

IDENTIFYING, VALIDATING, AND MODELING TECHNOLOGY MANAGEMENT SKILLS FOR COLLEGE LIBRARIANS IN KHYBER PAKHTUNKHWA

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Abstract

Purpose: The purpose of this study is to identify, validate, and propose a Technology Management Skills (TMS) Model for college librarians in Khyber Pakhtunkhwa (KP), Pakistan. This model aims to enhance librarians' ability to manage digital resources and modernize library services in response to the evolving technological landscape.

Methodology/Research Design: The research began with a comprehensive review of existing literature and content analysis to identify the most relevant TMS. A 5-point Likert scale survey was then distributed to 187 randomly selected librarians from various college libraries in KP. The survey measured 16 TMS items, categorized into four main dimensions: Information Technology, Information Assurance and Security, Library Content Management Systems, and Social Media Skills. Data collected from the survey were analyzed using SPSS to assess the significance of each TMS item.

Findings: The findings revealed that librarians across KP assigned substantial importance to all 16 TMS items. Moreover, librarians working in government colleges rated these skills higher than those in private colleges. The results underscore the growing recognition among librarians of the importance of technology management skills in enhancing library operations and service delivery.

Originality/Value: This study contributes by proposing a tailored TMS model specifically for college librarians in KP. It recommends incorporating TMS training into Library and Information Science (LIS) curricula and encourages library administrators to promote the adoption of the model, helping librarians meet the technological demands of the profession.

INTRODUCTION

Technology Management Skills (TMS) are defined as the essential skills needed to effectively design, implement, and manage technology solutions that align with an organization's goals. In the context of libraries, particularly academic libraries, these skills include the ability to manage and implement digital tools and systems. As libraries increasingly rely on

technology to manage resources, automate services, and interact with users, librarians need to adapt and develop these skills. Technology Management Skills enable librarians to navigate the fast-evolving technological landscape, ensuring they can improve library operations and provide better services to students and faculty. The importance of Technology

Management Skills has grown significantly as libraries shift from traditional paper-based systems to digital platforms. College libraries, as vital hubs of knowledge and information for academic institutions, have had to adapt to this transition. As technology advances, the role of librarians has expanded to include managing digital content, automating processes, and ensuring digital security. These changes demand that librarians acquire both technical and managerial skills to help them effectively handle digital resources, maintain systems, and enhance user experience.

Libraries are no longer merely physical spaces filled with books. They are evolving into digital information hubs where library management systems (LMS), digital archives, online databases, and e-books are part of the core service offering. Librarians play a central role in ensuring that these digital services run smoothly and are accessible to their patrons. However, this shift to digital requires librarians to acquire new technology management skills, such as familiarity with cloud computing, digital security, and project management.

This study seeks to assess the current technology management skills of college librarians in Khyber Pakhtunkhwa (KP), a province in Pakistan, and identify the skills they need to improve to manage these emerging technologies effectively. The Technology Management Skills Model (TMS Model) proposed by the study is designed to provide librarians with the framework to enhance their capabilities in the field of technology management.

Over the years, technology has significantly changed how information is stored, processed, and accessed. As technology continues to transform the information management landscape, librarians have been tasked with integrating new technologies into library services. These changes include managing digital collections, operating library systems, and ensuring secure access to digital resources. However, despite the advancements, many librarians—especially in resource-constrained regions like Khyber Pakhtunkhwa—struggle to keep pace with these changes due to insufficient professional training and access to technology.

In many parts of Pakistan, particularly in rural areas, librarians still rely on traditional manual systems, and digital infrastructure is often outdated or

underdeveloped. According to Rafiq and Ameen (2012), many librarians in Pakistan have limited access to professional training on digital technologies, and there is often a lack of infrastructure to support the digitalization of library operations. This limits the ability of librarians to fully harness the benefits of digital tools, preventing libraries from achieving their potential in providing modern, efficient services to their users.

In response to these issues, this study aims to assess the current technology management skills of college librarians in KP, identify the specific skills they require to effectively manage technology, and propose a TMS Model tailored to their needs. The goal is to equip librarians with the necessary skills to manage technological advancements and enhance the digital services offered by libraries.

Technology Management Skill

Technology Management Skills are multifaceted competencies that enable professionals to integrate technology into organizational operations and maximize its impact. For librarians, these skills are crucial in managing digital collections, maintaining automated library systems, and ensuring digital security. These skills include proficiency in handling library management software, understanding digital rights management (DRM), ensuring cybersecurity of digital resources, and utilizing emerging technologies like artificial intelligence (AI) and blockchain for secure data management.

As libraries transition into digital spaces, librarians must not only be adept at using technology but also be capable of managing technology within the library environment. This includes understanding how to manage and integrate various digital platforms, including online catalogs, digital archives, and research databases. Furthermore, librarians must have the leadership skills to guide digital transformations in their libraries, ensuring that these transformations align with the goals of the educational institutions they serve.

