023). In recent years, AI has gained significant attention in academic libraries through the lens of the Technology Acceptance Model (TAM) (Na et al., 2022). The users of modern technology always need a framework to help them with essential information regarding new and innovative technologies like perceived use of ease and perceived usefulness to enhance their interest levels. The TAM provides a framework as a primary determinant. Recent studies on AI in academic libraries, particularly in Western countries, adopted various theoretical models like UTAUT and TAM (Chen et al., 2024). The study of Shahzad et al. (2024) highlights numerous AI-driven solutions for academic libraries that navigate library resources and provide timely information to users. The TAM framework offers a comprehensive overview of AI in academic libraries. The study by Gupta and Yadav (2022) demonstrates that perceived ease of use and

CONTACT Abid Hussain abidhussain@issi.org.pk Deputy Director Library, Institute of Strategic Studies, Ataturk Avenue, Sector F-5/2, Islamabad, Pakistan

perceived usefulness are critical to determining user acceptance in academic setups. Another study further highlights that using AI tools in academic libraries is beneficial and easy for libraries in advanced countries (Yoon et al., 2022). These studies suggest that library users perceive AI applications in academic libraries, which will increase their likelihood of acceptance.

Several studies have used the traditional model of TAM for innovative technologies in library services; for instance, the study of Adeoye and Olanrewaju (2019) expanded the TAM model for higher education students who use digital academic readings on computers and examined the perceived ease of use and perceived usefulness are significant predictors for teachers in an academic environment. Another study has discovered that integration of the theory of planned behavior with TAM in agricultural research has posited that facilitating conditions also play significant roles in user acceptance of AI; the study further reveals that there is a nexus between social influence and facilitating conditions using both theories in this study (Rafique et al., 2020).

Despite the positive outlook of AI adoption, a notable gap exists concerning AI literacy among users. This study can used to understand AI in academic setup and the lack of knowledge of librarians toward AI that hampers their practical use in academic libraries. In academic libraries where peer institutional support and peer influence could enhance the acceptance of AI technologies, this study suggests that academic libraries must prioritize user education and training programs to strengthen AI literacy (Mabona et al., 2024). In academic libraries, the perception of AI technologies varies among user groups, which is why the study by Huang (2024) suggests that factors such as prior experience with technology and individual biases significantly influence user acceptance. Several studies, for instance, Lund et al. (2020) postulated that librarians' perceptions toward AI are diverse and understanding this perception is crucial for academic libraries in tailoring their AI services and marketing strategy. While the literature provides valuable insights into the acceptance of AI technologies in academic libraries, several knowledge gaps persist, like most of the existing research, which is cross-sectional, providing a snapshot of user acceptance. Longitudinal studies could offer deeper insights into how acceptance evolves as users become more familiar with AI technologies. There is limited research on how demographic factors, such as age, gender, and academic discipline, affect AI acceptance in libraries. Exploring these variables could help libraries better target their AI services.

For integrating AI technologies into academic setup, the TAM framework provides contextual factors driven by ease of use, perceived usefulness, and user attitude (Adeoye & Olanrewaju, 2019). The present study provides a foundation for understanding the complex landscape. Further research is essential to address the identified gap that meets the needs of their users. Several studies have highlighted that the adoption of AI in academic libraries has been influenced by factors like organizational, user-centric considerations and technological

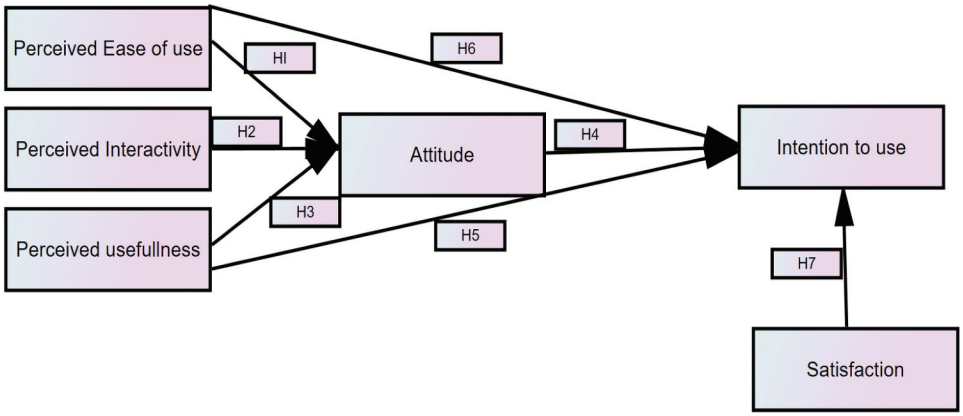

Figure 1. The proposed research model (Author's own).

factors; however, librarians in developing countries, particularly in Pakistan, are still resilient to adopting modern technologies in their academic setup. The study of Ajani et al. (2022) discovered that the Technology Acceptance Model (TAM) is a widely recognized model that explains the prediction of technology adoption in organizational setup. The study of Noorman according to TAM, two key determinants – perceived usefulness and ease of use – affect individuals' attitudes and intentions to use new technologies. The adoption of AI in Pakistani academic libraries allows us to discover how AI-driven tools can shape the willingness of librarians to adopt it and how they perceive the value of AI in their academic setup. The intended study aims to know the potential of AI in reshaping library operations and user experience in Pakistan. Adopting TAM constructs will help the librarians, stakeholders, and policymakers in Pakistan provide actionable insights in academic settings. The study seeks to provide insights into identifying barriers, perceptions surrounding AI and barriers the librarians face. The present study addresses the following hypotheses given in the proposed model of Figure 1 below:

