

Determining the impact of technological modernization and management capabilities on user satisfaction and trust in library services

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Abstract

Purpose – Dynamic technologies have revolutionized human socio-economic activities, including health care, higher education, business and improved customer service in academic sectors. Leveraging the latest technology leads to high productivity, confidence, improved management skills, satisfactory performance and innovative academic services. In the era of technocentrism, the purpose of this paper is to find out whether useful technologies and competent user managers support users in the use of resources, increasing research productivity and improving academic library services.

Design/methodology/approach – This study is based on primary data collected from students at universities in the provincial capital using a printed research questionnaire. The authors followed the Likert scale for instrument development and contacted service professionals prior to distribution to test the applicability. Based on the technology acceptance model, this study established a conceptual model with multiple associated hypotheses to test the suitability of the research model. The data were analyzed using structural equation modeling software for path analysis and model development.

Findings – The results of this study show that technological advances greatly accelerate the use of library resources, strengthen management skills, improve user performance and ultimately enhance academic performance and services. In addition to deploying and leveraging technology, expert leadership has also had a positive impact on improving user productivity and maintaining proactive academic library services.

Practical implications – The TAM-based theoretical model will prove to be a useful tool in the future for delivering technology, improving management skills, promoting the use of library resources, increasing user productivity and providing advanced library services.

Originality/value – Based on primary data collected from Khyber Pakhtunkhwa degree students, this study provides an insight into the actual state of technology used to improve academic performance for the first time. In addition, the study also explores executive collaboration to improve employee and user efficiency and service reform in academic libraries.

Keywords Technology, Trust, Satisfaction, Capabilities, Management, Services

Paper type Research paper



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Introduction

Digital aboriginal and literate societies make easy use of Web technologies with greater access to information resources in libraries and other sectors for related services (Heradio *et al.*, 2012). In addition to accessing a large number of online repositories and reliable information resources, technology also supports communities in learning and research (Hu *et al.*, 2014). In this regard, efficient technology infrastructure and proactive management further increase user confidence in technology when organizing information resources to provide appropriate services to users. It has been observed that usually, the number of readers visiting libraries using its resources and services is gradually decreasing due to the advent of 4G in developing countries and 5G in the developed world (Allison *et al.*, 2019). In recent years, in the face of the global pandemic, people have come to realize the importance of using technology to solve all problems such as distance learning, online class management, discussions with teachers and students, use of digital library (DL) services, e-business and many others. Despite the epidemic, digital libraries continue to demonstrate their potential by providing high-quality online services to support faculty and students who teach and study on and off campus during and after the global crisis (Mehta and Wang, 2020). In connection with the approaching dynamics and rapid development of internet technologies, electronic libraries and new trends in management, user behavior has undergone major changes. In situations where managers are competent and information providers provide reliable services, the interest and confidence of the younger generation in library services increases. Over the past three decades, digital libraries have gone from curiosity to mainstream (Arms, 2012), playing an increasingly important role in satisfying the researcher and educational needs of users in academic institutions (Malapela and De Jager, 2018). In addition to technical practicability, user satisfaction and improved performance have also started to rely heavily on digital libraries and new methods to increase user confidence in services and staff performance (Rao *et al.*, 1995; Park *et al.*, 2009; Zha *et al.*, 2019). In view of the huge investment in digital libraries, researchers in the field of library and information science have noticed that the benefits of digital libraries often fall short of expectations. Here, it is imperative to investigate the reasons, as library service cannot be improved simply by investing in databases or expanding technological infrastructure without reforming management, staff service performance and user confidence. University libraries provide users with various online and useful services in various ways based on the collaboration between managers and users (Xiao, 2010). However, most existing research mainly examines usage from a quantitative perspective, with the frequency, intensity or amount of time used as variables to measure the effective usage of Information Technology (IT) and services (Lin *et al.*, 2020). It is believed that with the emergence of technology, the theory and practice of digital libraries have developed rapidly on a global scale (Heradio *et al.*, 2012). At the same time, digital libraries as information providers are exposed to fierce competition and pay more attention to quality assessment (Ross and Sennyey, 2008; Heradio *et al.*, 2012). The interaction between the user and the library not only satisfies the user's information needs but also provides the library with more user resources (Li *et al.*, 2019). Compared with digital libraries, many search engines provide access to information on the internet and somehow meet the information needs of users when digital libraries reduce the satisfaction of information needs of users (Kiran and Diljit, 2011). It is time for digital libraries to start worrying about user satisfaction and intention to use (Xu and Du, 2018). However, in Pakistan, little research has been done on technological sustainability and managerial competence to meet user needs for resource utilization, productivity improvements and general library services for its users. Modern libraries need to improve knowledge sharing by developing governance through