College Librarianship in Pakistan

Librarianship in Pakistan has evolved from traditional library practices, where librarians were primarily responsible for managing physical collections, to a more complex role involving the management of

digital resources. With the growth of the internet, digital archives, and online databases, librarians are increasingly tasked with managing these digital resources. However, as noted by Mahmood (2013), many libraries in Pakistan, especially in rural areas like KP, still operate with outdated systems, and librarians lack the skills to manage digital resources efficiently.

In urban centers, some progress has been made in adopting digital technologies, but many college libraries in Pakistan remain far behind in terms of infrastructure and training. A study by Rehman & Shafique (2011) highlights the challenges faced by librarians in Pakistan, including limited access to training in emerging technologies, insufficient digital infrastructure, and a lack of institutional support for professional development. This makes it difficult for librarians to effectively manage digital tools and resources, leading to inefficiencies in library operations.

The Higher Education Commission (HEC) has made efforts to improve the situation by promoting the digitalization of libraries in universities and colleges, but these efforts have been slow and uneven. According to Siddique (2020), while some universities have adopted automated library systems, others continue to rely on manual systems, with limited digital resources. The need for more professional development programs in the field of technology management for librarians is evident, particularly in underserved regions like KP.

Competency Model for Librarians

International competency models have been developed to define the essential skills needed for modern librarianship. Prominent models include those from the American Library Association (ALA) and the International Federation of Library Associations (IFLA), which emphasize the importance of digital literacy, information security, data management, project management, and leadership skills. These competency frameworks are designed to help librarians stay abreast of new technologies and manage their integration into library services effectively.

In Pakistan, however, there is a gap in the development of localized competency models for librarians, particularly those in rural and resource-limited areas. The Pakistan Library Association (PLA)

and other professional bodies have highlighted the need for tailored training programs that address the specific challenges faced by librarians in the region. Khan & Parveen (2020) argue that the curriculum for Library and Information Science (LIS) programs in Pakistan needs to be updated to include more technology management skills, focusing on areas such as digital preservation, IT infrastructure management, and cybersecurity.

A Competency Framework for Federal Librarians (FLICC, 2011) outlines the key competencies required for modern librarianship. This framework emphasizes both technical and soft skills, including the ability to adapt to new technologies and manage digital projects. It serves as a useful guide for developing a similar model in Pakistan, particularly for college librarians in KP who face unique challenges related to infrastructure and professional development.

Technology Management Skill for Librarians

As libraries become more digital, technology management skills have become a necessity. Librarians must be proficient in managing digital resources, library management systems, and emerging technologies such as cloud computing and big data. Studies by Choi & Rasmussen (2019) indicate that these skills are essential for ensuring that digital resources are secure, accessible, and properly maintained.

In addition to technical expertise, librarians must also have project management and leadership skills to implement and manage new technology initiatives in libraries. Saunders (2020) highlights that librarians need to be able to lead digital transformation projects, which include implementing new systems, integrating emerging technologies, and promoting digital literacy among library users. Moreover, soft skills such as communication, problem-solving, and adaptability are becoming increasingly important for librarians as they navigate the rapidly changing landscape of technology.

In today's digital world, librarians must constantly upgrade their skills to stay relevant. Ongoing training programs, professional development workshops, and certifications are necessary to ensure that librarians are equipped to handle new technology and lead digital initiatives. Developing these skills will enable

librarians to provide better services, support digital learning environments, and improve overall library management.

RESEARCH OBJECTIVES

This study will achieve the following research objectives in the context of librarians serving in the government colleges of Khyber Pakhtunkhwa.

- 1) To examine the current technology management skills of college librarians in Khyber Pakhtunkhwa.
- 2) To identify the required technology management skills among the college librarians in Khyber Pakhtunkhwa.
- 3) To propose a technology management skills model for college librarians in Khyber Pakhtunkhwa.

SIGNIFICANCE OF THE STUDY

Developing a Technology Management Skills (TMS) model will be highly valuable for college librarians in Khyber Pakhtunkhwa (KP). This model will help

identify the essential skills librarians need to perform effectively in today's technology-driven environment. Through this study, we aim to explore the current level of technological management skills among college librarians in KP and determine what additional skills are required. The proposed model will serve as a tool for librarians to assess and better understand their own technological capabilities, ultimately helping them enhance their professional performance.

The findings will provide practical insights that librarians can use to manage digital resources more efficiently. By improving their TMS, librarians can make libraries more resourceful and relevant for both students and faculty. This will empower librarians to take a more active role in supporting teaching, learning, and research within their institutions. Additionally, this study seeks to address a gap in the existing literature by focusing specifically on technology management skills from the perspective of college librarians in KP.