Statement of the problem

Artificial Intelligence (AI) has significantly impacted various sectors like health, agriculture, commerce, education, and academic libraries in advanced countries. This rapid advancement of AI can potentially enhance education and library services in developing countries like Pakistan. Several AI-driven tools, such as machine learning, algorithms, chatbots, and automated cataloging systems, have been entirely deployed in developed nations. In contrast, developing countries like Pakistan remain uncertain due to challenges like technology literacy, infrastructure constraints, and concerns about job displacement. Librarians in developed countries perceive that AI has the potential to enhance library services by

improving information retrieval, reference services, and user engagement. AI's successful adoption in academic libraries is primarily based on librarians' acceptance and willingness to integrate them into their library services. Academic librarians in Pakistan, particularly in Islamabad, have both prospects and consequences for AI. This study aims to know librarians' perceptions of AI in academic libraries. Scholars in LIS have addressed technological usage in libraries in Pakistan; however, there is still limited empirical research on librarians' perception of AI adoption. Its acceptance in Islamabad remains uncertain due to a shortage of empirical research. The Technology Acceptance Model (TAM) has been utilized to provide a well-established framework for understanding the factors influencing librarians' acceptance of AI. LIS scholars in Pakistan have contributed to several research studies relevant to different geographical locations, and most provide a general overview. There is a lack of localized studies to examine how librarians' perceived usefulness, perceived ease of use, and external variables impact AI adoption in this context. This research addresses critical knowledge by investigating librarians' acceptance of AI in Islamabad's academic librarians. There is a lack of potential framework to guide higher education institutions (HEI), policymakers, and library administration in developing strategies that facilitate AI integration in academic setup. Without such guidelines, this study aims to provide practical recommendations for fostering AI adoption in Islamabad's academic libraries.

Literature review

Artificial Intelligence (AI) has become an integral part of modern institutions. Integrating AI in academic libraries has become increasingly relevant for different library services and has genuinely engaged library users with other digital technologies (Hussain, 2023). Several models and theoretical frameworks have been introduced to gauge the complexity of innovative technologies: Diffusion of Information Theory (DOI), Unified Theory of Acceptance and Use of Technology (UTAUT), Actor-Network Theory (ANT) and Technology Acceptance Model (TAM) among these, the use of TAM has been used by different scholars in librarianship for other technologies in academic libraries for instance (Masreka & Husseinb, 2021; Yoon, 2016) used this theory for mobile learning in academic environment. Similarly, in a recent study, Shehzad and Khan (2023a) used this theory to identify the integration of AI in academic libraries. The Technology Acceptance Model provides a robust framework for understanding how users perceive and accept new technologies in their academic setup. Since the popularity of AI in the academic setup has become increasingly relevant, particularly in academic libraries, the use of the TAM model will guide librarians because this model provides a robust framework for understanding how users perceive and accept

new technologies, emphasizing two critical constructs: perceived usefulness and perceived ease of use (Shehzad and Khan, 2023b).

A recent systematic literature review by Shahzad et al. (2024) discovers that the constructs of TAM in an education context are equally vital for academic libraries while adopting new and innovative technologies. Several other studies, mainly conducted in developed countries, such as the study of Hussain (2024), reveal that perceived usefulness and ease of use undoubtedly influence students' intentions in ChatGPT and Big Data in academic setup. The study (Nova, 2023) discovers that ease of use leads to greater acceptance of electronic health records. Similarly, the study of Subaveerapandiyan (2023)indicates that AI technology within library setups positively impacts librarians' attitudes. This study further elaborates that when users perceive AI as easy to navigate, they are more likely to view it as valid, ultimately fostering a positive attitude toward their adoption. Moreover, the study of Azam and Ahmad (2024) explains that psychological frameworks at workplaces are crucial factors for attitudes toward AI integration in academic libraries, so trust and personality traits can further moderate this relationship. If an environment is supportive, where librarians feel confident in using AI tools then, this is necessary for stakeholders to provide them with the opportunities. This construct demonstrates that an easy-to-use platform promotes positive perception (Na et al., 2022). Despite these insights, there is limited research on librarians' perceived ease of use and attitude toward AI. This research addresses the knowledge gap and the relationship between librarians' attitudes and perceived ease of use.

Perceived ease of use

Perceived ease of use is a valuable construct of TAM. The study of Davis (1989) suggests that perceived ease of use and perceived usefulness have strong linkages with human attitude to adopt any innovative technology in an academic setup. Both librarians and library users can systematically influence the attitude toward AI by underscoring its advantages. The study of Chen et al. (2023) also examines how perceived ease of use and usefulness impacted users' attitudes toward using augmented reality mobile applications in an innovative library. Similarly, the study of (Shal et al., 2024) reveals that in the context of transactional leadership, the perceived ease of use and perceived usefulness greatly influence the attitude of users to attain specific objectives. The transformation of traditional library services to AI-oriented services depends heavily on librarians' attitudes, particularly on the perception of use (PEOU). According to Davis (1989), the PEOU is "the degree to which a person believes that using a particular system would be free of effort." If the librarians in academic libraries perceive AI as an easy tool, they are more likely to develop a positive attitude toward its implementation. The study (Miller & Khera, 2010) has

further concluded that when AI is user-friendly, librarians will feel less frustrated adopting it. Similarly, the study also reveals that adopting AI for the automation of cataloging and chatbots will enhance librarians' confidence in technology and further lead them to a more favorable attitude. Despite the literature on AI in academic libraries, significantly less attention has been paid to the perceived ease of use of the TAM model. This study provides guidelines for librarians in developed and developing countries to adopt AI using the TAM framework. Hence, the present study hypothesizes the following:

H1: Perceived Ease of use has a positive effect on the attitude of Librarians toward AI in academic libraries

H6: Perceived Ease of use has a positive effect on the intention to use AI in academic libraries

Perceived interactivity

Perceived interactivity is pivotal in shaping user experience and attitude toward AI in various fields, particularly library environments. The evolving landscape of innovative technology, such as big data, blockchain, mobile technology and particularly the use of AI in academic libraries (Ali & Warraich, 2024). Hence, there is a need for a deeper understanding of librarians to know more about AI. A strong relationship exists between perceived interactivity and user's attitude toward adopting such technologies. Several research, for instance, highlights that the usability and responsiveness of AI chatbots significantly enhance online customer experience (Aminu, 2024). This insight exhibits a positive effect on user perception and satisfaction levels. This finding suggests that librarians may perceive AI as beneficial for their academic setup if designed to be interactive. Moreover, the work emphasizes that perceived capabilities and the interaction of AI systems often influence the acceptance of AI.