new artifacts such as ontologies, descriptions of semantic content, data links and new forms of collaboration through social media, specialized communities, wikis and collaborative games (Hallo *et al.*, 2016). The main aim of this study is to understand how technology is being introduced in developing countries how library resources can be used to improve teacher and user productivity, particularly to encourage reform and innovation by senior service managers. Pakistan's Higher Education Commission, established in 2002, has facilitated access to a range of databases for all public and private universities and subsequently to public libraries where the use of database resources is limited for quality education and research (Rafi *et al.*, 2019a, 2019b). However, compared to universities, the utilization rate of these databases is extremely low in public libraries due to lack of digital literacy, defective technologies and infrastructure that need major reforms (Rafi *et al.*, 2020a). In addition, it has been found that the deployment and use of the latest technology in the academic environment is very slow, and universities far away from big cities require direct government involvement to fill the gaps in increasing technology, use resources and improve the overall academic activity (Rafi *et al.*, 2020a, 2020b, 2020c, 2020d). Apart from technology and senior management reforms, this study details the challenges of technology use, modernizing leadership in meeting the technology dynamics and user confidence in library services.

Literature review

In the late 1980s DL was hardly a part of librarianship and computer science, but after a decade (1990), general interest in DL around the world began to grow. A DL is a collection of information related to services provided to user communities using various technologies, which is a logical extension of physical libraries in the electronic information society. Since the 1990s, the internet and the Web have been the primary platform for libraries to create and deliver information resources, services and instructions. Since the beginning of 1990, the use of electronic resources has been limited due to the inaccessibility of network technologies and the insufficient digital literacy of users (Hsieh-Yee, 1996). Library users are now offered many resources with different forms of interactivity and richness in multimedia. The ultimate goal of the DL system is to provide people with access to human knowledge in a friendly multimodal manner, overcoming obstacles related to distance, language, culture and using multiple connected devices (Heradio *et al.*, 2012). The concept of DL was first introduced in 1991 as part of the US National Information Infrastructure Initiative and was repeated in the US national political discourse in 1992 (Lee *et al.*, 2010). The gradual advances in technology brought about revolutionary changes in social circles and organizational structures, with new management skills, innovative ideas, improved cognitive skills and efficient services in university libraries. Innovative performance refers to the dynamic skills of data management and knowledge-based resource acquisition, generation, and combination to change the academic environment of the library (Zotoo *et al.*, 2021). Through the Internet, digital libraries and related electronic networks have expanded the information available to academic researchers. Arumugam and Thangaraj (2007) investigated that DL offer a wide range of digital information resources, including a digital collection of books, journals, documents and procedures. Therefore, effective integrated access to all of these resources is imperative for the development of the academic environment. Resources and available collection evaluation helps librarians understand the applicability of the resources so that users can determine the advantages and disadvantages of the repositories (Lim Li Min and Casselden, 2021). In addition, van Schaik *et al.* (2006) found that technology allows library users to use advanced browsing techniques, but the need for technical simplification and access to information has increased over time,