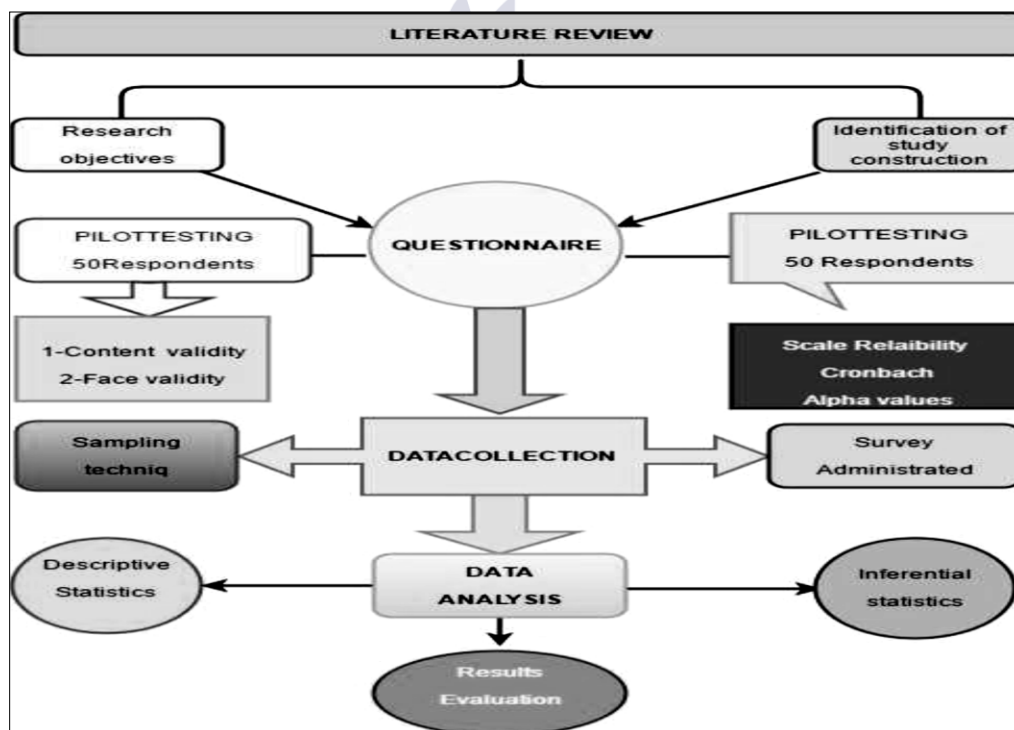


Figure 1: Theoretical flow chart of this study

THEORETICAL SUPPORT FOR THE STUDY

This study the technology management skills for college librarians in KP can be theoretically supported

by several frameworks and theories that emphasize the integration of technology, information management,

and organizational skills. The two dominant theoretical supports that might be useful are as under. Technology Acceptance Model (TAM) - This model was produced by Davis (1989) and widely used to understand how people accept and reject technologies. TAM recognizes three key influences on an individual's intentions to utilize technology e.g. external factors, usefulness, and easiness intention to utilize technology. TAM is relevant for college librarians because it helps them understand how likely they are to embrace new library management systems, digital catalogs, or automated services. Understanding TAM assists in developing strategies to increase technology adoption by stressing usability and benefits for college librarians in KP.

Competencies for Federal Librarians (FLICC)-FLICC are a competency framework for Federal Librarians produced by Tania Andreef and Kim Edwin including their group members in 2011. The purpose of this framework is to maintain professional capabilities in the federal library community. FLICC will frequently examine the competencies to ensure they are relevant. The competencies are expected to benefit individuals beyond the federal librarian community, such as human resource professionals,

information technology peers, executive management, policy-makers, product developers, vendors, educational institutions, certifying entities, and other information professionals.

RESEARCH METHODOLOGY & RESULTS

The study adopts a quantitative approach using a structured survey to assess both the current technology management skills and the skills needed for future development. A 5-point Likert scale was used to measure 16 TMS items across four key dimensions: Information Technology, Information Assurance and Security, Library Content Management Systems, and Social Media Skills. The survey was distributed to 187 randomly selected college librarians in KP, with data collected through both printed and online versions of the instrument. The responses were analyzed using SPSS to identify significant gaps in the skills possessed by librarians, with the aim of providing a framework to improve technology management skills in the region. The methodology ensured that the TMS model developed is contextually relevant and practical for enhancing the professional capabilities of librarians in KP.

DEMOGRAPHIC CHARACTERISTICS

CATEGORY	SUB-CATEGORY	FREQUENCY (F)	PERCENTAGE (%)
Gender	Male	64	36.6%
	Female	111	63.4%
Age Group	21-29 years	72	41.1%
	30-39 years	60	34.3%
	40-49 years	33	18.9%
	More than 49 years	10	5.7%
Job Experience	Up to 5 years	127	72.6%
	6-10 years	31	17.7%
	11-15 years	10	5.7%
	16-20 years	1	0.6%
	21-25 years	3	1.7%
	More than 25 years	3	1.7%
Qualification	Master in LIS	145	82.9%
	MPhil/MS	25	14.3%
	PhD	5	2.9%
Type Of College	Government college	147	84.0%
	Private college	28	16.0%
Job Status	Permanent	124	70.9%

	Contract	51	29.1%
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Table 1: Summary of Respondents Demographic Characteristics (N = 175)