Furthermore, Gupta and Yadav (2022) emphasize the importance of perceived socialness in AI interactions, particularly regarding AI. If librarians perceive AI as socially interactive, they will have greater acceptance of AI. Despite these insights, there is still an ample gap in the previous literature, particularly in the perceived interactivity and how this construct influences the user attitude. Future research could explore this dimension by examining librarians' unique needs and expectations at the country level. The current study has underscored the importance of perceived interactivity and its relationship with librarian's attitudes. Therefore, the present study hypothesized the following:

H2: Perceived Interactivity has a positive effect on the librarian's attitude toward AI in academic libraries

Perceived usefulness

AI integration with different domains has gained enormous attraction, particularly in academic libraries. The key factors of these acceptances are based on perceived usefulness. Other domains where AI is adopted have been linked with user attitude, and perceived usefulness positively affects user attitude. Regarding librarians' attitudes, the adoption of AI in academic libraries has been altered by the perceived usefulness (Rafique et al., 2020). For instance, the study (Masreka & Husseinb, 2021) demonstrates that the use of a robot advisor has dramatically influenced their perception of the usefulness of this AI tool. Kim et al. (2022) postulated that the adoption rate of AI in academic libraries is based on familiarity with technology. More librarians in advanced countries are inclined toward AI and perceive that AI will enhance their work efficiency and service quality. A similar study was conducted by medical students in America, which discovered that a positive attitude toward AI technology is linked with perceived usefulness. The study of Chong et al. has. Suggested that librarians who view AI as a reliable tool for their academic libraries are linked with perceived usefulness because the favorable attitude toward AI is often based on perceived usefulness. The study shows that despite the available literature, there is still a knowledge gap between perceived usefulness and librarian's attitude. There is a need for a holistic approach, particularly in developing countries like Pakistan, to fill the knowledge gap of AI in library services. Additionally, longitudinal studies could assess how attitudes evolve with increasing exposure to AI. This study provides guiding rules for future research and its linkages with the attitude of librarians and perceived usefulness. The present study, therefore, hypothesizes the following:

H3: Perceived usefulness has a positive effect on librarian's attitudes toward AI in academic libraries

H7: Perceived usefulness has a positive effect on librarian's intention toward AI in academic libraries

Satisfaction

The literature of advanced countries reveals that there are significant linkages of AI with academic libraries and the integration of AI into academic libraries,

which positively influences librarian satisfaction. Librarians' intentions toward AI indicate that most librarians who have already used AI are reasonably satisfied with this technology. The study of (Rubin et al., 2010) discovered that the use of AI in medical sectors positively influences doctor's satisfaction. Librarianship is a vast field, and integrating AI with academic libraries will significantly satisfy librarians' needs. Similarly, (Nehra & Bansode, 2024) examine that AI is an innovative learning experience and the positive emotions and willingness among librarians are linked to higher literacy of AI. Chatbots, which are highly usable AI tools, have influenced librarians' attitudes in Chinese libraries (Li, 2024). Similarly, the study discovers that AI provides personalized learning, freeing librarians to focus on other tasks; such satisfaction has excellent linkages with librarians' attitudes. The hypothesis of this study, which is shown below, is that the satisfaction of librarians is linked to the intention to use AI in academic libraries. Despite research on this topic, a gap exists in developing countries like Pakistan regarding satisfaction with intention to use. Although this study provides guidelines for satisfaction with AI, it is still longitudinal; research in future may further discover the quality of librarians' attitudes toward AI and their inner satisfaction with AI technologies in academic setups. This study hypothesizes the following:

H4: The librarians' satisfaction has a positive effect on librarians' intention toward AI in academic libraries.

H5: Intention to use has a positive effect on the satisfaction of librarians toward AI in academic libraries.

Research methodology

Research design

The study used a positivist paradigm based on a quantitative research approach. Numerous other studies have used this paradigm; for instance, Hussain and Rafiq (2023) used a quantitative survey research design through a structured questionnaire to collect data from the librarians in Islamabad. For empirical evidence, survey research design is the most common method, which ensures a systematic approach for gathering comprehensive data, allowing for statistical analysis and generalization of findings across the target population.

Instrument development and pilot testing

A questionnaire was developed based on the proposed scale of Yoon (2016). Who used the Technology Acceptance Model (TAM) to use

mobile applications in academic libraries? A five-point Likert scale was used to measure the respondents' opinions of each item. The five-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree was used, and each respondent was required to indicate the extent with each statement to which they agreed or disagreed. Before deploying a full-scale questionnaire, the author shared the questionnaire with a few experts in the field for pre-testing. The experts who worded specific questions for contextual relevance and clarity suggested minor modifications. This step helped the scholar ensure the questionnaire's reliability and validity (see Appendix).

Population and sampling

Every study in the quantitative paradigm has a particular unit of analysis to collect the data. The unit of analysis for this study was academic librarians in Islamabad. Academic libraries include college and university libraries in a broader sense; however, the targeted population of this study was librarians working in both public and private sector universities of Islamabad. Initially, the scholar found the total number of public sector universities from the Higher Education Commission of Pakistan (HEC). According to the HEC website, as of December 2024, there are 26 universities in Islamabad, comprising 17 public sector universities, while 9 are private sector universities. Each university has central and department libraries, forming the study's target population. The study employed a convenient sample approach as this method aligns with the methods of Sarker and AL-Muaalemi (2022), who postulated that for theoretical assumption, a convenient sample approach is appropriate for non-probability sampling. While ensuring the representation from various universities, this approach is suitable for accessible participants.

Data collection procedure

The questionnaire was mounted on Google Forms, and the link was emailed to 240 academic librarians in Islamabad. Initially, only 88 respondents returned the questionnaire; however, after regular follow-up on e-mails and WhatsApp numbers, 218 librarians returned the questionnaire, of which 212 were found suitable for data analysis and results. The high response rate of librarians reflects their willingness to contribute to the study.