requiring users to improve their technical skills through learning over time. [Ahmad and Abawajy \(2014\)](#) pointed out that delays in technology adoption and lack of awareness of e-resource use can create gaps in technology deployment in organizations. Libraries need to provide users with educational services, including browsing online database resources and information accuracy based on technical skills. [Malabanan and Bayeng \(2019\)](#) stated that technology has completely reshaped the functions and research concepts of libraries. Similarly, [Choi and Rasmussen \(2009\)](#) investigated that libraries develop physical resources and activities, including DL models, digital resources and services that support academic performance and the emergence of new skills. Technical skills and experience with the DL environment and metadata are important to digital librarians, along with management skills. Therefore, [Chen and Chen \(2010\)](#) observed that compared to search engines; learning efficiency and student satisfaction are significantly improved through the use of the DL and archival resources. However, in his studies, [Kim and Sin \(2007\)](#) revealed that the increasing use of network resources has attracted the attention of professionals because students often try to access information resources that are not suitable for academic research. Given that DL is a complex and diverse structure, information on various topics, cultures and languages simplifies information search and creates a more advanced information retrieval system for end-users ([Shiri, 2008](#)). [Ho \(2019\)](#) pointed out that the rapid growth of electronic resources has a positive impact on the future development of library collections and the use of resources that affect user performance and development skills. Taking this statement, [Jan and Anwar \(2018\)](#) confirmed that in career development and academic performance, students' information and emotional skills play an important role in various academic factors. In terms of professional development, [Liu et al. \(2016\)](#) suggested that the ability to leverage technology helps improve information, teaching, cognitive and related skills that support the academic performance of users. Also, [Park et al. \(2009\)](#) closely observed that the underutilization of the system is usually attributed to the design of the information system, gaps of local users in using technology, user actions and many others. To fully use the functions and benefits of technology-based systems, information literacy and related infrastructure need to be activated. [Muthanna and Sang \(2019\)](#) said that professionalism requires leadership, knowledge, experience, strategic planning and the application of methods to train new hires and students to develop their skills. [Jan and Anwar \(2018\)](#) researched that management skills in social interaction are believed to better cope with the anxiety caused by interactions with library staff and reduce the negative consequences faced by students at all levels. [Dahan et al. \(2016\)](#) experienced that the University libraries are transforming their traditional services and roles into more complex and universal services for users to increase competition between information and service departments to meet their service needs. Service quality and user satisfaction are usually used interchangeably, but the role of academic libraries has changed due to the multitude of sources of information, high user demand, use of information technology and competition between service departments. [Wang et al. \(2019\)](#) unveiled that the experts generally believe that providing free, high-quality knowledge helps promote digital equality among users, thereby improving academic performance. Taking into account the active participation of digital technologies in the use of resources, access to databases, improving academic performance and administration, this study aims to improve library services and help students build confidence in library services.

Theoretical framework of the study

Modern academic libraries, with the advent of ICT and changing technology, presented management with a number of budgeting challenges for deploying the latest system,

training service staff and reforming the service sector to enable users to support academic research. The introduction of technology in the education sector will not be profitable until the entire system is subject to a proven model to make the system successful and better functioning. Because Davis's technology acceptance model (TAM) is flexible and effectively linked to technology adoption in academic reform, this model was applied in this study in the long term for the benefit of academia. The method aims to facilitate access to database and other library resources in the digital environment and provide potential knowledge to academic researchers. It has been observed that people in the technology-driven era are delighted to use the latest technology to improve their skills. Therefore, the TAM has been adopted in this study. The TAM was developed in 1989 by Davis and the conceptual structure, which was formed after extensive literature research (Pérez Pérez *et al.*, 2004). The Davis model (1989) is the theoretical basis for the interpretation and prediction of personal adoption of information technology (Chang, 2011). In the library environment, TAM is considered to be a beneficial tool for accessing and using database resources and deploying technologies (Kapoor *et al.*, 2014). In this way, researchers can use database resources to manage academic affairs using Web technologies. An important goal of technology development is to improve the quality, quantity and accuracy of existing internet search engines through the use of structured resource descriptions (Trnkoczy and Stankovski, 2008). Through TAM employee training, management experience, professional skills, resource utilization and effective library services with new technologies enable users to find information in a variety of databases. The published literature, disclosed that most of these theories and models were originally proposed for organizational improvement and empowerment (Alalwan *et al.*, 2017). The TAM model is a combination of four variables:

- (1) Perceived usefulness: This is the extent to which one thinks that using a particular system can improve performance.
- (2) Perceived ease of use: Is the extent to which a person believes that the use of a particular system can be free of trouble.
- (3) Behavioral intent: To what extent does a person deliberately plan or omit specific future measures?
- (4) Actual system usage: The behavior of the person who uses the system and buys the required resources (Isibika and Kavishe, 2018).