The demographic profile of the respondents is presented based on gender, age, job experience, qualification, type of college, and job status. The majority of participants were female librarians, accounting for 63.4% (111) of the sample, while male librarians comprised 36.6% (64). This indicates a stronger representation of female professionals in the field. In terms of age distribution, the largest group was between 21 and 29 years old, making up 41.1% (72) of respondents, followed by 34.3% (60) aged 30 to 39 years. Librarians aged 40 to 49 years accounted for 18.9% (33), whereas only 5.7% (10) were above 49 years, suggesting a workforce dominated by younger professionals. Regarding job experience, most respondents (72.6%, 127) had up to five years of experience, reflecting a significant presence of early-career librarians. Those with 6 to 10 years of experience made up 17.7% (31), while 5.7% (10) had 11 to 15 years. A small number had more than 15 years of experience, indicating fewer senior professionals in the sample. Concerning academic qualifications, a substantial majority held a Master's degree in Library and Information Science (82.9%, 145), with 14.3% (25) possessing an MPhil/MS degree, and a small minority (2.9%, 5) holding a PhD. This highlights the strong educational background of the participants. The type of college affiliation showed that most librarians (84%, 147) worked in government colleges, while 16% (28) were employed in private colleges. Lastly, job status data revealed that 70.9% (124) of the respondents held permanent positions, whereas 29.1% (51) were on contract,

reflecting overall employment stability among the librarians surveyed.

RESULTS

The findings of this study are based on the responses from the survey, which was divided into two main sections: the first section aimed to assess the current level of technology management skills among librarians, while the second focused on identifying the skills needed for effective technology management. Each section included several items measured using a 5-point Likert scale. For the current skill level, respondents rated themselves from 5 = Very High to 1 = Very Low, while for the needed skill level, the scale ranged from 5 = Highly Required to 1 = Not Required at All. Participants were instructed to circle the number that best represented their opinion for each item, enabling the study to capture both the existing capabilities of librarians and the areas where skill development is needed. The Information Technology (IT) dimension was one of the key areas assessed in the study, consisting of eight statements. Four of these statements were designed to evaluate the current IT skills of librarians, while the other four addressed the skills they perceived as necessary for future growth. The results, including the mean (M) and standard deviation (SD) for each item, are presented in Table 2, with rankings that reflect the priority and importance placed on each skill by the respondents. These findings offer a detailed overview of the existing competencies and the areas where librarians in Khyber Pakhtunkhwa require further skill development in the IT domain.

INFORMATION TECHNOLOGY RANKING OF TMS SKILLS

No	Skill statement	College Librarians		
		Mean	SD	Rank
Current level skill (information technology)				
1c	Ability of hardware, operating system or software applications for library services	2.82	1.165	2
2c	Ability to solve technological issues in the library	2.82	.987	1
3c	Ability to evaluate library staff technology training needs	2.77	1.036	4
4c	Ability to create and modify the library's IT policies and procedures	2.78	.904	3
Needed level skill (information technology)				
	Ability of hardware and software	4.25	.729	4
1n	Ability to solve technological issues	4.29	.959	3
2n	Ability to evaluate library staff technology training needs			
3n	Ability to create and modify the library's IT policies and procedures	4.39	.685	2
4n		4.47	.757	1

Table: 2 Information Technology' ranking of TMS skills

As shown in Table 2, college librarians ranked key Information Technology (IT) skills under the Technology Management Skill (TMS) model. The highest needed skill was the ability to create, explain, and modify IT policies (M = 4.47, SD = 0.757), though the current skill level was not reported, suggesting a potential gap. Other high-needed skills included solving technological issues (M = 4.39) and evaluating staff training needs (M = 4.29), but current scores (M = 2.82 and M = 2.77) show a clear discrepancy, indicating a need for targeted professional development.

No	Technology skill statements	Male Librarians (n=64)		Female Librarians (n=111)		t-test (2-tailed)	sig.
		M	SD	M	SD		
Current level skill (information technology)							
1c	Ability of hardware, operating system or software applications	3.03	1.272	2.69	1.085	.158	
2c	Ability to solve technological issues	2.95	.983	2.75	.986	.747	
3c	Ability to evaluate library staff technology training needs	2.86	.974	2.72	1.072	.354	
4c	Ability to create and modify the library's IT policies and procedures	2.94	.889	2.68	.904	.629	
Needed level skill (information technology)							
1n	Ability of hardware and software	4.03	.872	4.37	.602	.051	
2n	Ability to solve technological issues	4.08	1.074	4.41	.868	.292	
3n	Ability to evaluate training needs	4.09	.706	4.56	.613	.844	
4n	Ability to create and modify the library's IT policies and procedures	4.22	1.031	4.62	.487	<.001	

Table: 3 Use of information technology: gender-wise distribution of data with t-test

As shown in Table 4. An independent samples t-test examined gender-based differences in current and needed IT skills among college librarians. Male librarians reported slightly higher current skill levels (e.g., hardware/software use: M = 3.03 vs. M = 2.69), but these differences were not statistically significant ($p > .05$). However, female librarians

expressed a significantly higher perceived need for IT skills, particularly in creating and modifying IT policies ($M = 4.62$ vs. $M = 4.22$, $p < .001$). This indicates a stronger demand among female librarians for strategic technology management training, highlighting a key area for targeted professional development.