Data analysis

Data analysis is a crucial factor in finding the result of any empirical study. Multiple software tools are available for quantitative data results. The scholar has used the following software tools to examine the collected dataset

comprehensively. The SPSS version was used for demographic analysis and description, while SPSS AMOS was utilized to test the hypothesized model and evaluate the acceptance or rejection of hypotheses. However, the ADANCO was used to construct operationalization, construct reliability, convergent validity, and evaluation of discriminant validity using Fornell & Larcker's (1981) criteria because, in SPSS AMOS, such a dataset required a comprehensive skill of Microsoft Excel.

Ethical considerations

Ethical considerations are crucial for collecting data from diverse communities. The present study adhered to ethical guidelines to ensure the respondents' voluntary participation and anonymity throughout the research process. The study also followed the institution's ethical procedure rules before collecting the data from the targeted respondents.

Results

Table 1 reveals the demographic information of participants. The data shows that most participants are male, accounting for 70.3% of the sample, while female participants make up 29.7% of the sample population. As far as the age

Table 1. Summary of respondent's profiles.

Demographic variables	Categories	Frequency	Percentage (%)
Gender	Male	149	70.3
	Female	63	29.7
Age	<30	46	21.7
	31–40	98	46.2
	41–50	60	28.3
	>50	8	3.8
Highest Degree	BS/Master	156	73.6
	MS/M.Phil.	48	22.6
	PhD	8	3.8
Types of Organization	Public Sector	168	79.2
	Private Sector	44	20.8
Experience in years	1–5 Years	77	36.3
	6–10 Years	98	46.2
	11–15 Years	25	11.8
	16–20 Years	12	5.7
	Total	**212**	**100.0**

Table 2. Construct operationalization.

Construct	Type of outer model	Number of indicators	Predefined reliability
Perceived Ease of Use	Latent variable (Mode A consistent)	3	1.0000
Perceived Interactivity	Latent variable (Mode A consistent)	4	1.0000
Perceived Usefulness	Latent variable (Mode A consistent)	3	1.0000
Attitude	Latent variable (Mode A consistent)	3	1.0000
Intention to use	Latent variable (Mode A consistent)	3	1.0000
Satisfaction	Latent variable (Mode A consistent)	3	1.0000

of participants is concerned, 21.7% of the participants are younger than 30 years old. The largest group of participants comprises 46.2% aged between 31 and 40 years. Meanwhile, 28.3% of the participants fall in the age group of 41–50 years. Only 3.8% of participants are over 50 years old. The scholar defined the three categories of highest degrees; among them, most participants (73.6%) hold a BS or Master's degree, followed by MS/M. Phil. has 22.6% of participants, and only 3.8% hold PhD degrees in library and information science. The scholars i.e. (Public and Private Sectors) defined two types of organizations. The data reveals that 79.2% of the sampling population work in public sector organizations, while only (20.8%) work in private sector organizations. Experience in years shows that 36.3% of participants have 1–5 years of work experience, while (46.2%) have 6–10 years of work experience, the largest group among the sample population. About 11.8% of participants have 11–15 years of experience, while A smaller proportion (5.7%) have 16–20 years of experience. The sample size consists of 212 participants.

Results

The Table 2 operationalizes six constructs essential to the model: Perceived Ease of Use, Perceived Interactivity, Perceived Usefulness, Attitude, Intention to Use, and Satisfaction. Each is measured using the Mode (A) consistent approach with predefined reliability, demonstrating high validity and consistency in the model's design. Let me know if you would like further clarification!

Table 3 demonstrates the construct reliability of the hypotheses. Dijkstra-Henseler's rho (ρA). This sign can be used for reflective constructs, and most constructs here exhibit high (>0.70), indicating strong reliability. The Jöreskog's rho (ρc) (Composite Reliability): ρc measures the construct's internal consistency. All values exceed the threshold of 0.70, which is typically acceptable in structural equation modeling (SEM). Constructs like Perceived Interactivity and Intention to Use exceed 0.95, indicating high consistency. Cronbach's alpha (α) α assesses the reliability of items within a construct. While slightly less robust than the other measures, all values are above 0.70, supporting the constructs' reliability. The table below shows that all constructs in the model show satisfactory to excellent reliability across the three metrics.

Table 3. Construct reliability.

Construct	Dijkstra-Henseler's rho (ρ_A)	Jöreskog's rho (ρ_c)	Cronbach's alpha(α)
Perceived ease of use	0.7888	0.7574	0.7536
Perceived Interactivity	0.9628	0.9608	0.9607
Perceived Usefulness	0.9196	0.9187	0.9184
Attitude	0.9444	0.9440	0.9440
Intetion to use	0.9522	0.9508	0.9503
Satisfaction	0.9326	0.9291	0.9272

Constructs such as Perceived Interaction, Attitude, Intention to Use, and Satisfaction have exceptionally high reliability, reflecting strong internal consistency in their measurement. Perceived Ease of Use has the lowest reliability but remains acceptable for SEM standards.

Table 4 provides Average Variance Extracted (AVE) values for various constructs used in a study. AVE can be used to assess the convergent validity of latent constructs. It is a measure used in structure equation modeling (SEM). AVE is a measure used in structural equation modeling (SEM) to assess the convergent validity of latent constructs. AVE is slightly above the threshold (0.50) showing acceptable convergent validity. Perceived Interactivity (AVE = 0.8601), the highest AVE in the model, suggests strong convergent validity, followed by intention to use (AVE = 0.8659), which also suggests strong convergent validity. Intention to Use (AVE = 0.8659). Perceived Ease of Use (AVE = 0.5177) Indicates how easily users feel they can use the technology. This AVE is slightly above the threshold (0.50) showing acceptable convergent validity.

Table 5 shows the Fornell-Larcker Criterion analysis reveals issues with discriminant validity for the constructs in this table. Many diagonal values (square roots of AVE) are lower than the off-diagonal correlations, suggesting significant overlap between constructs. The discriminant validity can be assessed by comparing the square root of each construct AVE (Fornell & Larker, 1981). Diagonal values (bold, e.g., 0.5177, 0.8601, etc.): represent the square root of the AVE for each construct. Perceived ease of use (square root of AVE) is 0.5177 shows that this value is lower than many of the off-diagonal values, such as its correlation with perceived interactivity (0.9691), Perceived Usefulness (1.0165), and others. The perceived interactivity (0.8601) diagonal value is more significant than its correlation with other constructs like

Table 4. Convergent validity.