In our study, the five components of the library, such as technology usefulness, resource utilization, skilled management, performance improvement and service confidence, are suitable for customization in this model to organize them. Therefore, Davis' conceptual model (Figure 1) better represents our study, based on the conceptual structure of TAM, to demonstrate the synthesis of various variables. Besides, we found that TAM is a powerful

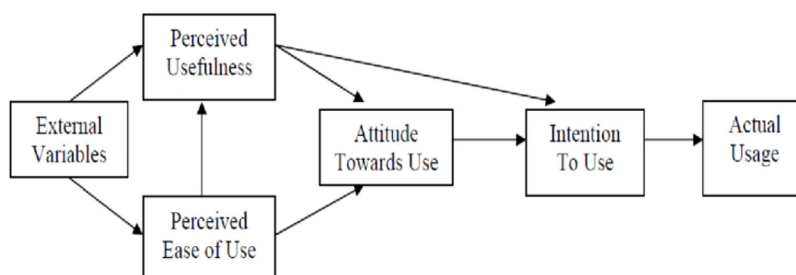


Figure 1.
Technology
acceptance model
(TAM)

model that provides many successful applications for different users to accept and adopt different technologies in different research environments.

Development of research hypothesis

In the field of education, the world has seen tremendous technological progress, among which the use of technology to mediate teaching, learning and obtaining the necessary resources has become a top priority. In digital libraries, information technology, the combination of resources, financial planning and service promotion provides users with effective academic services. It is also important to ensure users that all data centers are the primary sources of accurate and reliable information in the information ocean; otherwise, users may lose trust in online tracking and trust in technology. Mobile has recently been recognized as a leading technology that influences and strengthens the existing relationship between the library and the multi-user education system (Ocran *et al.*, 2020). It has been proven that the positive effect of the use of technology allows the use of resources in different organizations to improve management skills, increase employee satisfaction and modernize services. According to Shiau and Luo (2013), users are more likely to enjoy using technology for multi-dynamic objectives in different organizations and specially in academic institutions. Thong *et al.* (2006) disclosed that technology-based services are motivating sources of entertainment and helping users develop managerial skills and enabling employees to better serve. More importantly, expectations are predictors of perceived pleasure in academic research using technology, especially for mobile data services that improve cognitive skills and provide balance services for users, supported by multiple studies (Kim, 2010; Lee and Kwon, 2011; Lin *et al.*, 2005). Besides using a Web portal site, for ordinary use, the utilization of database resources is highly useful to fulfill the user's expectations (Lin *et al.*, 2005). Previous research has shown that the use of technology has increased, resulting in significant productivity in the education and research sectors, which has sparked management interest in further reforms in the service sector (Ashfaq *et al.*, 2019; Crick and Yu, 2008; Dabbagh and Kitsantas, 2012; Li *et al.*, 2017). Even advances in modern technology not only improve resource utilization but also improve user productivity and management skills when combined with big data analytics, blockchain technology, and the cloud to improve organizational efficiency and productivity (Islam *et al.*, 2020). In addition, the technology-based performance and applicability of management functions can help make clear decisions, develop professional skills and strengthen human resource organizations to improve library efficiency (Rafi *et al.*, 2020b). Therefore, to investigate the techno-based performance and impact the authors following TAM have developed a conceptual model (Figure 2) of how technology dynamics affect management modernization, search skills, performance improvement and innovation in reader services.

Thus, the following hypotheses have been developed and linked to the conceptual model:

- H1. The convenience of technology has a big impact on the use of library resources.
- H2. Using library resources actively increases user productivity.
- H3. Improved performance instills confidence in the service.
- H4. Skilled management has a positive and significant impact on productivity and service confidence.