No	Technology Skill statements Current level skill(information technology)	<21-29yr n=74	30-39 Yr n= 59	40-49 Yr n=32	49 > Yr n=10	F value	Sig
		M (SD)	M (SD)	M (SD)	M (SD)		
1c	Ability of hardware and software	2.81 (1.155)	2.90 (1.322)	2.69 (.931)	2.80 (1.033)	.226	.878
2c	Ability to solve technological issues	2.77 (.987)	2.92 (1.055)	2.78 (.941)	2.80 (.789)	.260	.854
3c	Ability to evaluate library staff training	2.84 (1.021)	2.83 (1.117)	2.53 (.983)	2.70 (.823)	.751	.523
4c	Ability to create and modify the library's IT policies and procedures	2.84 (.922)	2.66 (.940)	2.81 (.821)	2.90 (.876)	.509	.677
	Needed level skill(information technology)						
1n	Ability of hardware and software	4.24 (.904)	4.32 (1.008)	4.31 (.998)	4.20 (.632)	1.031	.380
2n	Ability to solve technological issues	4.24 (.904)	4.32 (1.008)	4.31 (.998)	4.40 (1.075)	.128	.943
3n	Ability to evaluate library staff training	4.35 (.650)	4.41 (.746)	4.41 (.665)	4.50 (.707)	.180	.910
4n	Ability to create and modify the library's IT policies and procedures	4.41 (.826)	4.58 (.563)	4.47 (.671)	4.40 (.1.350)	.590	.622

Table 4. Use of information technology: age-wise data with One-way ANOVA test (Degree of Freedom 4)

LIBRARY CONTENT MANAGEMENT SYSTEM

Table 5 presents how college librarians in KP evaluate their skills in managing digital library content, a key area in the TMS model. Current skill levels were moderate, with the highest being the ability to develop technological solutions for permanent access ($M = 3.05$), and the lowest in evaluating performance measures ($M = 2.89$). Needed skill levels, however, were all rated above 4.0, indicating strong future demand. The highest needed skill was implementing emerging content management systems ($M = 4.44$), followed by evaluating performance measures ($M = 4.42$), highlighting significant gaps between current capabilities and future requirements.

No.	Skill statements (Current level of library content management)	College Librarians		
		Mean	SD	Rank
15c	Ability of principles and practices of library content management skills, networking and security	2.99	1.003	2

16c	ability to create or implement emerging library content management	2.77	1.060	4
17c	Ability to develop and evaluate technological solutions for permanent access	3.05	.905	1
18c	Ability to develop and evaluate performance measures for library technology applications	2.89	.934	3
(Needed level of library content management)				
15n	Ability of principles and practices of library content management	4.33	.769	4
	Skills: networking and security			
16n	ability to create or implement emerging library content management	4.44	7.47	1
	Ability to develop and evaluate technological solutions for permanent access			
17n	Ability to develop and evaluate performance measures for the library	4.37	.753	3
18n		4.42	.610	2

Table: 5 Library content management ranking

Table 6 presents a comparison of digital content management skills between government and private college librarians using an independent samples t-test ($p = .05$). While current skill levels were generally similar, significant differences emerged in perceived needed skills. Government college librarians reported higher mean scores for needed competencies, such as implementing emerging content management systems ($M = 4.54$ vs. 3.89 ; $p < .001$) and evaluating performance measures ($M = 4.68$ vs. 4.37 ; $p = .016$). These findings suggest greater awareness among public librarians of the growing demands in digital technology management.

No.	Skill statements (Current level of library content management)	Librarians government college (n= 147)		Librarians Private college (n=28)		T-test sig. (2-tailed)
		M	SD	M	SD	
15c	Ability of principles and practices of library content management	2.96	.985	3.18	1.090	.522
16c	ability to create or implement emerging library content management	2.71	1.042	3.07	1.120	.562
17c	Ability to develop and evaluate technological solutions for permanent access	3.05	.882	3.04	1.036	.253
18c	Ability to develop and evaluate performance measures for library technology applications	2.93	.922	2.68	.983	.982
(Needed level of library content management)						
15n	Ability of principles and practices of library content management	4.44	.563	3.75	1.295	<.001
16n	ability to create or implement emerging library content management	4.54	.576	3.89	1.197	<.001
17n		4.36	.758	4.39	.737	.979

18n	Ability to develop and evaluate technological solutions for permanent access	4.37	.622	4.68	.476	.016
	Ability to develop and evaluate performance measures for the library					

Table 6. Library content management system: results based on the type of college with t-test

SKILLS REGARDING SOCIAL MEDIA

Table 7 highlights college librarians' current and needed skills in managing social media—a key area in modern library technology. Current skill levels were modest, mostly below a mean of 3.0, with integrating social media into library technology plans rated highest ($M = 2.65$), followed by staff training ($M = 2.67$). In contrast, all needed skills received strong endorsement, with mean scores above 4.0. The top-rated need was the ability to create and implement social media policies ($M = 4.62$), indicating librarians' recognition of the importance of strategic use and governance of social media in library services.