Standardized Regression Weights: (Group number 1 - Default model)	
Construct	Average variance extracted (AVE)
Perceived ease of use	0.5177
Perceived Interactivity	0.8601
Perceived Usefulness	0.7904
Attitude	0.8490
Intention to use	0.8659
Satisfaction	0.8142

Table 5. Discriminant validity: Fornell-Larcker criterion.

Construct	(1)	(2)	3)	(4)	(5)	(6)
Perceived ease of use	0.5177					
Perceived Interactivity	0.9691	0.8601				
Perceived Usefulness	1.0165	1.0048	0.7904			
Attitude	0.9462	0.9743	1.0354	0.8490		
Intention to use	0.9532	0.9632	1.0402	0.9804	0.8659	
Satisfaction	0.9539	0.9586	1.0417	0.9697	0.9902	0.8142

Table 6. Summary of hypotheses testing.

Hypothesis	Estimate	CR.	P-value	Decision
H1: Perceived Ease of use —>Attitude	0.035	1.006	.315	Rejected
H2: Perceived Interactivity —>Attitude	0.514	16.261	***	Accepted
H3: Perceived Usefulness —>Attitude	0.480	14.751	***	Accepted
H4: Attitude —> Intention to use	0.563	13.582	***	Accepted
H5: Satisfaction —> Intention to use	0.242	14.513	***	Accepted
H6: Perceived Ease of use —> Intention to use	0.040	1.315	.189	Rejected
H7: Perceived Usefulness —>Intention to use	0.224	8.855	***	Accepted

perceived usefulness (1.0048) and satisfaction (0.9586). Similarly, the square root of AVE's Perceived usefulness (0.7904) is lower than its correlations with Intention to Use (1.0402), satisfaction (1.0417), and others. The square root of Attitude AVE (0.8490) is lower than many correlations, such as with Intention to Use (0.9804) and Satisfaction (0.9697). Intention to Use (0.8659): the square root of AVE (0.8659) is lower than its correlations with other constructs (e.g., Satisfaction: 0.9902). Satisfaction (0.8142) and its square root AVE (0.8142) are also lower than several correlations, such as Perceived Usefulness (1.0417) and Intention to Use (0.9902).

Table 6 presents the causal relationships of constructs in a conceptual structural model. The table also shows the path coefficients. A CR value above ± 1.96 indicates statistical significance at a 95% confidence level. A p-value below 0.05 indicates statistical significance, while "***" signifies extremely low p-values (e.g., <0.001). Perceived ease of use has an insignificant effect on librarians' attitudes ($\beta = 0.035$, CR = 1.006, $p = .0035$), and this hypothesis is rejected; perceived interactivity has a powerful significant effect on librarian's attitudes with ($\beta = 0.514$, CR = 16.261, $p = .001$) which has been accepted. The Perceived usefulness significantly influences librarians' attitudes ($\beta = 0.480$, CR = 14.751, $p = .001$). While attitude significantly influences intention to use ($\beta = 0.563$, CR = 13.582, $p = .001$). Satisfaction has a decisive significance on intention to use ($\beta = 0.242$, CR = 14.513, $p = .001$). While Perceived Ease of Use negatively impacts the intention to use AI ($\beta = 0.040$, CR = 1.315, $p = .189$), this hypothesis is rejected. Table 6 and Figure 2 illustrate the structural model results from the Amos output.

Discussion

The study reaffirms the applicability of the Technology Acceptance Model in understanding the academic librarian's perception toward AI Islamabad. The findings of this study provide valuable insights into the acceptance of AI in Islamabad's academic libraries. Most previous studies used general statistics, such as descriptive statistics. Comparatively, less attention has been paid to introducing TAM as a framework. As AI can be used as a digital library service, the TAM could serve as a convincing framework to define user acceptance of AI in academic setup (Davis, 1989).

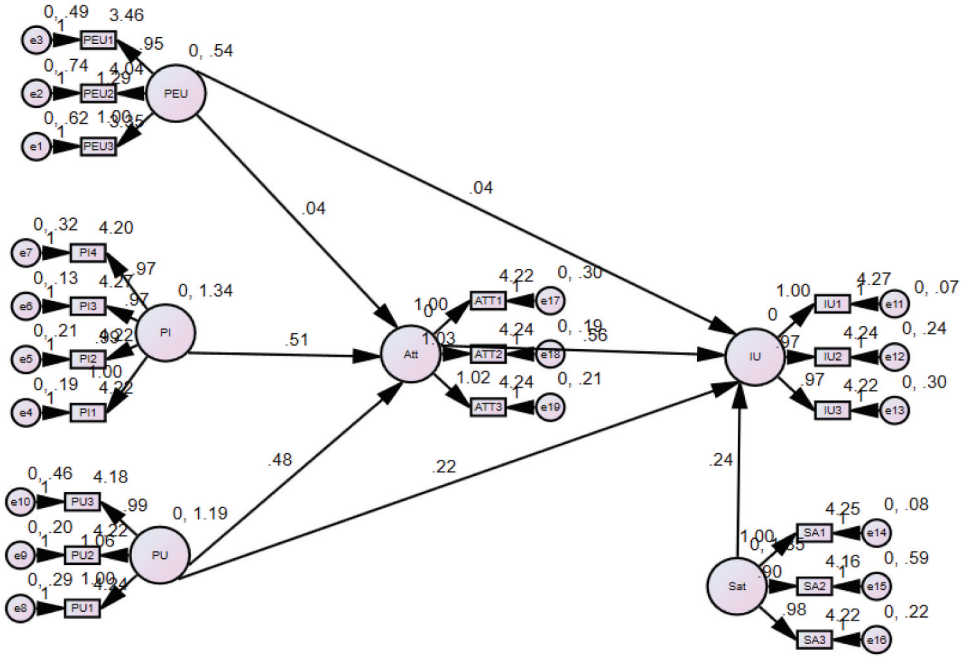

Figure 2. Result of proposed model.

The study further elaborates that the perceived ease of use (PEOU) significantly influences the attitude of librarians toward AI, while perceived usefulness inclines the librarianship toward AI. This aligns with the study of Shahzad and Khan (2023), who suggest that librarians in the Punjab district perceive AI as a beneficial and easy-to-use tool. Perceived interactivity is a crucial determinant for AI in academic libraries such as virtual assistance and chatbots; these applications can enhance user engagement and streamline information retrieval processes. The findings of this determinant align with the study (Hussain, 2024), which highlights that AI is useful for handling complex reference enquiries for users who need answers. Perceived attitude on intention to use suggests that librarian's inclination toward AI is positive. Librarians with a constructive perception of AI were more likely to integrate it with academic libraries. The findings align with the study of Ali et al. (2024), who demonstrate that librarians who view AI as a supportive tool will find it as an enhancement rather than a replacement.

Similarly, the study acknowledges the potential use of AI for various library functions, and librarians are likelier to embrace it in their academic libraries Kim, J. H. (2020). The study of (Acosta-Enriquez et al., 2024) has also suggested that AI-driven library services may improve efficiency and user satisfaction (Subaveerapandiyan, 2023). It indicates that though AI is still interesting, it has some concerns for librarians; addressing these challenges requires training and skill development as critical factors. Librarians' attitudes

toward AI were largely positive; nevertheless, based on the experience level of librarians, it has been found in the study (Abid, 2021) that some librarians expressed concerns about job security and the potential for AI to replace specific traditional roles of librarians. The findings underscore the need for AI to be positioned as an augmentation tool rather than a replacement for librarians as human experts.

The study of Asante et al. (2024) highlights that some external factors can also influence AI adoption of AI, like infrastructure, policy framework, institutional support, etc. This study identified a lack of formal AI policies in developing countries; the study is aligned with the study that ensured that specific problems like financial limitations and resource constraints are associated with AI integration in academic libraries. The study also highlighted some barriers and discovered that institutional readiness is crucial for implementing AI in academic libraries (Wheatley & Hervieux, 2019). The study (Tait & Pierson, 2022) highlights some challenges and future considerations for AI in academic libraries. Despite the positive inclination of librarians toward AI. Several barriers, like limited technical expertise, ethical concerns and resistance to change, were mentioned frequently. Moving forward, targeted training programs and strategic policy interventions could enhance AI literacy and mitigate resistance among librarians.

This study's findings offer theoretical and practical implications for librarians, academicians, library research scholars, engineers and AI developers. Although the findings of the present study are valuable and find important factors of AI for academic libraries, the authors still highlight some limitations. As this study was undertaken in Islamabad, the result of this study cannot be generalized to the whole country; similarly, as the academic libraries include college and degree awarding institutions, hence the scholar included only 26 universities (Public and Private Sector Universities based in Islamabad only). Similarly, the finding of this research is based on the positivism paradigm (quantitative research); the scholar also suggests that future research of qualitative paradigms may be conducted to explore the work of AI toward academic libraries. Similarly, the scholar also indicates that future works should be extended to country-wise research using the same framework of TAM.

Conclusion

AI has brought tremendous revolutions in academic libraries across different continents. Pakistan's libraries, particularly in Islamabad, are lagging in fully implementing AI in library operations. This study provides a comprehensive analysis of academic librarians' intention to adopt AI in the academic libraries of Islamabad. Based on the Technology Acceptance Model, the study strongly affirms that some key determinants influence AI adoption, such as perceived usefulness, perceived

interactivity and satisfaction; the study also reaffirms some challenges related to perceived ease of use and institutional readiness. The findings show that perceived interactivity and usefulness significantly impact librarians' attitude toward AI and reaffirm that librarians perceive AI as a valuable tool for enhancing library services. Still, the study indicates that the insignificant effect of perceived ease of use on attitude recommends that more efforts are needed to improve librarians' confidence and understanding toward AI technologies. The findings also reveal that librarians with positive attitudes toward AI are more likely to integrate it into their professional practices. The present study has significant implications for academic institutions, policymakers, AI developers, and librarians. The study also reveals that few worthy steps should be taken to deploy AI in academic institutions, such as institutional policy development, training programs, and strategic interventions to enhance AI literacy among librarians. The study also recommends that additional steps are essential for a smooth transition of AI in academic libraries. These are technical expertise gaps, resistance to change and ethical concerns toward AI integrations in academic libraries. Artificial intelligence in libraries presents immense opportunities for academic libraries in Pakistan. Its successful adoption requires a holistic approach; this study serves as a foundational step in understanding librarians' perception toward AI and paves the way for further research to optimize the services in academic libraries of Pakistan and beyond.

Limitations

The research provides valuable insights, however. Still, it has inevitably had some shortcomings, and the scholar should consider certain limitations. The research was undertaken in academic libraries in Islamabad, so its result may not be generalized to a broader and global context. Moreover, the study primarily adopted the quantitative approach within a positivist background; there should be more research in the qualitative paradigm to gain a deeper understanding of library domains. Further research should also explore AI implementation in libraries of different regions of Pakistan to provide a more holistic understanding of its adoption and impact. Further research should also explore AI implementation in libraries across different areas of Pakistan to provide a more holistic understanding of its adoption and impact.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Abid, H. (2021). Uses of blockchain technologies in library services. *Library Hi Tech News*, *38* (8), 9–11. https://doi.org/10.1108/LHTN-08-2020-0079

Acosta-Enriquez, B. G., Ballesteros, M. A., Pérez, C. R. V., Jordan, O. H., Vergara, J. A. M., Acosta, R. M., & Castillo, J. C. A. (2025). AI in academia: How do social influence, self-efficacy, and integrity influence researchers' use of AI models?. *Social Sciences & Humanities Open*, *11*, 101274.

Adeoye, A. A., & Olanrewaju, A. O. (2019). Use of technology acceptance model (TAM) to evaluate library electronic information resources used by lead city university, Ibadan, Nigeria undergraduate students. *Library Philosophy & Practice*, 1–24.