No.	Skill statements Current level skill(social media)	College Librarians		
		Mean	SD	Rank
19c	Ability to utilize social media for the library's	2.84	1.076	1
20c	Ability to identify needs and develop staff training in the use of social media	2.67	.905	3
21c	Ability to integrate social media into the library's technology plan	2.65	1.005	4
22c	Ability to create and implement the library's social media policies	2.74	1.021	2
	Needed level skill(social media)			
19n	Ability to utilize social media for the library's	4.46	.584	3
20n	Ability to identify needs and develop staff training in the use of social media	4.50	.651	2
21n	Ability to integrate social media into the library's technology plan	4.37	.722	4
22n	Ability to create and implement the library's social media policies	4.62	.522	1

Table: 7 Social media group of a new kind of online media: college librarians' ranking of TMS

Table 8 presents the results of a one-way ANOVA conducted to examine age-wise differences in college librarians' social media-related skills within the TMS framework. Using a significance level of $p = .05$, the analysis found no statistically significant differences across four age groups for either current or needed skill levels. All age groups—ranging from under 30 to over 40—reported similar mean scores in both current competencies and perceived need, with needed skills consistently rated above 4.4, highlighting a uniformly high awareness of social media's importance in library services.

No	Skill statements Current level skill(social media)	< 21-29 yr n= 74	30-39 yr n= 59	40-49 yr n= 32	More than 40 years n= 10	>	F value	Sig
		M (SD)	M (SD)	M (SD)	M (SD)			
19c	Ability to utilize social media for the library's	2.89 (1.117)	2.71 (1.084)	2.94 (1.045)	2.90 (.876)		.430	.732

20c	Ability to identify needs and develop staff training in the use of social media	2.66 (.955)	2.66 (.863)	2.72 (.924)	2.70 (.823)	.036	.991
21c	Ability to integrate social media into the library's technology plan	2.69 (1.033)	2.59 (1.085)	2.59 (.798)	2.90 (.994)	.336	.799
22c	Ability to create and implement the library's social media policies	2.82 (1.012)	2.58 (1.148)	2.91 (.856)	2.60 (.699)	1.019	.386
Needed level skill(social media)							
19n	Ability to utilize social media for the library's	4.43 (.621)	4.47 (.568)	4.47 (.567)	4.50 (.527)	0.82	.970
20n	Ability to identify needs and develop staff training in the use of social media	4.49 (.646)	4.49 (.653)	4.50 (.672)	4.60 (.699)	.090	.965
21n	Ability to integrate social media into the library's technology plan	4.32 (.760)	4.37 (.692)	4.47 (.621)	4.30 (.949)	.324	.808
22n	Ability to create and implement the library's social media policies	4.54 (.554)	4.66 (.477)	4.69 (.535)	4.70 (.483)	.948	.419

Table 8: Social media group of a new kind of online media: age-wise data with One-way ANOVA test (Degree of Freedom = 4)

INFORMATION ASSURANCE AND SECURITY

Table 9 highlights college librarians' self-assessment of skills related to Information Assurance and Security within the broader TMS model. Current skill levels were generally low across all four areas, with the highest rating for handling and disseminating information ($M = 3.03$) and the lowest for understanding security policies ($M = 2.85$) and compliance with regulations ($M = 2.62$). In contrast, needed skill levels were consistently high (all above $M = 4.0$), particularly in assessing library-specific information assurance tools ($M = 4.34$). These results reveal a significant gap between current knowledge and perceived needs, emphasizing that digital security, policy compliance, and risk management are increasingly recognized as critical competencies for college librarians in KP.

No.	Current level Skill (information assurance and security)	College Librarians		
		Mean	SD	Rank
11c	Ability of the library's information security policies and best practices	2.85	1.019	2
12c	Ability to access and ensure compliance with monitoring regulations	2.62	.986	4
13c	Ability to handle and disseminate information	3.03	1.002	1
14c	Ability to assess library-specific applications to information assurance requirements	2.83	1.031	3
The needed skill level (information assurance and security)				
11n	Ability of the library's information security policies and best practices	4.27	.885	3
12n	Ability to access and ensure compliance with monitoring regulations	4.30	.745	2
13n	Ability of handling and dissemination of information	4.21	.936	4

14n	Ability to assess library-specific application to information assurance requirement	4.34	.800	1
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Table 9: Information assurance and security: librarians' ranking of TMS

Table 10 presents findings from an independent samples t-test assessing gender differences in information assurance and security competencies under the TMS model. Results showed no significant gender differences in most current skill areas, with only a marginal gap in handling and disseminating information (Males: 3.05; Females: 3.02; $p = .024$). However, female librarians consistently reported **higher needed skill levels**, particularly in implementing security policies ($M = 4.45$ vs. 3.95 ; $p < .001$), handling information ($M = 4.41$ vs. 3.84 ; $p < .001$), and assessing information assurance tools ($M = 4.45$ vs. 4.16 ; $p < .001$). These results suggest that female librarians place greater emphasis on developing digital security competencies, highlighting an important area for targeted professional development.