Ajani, Y. A., Tella, A., Salawu, K. Y., & Abdullahi, F. (2022). Perspectives of librarians on awareness and readiness of academic libraries to integrate artificial intelligence for library operations and services in Nigeria. *Internet Reference Services Quarterly*, *26*(4), 213–230. https://doi.org/10.1080/10875301.2022.2086196

Ali, I., & Warraich, N. F. (2024). Use and acceptance of technology with academic and digital libraries context: A meta-analysis of UTAUT model and future direction. *Journal of Librarianship and Information Science*, *56*(4), 965–977. https://doi.org/10.1177/09610006231179716

Ali, M. Y., Naeem, S. B., Bhatti, R., & Richardson, J. (2024). Artificial intelligence application in university libraries of Pakistan: SWOT analysis and implications. *Global Knowledge, Memory & Communication*, *73*(1/2), 219–234. https://doi.org/10.1108/GKMC-12-2021-0203

Aminu, M. B. (2024). Adoption of artificial intelligence for library operations in federal university libraries in North West states of Nigeria. *BW Academic Journal*, *1*(3), 88–93.

Asante, I. K., Ametepey, E. T., Ocran, J. K., Omega, S., & Annor-Frempong, F. (2024). Factors influencing the behaviour of extension agents towards adopting digital technologies in agricultural extension: A theory of planned behaviour perspective. *International Journal of Agricultural Extension*, *12*(2), 361–378. https://doi.org/10.33687/ijae.012.002.4528

Azam, M., & Ahmad, K. (2024). Adoption of big data analytics for sustainability of library services in academic libraries of Pakistan. *Library Hi Tech*, *42*(5), 1457–1476. https://doi.org/10.1108/LHT-12-2022-0584

Chen, C.-C., Liu, C.-C., Chiu, T.-H., Lee, Y.-W., & Wu, K.-C. (2023). Role of perceived ease of use for augmented reality app designed to help children navigate smart libraries. *International Journal of Human-Computer Interaction*, *39*(13), 2606–2623. https://doi.org/10.1080/10447318.2022.2082017

Chen, G., Fan, J., & Azam, M. (2024). Exploring artificial intelligence (AI) chatbots adoption among research scholars using unified theory of acceptance and use of technology (UTAUT). *Journal of Librarianship and Information Science*, 09610006241269189. https://doi.org/10.1177/09610006241269189

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.

Gupta, P., & Yadav, S. (2022). A TAM-based study on the ICT usage by the academicians in higher educational institutions of Delhi NCR. In M. Saraswat, H. Sharma, K. Balachandran, J. H. Kim, & J. C. Bansal (Eds.), *Congress on intelligent systems* (Vol. 111, pp. 329–353). Springer Nature Singapore. https://doi.org/10.1007/978-981-16-9113-3_25

Gürsen, A. E., Öncel, A. G., Plaisent, M., Benslimane, Y., & Bernard, P. (2023). Artificial intelligence utilization in libraries. *Athens Journal of Sciences*, *10*(2), 83–94. https://doi.org/10.30958/ajs.10-2-2

Huang, Y.-H. (2024). Exploring the implementation of artificial intelligence applications among academic libraries in Taiwan. *Library Hi Tech*, *42*(3), 885–905. https://doi.org/10.1108/LHT-03-2022-0159

Hussain, A. (2023). Use of artificial intelligence in the library services: Prospects and challenges. *Library Hi Tech News*, *40*(2), 15–17. https://doi.org/10.1108/LHTN-11-2022-0125

Hussain, A. (2024). Unlocking the potential of ChatGPT in academic libraries. *IP Indian Journal of Library Science and Information Technology*, *9*(2), 88–97. https://doi.org/10.18231/j.ijlsit.2024.015

Hussain, A., & Rafiq, M. (2023). *Perceptions of academic librarians toward open-source library system (OSLS): Case study of Pakistan*. Science & Technology Libraries.

Kim, J.-H. (2020). A study on library service using artificial intelligence: Focused on North American university libraries. *Journal of Korean Library and Information Science Society*, *51*(4), 231–247.

Kim, S., Park, S., Parkk, J., & Oh, Y. (2022). A study on the intention to use the AI-related educational content recommendation system in the university library: Focusing on the perceptions of university students and librarians. *Journal of Korean Library and Information Science Society*, *53*(1), 231–263.

Liu, Y., Liang, Z., & Liu, Y. (2024). Factors influencing the adoption of public mobile libraries in China: A stimulus–response perspective. *Electronic Library*, *42*(1), 37–59.

Lund, B. D., Omame, I., Tijani, S., & Agbaji, D. (2020). Perceptions toward artificial intelligence among academic library employees and alignment with the diffusion of innovations' adopter categories. *College & Research Libraries*, *81*(5), 865. https://doi.org/10.5860/crl.81.5.865

Mabona, A., Van Greunen, D., & Kevin, K. (2024). Integration of artificial intelligence (AI) in academic libraries: A systematic literature review. In *2024 IST-Africa conference (IST-Africa)* (pp. 1–9). https://ieeexplore.ieee.org/abstract/document/10569288/

Masreka, M. N., & Husseinb, A. (2021). Intention to adopt mobile applications services: A study among Pakistani academic librarians. *International Journal of Innovation, Creativity, and Change*, *15*(3), 38–54.

Miller, J., & Khera, O. (2010). Digital library adoption and the technology acceptance model: A cross-country analysis. *The ELectronic Journal of Information Systems in Developing Countries*, *40*(1), 1–19. https://doi.org/10.1002/j.1681-4835.2010.tb00288.x

Na, S., Heo, S., Han, S., Shin, Y., & Roh, Y. (2022). Acceptance model of artificial intelligence (AI)-based technologies in construction firms: Applying the technology acceptance model (TAM) in combination with the technology–organisation–environment (TOE) framework. *Buildings*, *12*(2), 90. https://doi.org/10.3390/buildings12020090

Nehra, S. S., & Bansode, S. Y. (2024). Exploring the prospects and perils of integrating artificial intelligence and ChatGPT in academic and research libraries (ARL): Challenges and opportunity. *Journal of Web Librarianship*, *18*(3), 111–132. https://doi.org/10.1080/19322909.2024.2390413

Nova, K. (2023). Generative AI in healthcare: Advancements in electronic health records, facilitating medical languages, and personalized patient care. *Journal of Advanced Analytics in Healthcare Management*, *7*(1), 115–131.