No	Current level Skill (information assurance and security)	Male Librarians (n= 64)		Female Librarians (n= 111)		t-test sig. (2-tailed)
		M	SD	M	SD	
		3.02	1.148	2.75	.929	.323
11c	Ability of the library's information security policies and best practices					
12c	Ability to access and ensure compliance with monitoring regulations	2.48	.943	2.70	1.005	.966
13c	Ability to handle and disseminate information	3.05	1.188	3.02	.884	.024
14c	Ability to assess library-specific applications to information assurance requirements	2.83	.883	2.83	1.111	.012
	Needed skill level (information assurance and security)					
11n	Ability of the library's information security policies and best practices	3.95	1.253	4.45	.500	<.001
12n	Ability to access and ensure compliance with monitoring regulations	4.33	.798	4.28	.716	.248
13n	Ability to handle and disseminate information	3.84	1.237	4.41	.625	<.001
14n	Ability to assess library-specific application to information	4.16	1.072	4.45	.568	<.001

Table 10 Information Assurance and Security: gender-wise distribution of data with t-test

Table 11 presents a One-way ANOVA examining age-related differences in college librarians' perceptions of Information Assurance and Security skills within the TMS framework. Results showed no statistically significant differences across five age groups for either current or needed skill levels (e.g., $F = 2.343$, $p = .075$ for assessing library-specific applications). This suggests a shared perception among librarians of all ages regarding their competencies and the importance of digital security skills. Notably, librarians aged over 49 rated the need for understanding security policies and compliance highest ($M = 4.80$), reflecting broad recognition of the growing importance of information assurance, even among senior staff.

No	Current level Skill	< 21-29 yr n= 74	30-39yr n= 59	40-49 yr n= 32	More than 49Yr N=10	>	F value	Sig

(information assurance and security)		M (SD)	M (SD)	M (SD)	M (SD)		
11c	Ability of the library's information security policies and best practices	2.85 (1.016)	2.75 (1.044)	3.03 (.967)	2.80 (1.135)	.546	.652
12c	Ability to access and ensure compliance with monitoring regulations	2.54 (1.036)	2.76 (.953)	2.59 (.911)	2.50 (1.080)	.626	.600
13c	Ability to handle and disseminate information	2.62 (.986)	3.14 (1.114)	2.88 (.930)	3.00 (.916)	.806	.492
14c	Ability to assess library-specific applications to information assurance requirements	3.20 (.789)	3.03 (1.002)	2.97 (.965)	2.56 (1.178)	2.343	.075
Needed skill level (information assurance and security)							
11n	Ability of the library's information security policies and best practices	4.20 (.906)	4.24 (.878)	4.31 (.931)	4.80 (.422)	1.398	.245
12n	Ability to access and ensure compliance with monitoring regulations	4.26 (.760)	4.34 (.685)	4.16 (.808)	4.80 (.632)	2.073	.106
13n	Ability to handle and disseminate information	4.15 (1.002)	4.39 (.743)	4.13 (.976)	3.80 (1.229)	1.572	.198
14n	Ability to assess library-specific	4.36 (.732)	4.27 (.980)	4.44 (.619)	4.30 (.675)	.331	.803

Table 11 Information assurance and security: age-wise data with One-way ANOVA test (Degree of Freedom = 4)

INTEGRATED LIST OF VALIDATED TECHNOLOGY MANAGEMENT SKILLS (TMS)

Table 12 presents an integrated list of validated Technology Management Skills (TMS) based on librarians' ratings. Each skill is shown with its mean, standard deviation (SD), and a rank derived from consistency (lower SD gives higher priority when means tie). Among 32 statements, 29 skills were validated (mean > 3.00), while 3 were not, indicating limited current relevance.

In the needed-skill rankings, "creating and implementing social media policies and procedures" topped the list (M = 4.62, SD = 0.522). Close runners included *integrating social media into the technology plan* (M = 4.50), *developing solutions for permanent access* (M = 4.46), and *evaluating performance measures for library technologies* (M = 4.42). These reflect librarians' increasing emphasis on strategic planning, digital preservation, measurement, and social media in library services.

On the other hand, the lowest current skills involved *evaluating staff training needs* (M = 2.62), *solving technological issues* (M = 2.85), *applications for library services* (M = 2.78), and *hardware/OS/software management* (M = 2.77). A notable skills gap is seen: for example, *information security policy application* shows a jump from current (M = 2.83, SD = 1.031) to needed (M = 4.30, SD = 0.745) – a difference of 1.47 points. Also, male librarians rated many skills a bit higher than females, hinting at possible differences in exposure or training access, which suggests a need for more equitable capacity building.