Rafique, H., Almagrabi, A. O., Shamim, A., Anwar, F., & Bashir, A. K. (2020). Investigating the acceptance of mobile library applications with an extended technology acceptance model (TAM): *Computers & education*. *Computers and Education*, *145*, 103732. https://doi.org/10.1016/j.compedu.2019.103732

Rubin, V. L., Chen, Y., & Thorimbert, L. M. (2010). Artificially intelligent conversational agents in libraries. *Library Hi Tech*, *28*(4), 496–522. https://doi.org/10.1108/07378831011096196

Sarker, M., & AL-Muaalemi, M. A. (2022). Sampling techniques for quantitative research. In M. R. Islam, N. A. Khan, & R. Baikady (Eds.), *Principles of social research methodology* (pp. 221–234). Springer Nature. https://doi.org/10.1007/978-981-19-5441-2_15

Shahzad, K., & Khan, S. A. (2023a). Effects of e-learning technologies on university librarians and libraries: A systematic literature review. *The Electronic Library*, *41*(4), 528–554. https://doi.org/10.1108/EL-04-2023-0076

Shahzad, K., & Khan, S. A. (2023b). Factors affecting the adoption of integrated semantic digital libraries (SDLs): A systematic review. *Library Hi Tech*, *41*(2), 386–412. https://doi.org/10.1108/LHT-05-2022-0231

Shahzad, K., Khan, S. A., & Iqbal, A. (2024). Identifying librarians' readiness to leverage artificial intelligence for sustainable competence development and smart library services: An empirical investigation from universities' librarians. *Global Knowledge, Memory & Communication*, ahead-of-print(ahead-of–print). https://doi.org/10.1108/GKMC-02-2024-0107

Shal, T., Ghamrawi, N., & Naccache, H. (2024). Leadership styles and AI acceptance in academic libraries in higher education. *Journal of Academic Librarianship*, *50*(2), 102849. https://doi.org/10.1016/j.acalib.2024.102849

Subaveerapandiyan, A. (2023). Application of artificial intelligence (AI) in libraries and its impact on library operations review. *Library Philosophy & Practice*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4528216

Tait, E., & Pierson, C. M. (2022). Artificial intelligence and robots in libraries: Opportunities in LIS curriculum for preparing the librarians of Tomorrow. *Journal of the Australian Library and Information Association*, *71*(3), 256–274. https://doi.org/10.1080/24750158.2022.2081111

Wheatley, A., & Hervieux, S. (2019). Artificial intelligence in academic libraries: An environmental scan. *Information Services & Use*, *39*(4), 347–356. https://doi.org/10.3233/ISU-190065

Yoon, H.-Y. (2016). User acceptance of mobile library applications in academic libraries: An application of the technology acceptance model. *Journal of Academic Librarianship*, *42*(6), 687–693. https://doi.org/10.1016/j.acalib.2016.08.003

Yoon, J., Andrews, J. E., & Ward, H. L. (2022). Perceptions on adopting artificial intelligence and related technologies in libraries: Public and academic librarians in North America. *Library Hi Tech*, *40*(6), 1893–1915. https://doi.org/10.1108/LHT-07-2021-0229

Appendix

Participant Questionnaire

Assalam-O-Alaikum, Thank you for your participation. The aim of this paper is to examine "Librarian acceptance of Artificial Intelligence in Academic Libraries of Islamabad: An Application of the Technology Acceptance Model" This survey will take 5–10 min to complete. Your participation in this research is voluntary. Your anonymity is assured. The data collected from this questionnaire will be solely used for research and academic purposes.

With Profound regards

Abid Hussain (Deputy Director Library) Institute of Strategic Studies IslamabadMobile No: 0333–9285087

Section A: Demographic Information

(Please tick ✓ the appropriate option)

Gender: ☐ Male ☐ Female

Age: ☐ <30 ☐ 31–40 ☐ 41–50 ☐ 50 and above

Qualification: ☐ BS ☐ BLISc ☐ MLISc/M. A ☐ MS/M.Phil ☐ Ph.D.

Organization: ☐ Public Sector ☐ Private Sector

Experience in the University: ☐ 1–5 years ☐ 6–10 years ☐ 11–15 years ☐ 16–20 years ☐ More than 20 years

Name of the University (optional): _____

Section B: (Please rate the following statements on a 5-point Likert scale: 1 = Strongly Disagree to 5 = Strongly Agree)

Perceived Ease of use						
No	Statement	1 SD	2 DA	3 Neutral	4 Agree	5 SA
PEU1	Using AI in libraries does not requires much effort					
PEU2	I find AI easy in academic libraries					
PEU3	I find it easy to access and use AI in academic libraries					
Perceived Interactivity						
No	**Statement**					
PI1	AI in academic libraries works quickly and responds fast.					
PI2	I think AI content is helpful for me.					
PI3	It is easy to use AI at any time.					
PI4	It is easy to use AI anywhere					
Perceived Usefulness						
No	**Statement**					
PU1	I think AI in my academic library is helpful to me					
PU2	I think AI content is helpful for me					
PU3	AI in my library helps me provide services more quickly.					
PU4	Using AI in my library saves my time					

(*Continued*)

(Continued).

Perceived Ease of use						
No	Statement	1 SD	2 DA	3 Neutral	4 Agree	5 SA
Attitude						
No	**Statement**					
AT1	It is a great idea to use AI in library services					
AT2	I feel good about using AI in library services.					
AT3	It is easier and better for me to use AI in my library					
Satisfaction						
No	**Statement**					
SA1	Overall, I am happy with AI in library services					
SA2	I am satisfied that AI in my library meets my needs					
SA3	AI is useful for both library users and staff					
Intention to use						
No	**Statement**					
IU1	I plan to use AI in my library soon					
IU2	I plan to keep using AI in the future					
IU3	I would recommend AI to my colleagues					