No.	Skill statements	Librarians		
		Mean	SD	Rank

Current level skills				
1c	Ability of hardware, operating system or software Applications for library services.	2.82	1.165	5.5
2c	Ability to solve technological issues in library practices.	2.82	.987	5.5
3c	Ability to evaluate library staff technology training need.	2.77	1.036	14.4
4c	Ability to create ,explain and modify the library It policies and procedure	2.78	.904	13
5c	Ability of the library's information security policies and best practices	2.85	1.019	4
6c	Ability to access and ensure compliance with monitoring regulation.	2.62	.986	16
7c	Ability of handling and dissemination of information process.	3.03	1.002	2
8c	Ability to assess library specific application to information assurance requirements.	2.83	1.031	7
9c	Ability of principles and practices of library content management.	2.99	1.003	9
10c	Ability to create or implement emerging library content management technologies and applications.	2.77	1.060	14.5
11c	Ability to develop and evaluate technological solutions for permanent access.	3.05	.905	1
12c	Ability to develop and evaluate performance measures for library technology applications.	2.89	.934	8
13c	Ability to utilize social media for the library's products, services and programs.	2.84	1.076	9
14c	Ability to identify needs and develop user or staff training in the use of social media	2.67	.905	11
15c	Ability to integrate social media into the library's technology plan.	2.65	1.005	10
16c	Ability to create and implement the library's social media policies or procedures.	2.74	1.021	12
The needed level of skill				
1n	Ability of hardware, operating system or software Applications for library services.	4.25	.729	15
2n	Ability to solve technological issues in library practices.			10
	Ability to evaluate library staff technology training needs.	4.29	.959	
3n	Ability to create, explain and modify the library It			6
		4.39	.685	
4n	policies and procedure			3
5n	Ability of the library's information security policies and best practices	4.27	.885	11
6n	Ability to access and ensure compliance with monitoring regulation.	4.30	.745	12

7n	Ability of handling and dissemination of information process.	4.21	.936	16
8n	Ability to assess library specific application to information assurance requirement.	4.34	.800	13
9n	Ability of principles and practices of library content management.	4.33	.769	14
10n	Ability to create or implement emerging library content management technologies and applications.	4.44	.747	7
11n	Ability to develop and evaluate technological solution for permanent access.	4.37	.753	8.5
12n	Ability to develop and evaluate performance measures for library technology applications.	4.42	.610	5
13n	Ability to utilize social media for library's products, services and programs.	4.46	.584	4
14n	Ability to identify needs and develop users or staff training in the use of social media	4.50	.651	2
15n	Ability to integrate social media in to the library's technology plan.	4.37	.722	8.5
16n	Ability to create, and implement the library's social media policies or procedure.	4.62	.522	1

Table 12: Integrated list of validated TMS

DISCUSSION

This study undertook to identify, validate, and propose a Technology Management Skills (TMS) model specifically for college librarians in Khyber Pakhtunkhwa (KP), grounded in both international literature and local needs. After developing 32 skill statements through expert review and refining via content analysis, a survey among 170 librarians revealed a pronounced gap between current and needed skill levels—particularly in areas such as content management, IT security, policy-making, and integration of social media. For example, while librarians rated many current skills moderately (often below mean = 3), they assigned high importance (often above mean = 4) to skills like creating and implementing social media policies, integrating social media in planning, evaluating performance, and managing secure information. These findings indicate that while awareness of technological demands is strong, current capacities lag behind. The proposed TMS model, structured around four dimensions—Information Technology; Information Assurance & Security; Library Content Management; and Social Media—offers a roadmap for targeted professional

development. For this model to be effective, recommendations include revising LIS curricula to include these skills, instituting regular training workshops, and ensuring equitable access to capacity-building across gender and institution type.

CONCLUSIONS

This study set out to design a practical and relevant Technology Management Skills TMS model for college librarians serving in Khyber KP. In today's fast changing digital landscape, libraries are no longer just about books they are evolving into technology driven information hubs. Therefore, librarians must possess strong technology management skills to meet the needs of modern users and run efficient library services. To achieve this goal, the researcher first conducted an in-depth content analysis of existing literature, frameworks, and global models, focusing particularly on those that had relevance for developing countries like Pakistan. After carefully reviewing and refining a draft list of TMS through expert panels, supervisors' input, and repeated reviews, a final set of 16 key TMS statements was developed and tested. Using a survey approach, data

was collected from college librarians across KP, with a strong response rate of 79%. Respondents evaluated both their current level of skills and the level they believed was needed using a 5-point Likert scale. Total 29 out of 32 proposed skills statements in the model are highly relevant and validated by the librarians in the college libraries of KP. The results provided several important insights that there is a clear gap between the current skill levels of librarians and the levels they feel are needed to perform effectively in today's technology rich environment.

Overall, the findings make it clear that college librarians in KP recognize the need to upgrade their technology management skills to keep up with the demands of modern library services. The proposed TMS model, based on both global standards and local needs, provides a roadmap for capacity building, training programs, and policy development tailored to the KP context. This study not only highlights the skill gaps but also offers a structured way forward by equipping librarians with the right technological competencies, they will be better prepared to support academic institutions and enhance access to information in the digital age.

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