Research methodology

Data collection

The authors developed research tools after an extensive review of the literature on the topic to fully understand the technological utility and its impact on resource utilization, user academic productivity, better governance, user satisfaction and trust in library services in a Pakistani context. Before the questionnaire was distributed, the suitability and accuracy of the tools were validated in a pilot study with 100 students to ensure that all questions and texts were understood by assessing their scope and ease of use. In the instructions for the questionnaire, students were asked to read the cover letter, which explains the purpose of the study, voluntariness and the right to refuse to participate in the study if problems arise. Participants were asked to freely express their concerns to the author if they felt any ambiguity in completing the questionnaire and were also reassured of the confidentiality of their personal information. In addition, a targeted random sampling method was considered to assess the benefits of technology and its impact on resource consumption, user's productivity, management reform and service satisfaction through innovative ideas. For this purpose, a structured research questionnaire was adopted to measure all variables based on a 5-point Likert scale ranging from "1 = strongly agree" to 5 = strongly disagree. The Likert scale is the correct scale, and respondents choose the option that best suits their opinion. In this study, the research questionnaire was distributed among 2,000 students, of which only 1,477 responses were received, with a rate of 73.85%. The data collection process remained challenging due to COVID-19 as it was at its peak in Pakistan, so the entire data collection process took about three months from June to August 2020. The authors preferred to distribute printed questionnaires to students in the provincial capitals of Khyber Pakhtunkhawa, Pakistan, by using the sampling method because of its applicability and accuracy in representing a larger number of students from public and private universities. This method has been used by many researchers as a good source of direct collection of data from respondents (Rafi *et al.*, 2019a, 2019b). It is a fact that Information and communication technologies (ICT) encourage people to use the internet and benefit from it, thereby achieving social and economic progress. The internet has become an integral part of academic research, demonstrating the need to extend IT to remote areas to make it easier for users to access information and use digital resources (Chao and Yu, 2016). Collecting data in the absence of network technology using printed questionnaires has been a reliable source for decades, but this has always remained problematic in terms of resources, time and physical availability of the author and respondents. This process is useful in the developing world when there is no technological infrastructure for the dissemination of research questionnaires via social media.

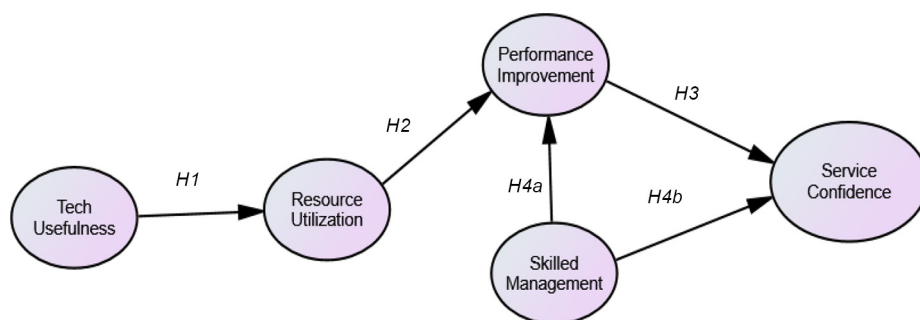


Figure 2.
Hypothesized
conceptual model

Data analysis

After completing the data collection processes, respondent demographics were explained with descriptive statistics using SPSS software version 25. In terms of research questions, the data of 1,477 respondents were analyzed based on statistical methods of exploratory factor analysis (EFA) using SEM software to validate the research model and the hypotheses. The survey involved 956 male students (64.7%) and 521 female students (35.2%), respectively. The age distribution of postgraduate students who took part in the survey was 808 between the ages of 20 and 25 (54.7%), 535 between the ages of 26 and 30 (36.2%) and 134 respondents between the ages of 31 up to 35 years of age (9%). The education level of respondents in the demographic section, 104 were PhD students with a percentage of (7.0%), 298 masters in philosophy (MPhil) with a ratio of (20.1%), 523 masters in arts/science (MA/MSc) with a percentage of (35.4%) and the highest response 552 with a percentage of (37.4%) were BA/BSc students. In addition, to determine internal consistency and reliability, all five latent factors were tested using Cronbach's alpha, which shows values of 0.760 for resource utilization, 0.848 for productivity, 0.776 for technological utility, 0.841 for managerial skills and finally, 0.799 for service user satisfaction (Table 1). At this stage, the Cronbach's alpha reliability value had to be greater than 0.70 to achieve an acceptable standard that was met at this stage (Sahari *et al.*, 1999). In addition, the loading of the retained objects greater than 0.50 is to be regarded as statistically significant. In the analysis, with the exception of one item with loads of 0.567, all other loads were in the range from 0.612 to 0.890.

Results

Table 2 shows the results of EFA after excluding inappropriate data collected from students at public and private universities. The EFA was used to validate the instrument of this study using the varimax rotation method. The instrument contained a total of 20 elements, but two cross-loaded elements (SM1 and SM2) were removed based on the result of the rotated component matrix (Figure 3). With regard to the eigenvalues and the cumulative contribution rate, the EFA categorizes five suitable components. The cumulative contribution rate of extracting five factors is 69.093%. In addition, Kaiser–Meyer–Olkin (KMO) assesses whether the sampling is sufficient. The cumulative contribution rate for extracting the five factors is 69.093%. In addition, a Kaiser–Meyer–Olkin (KMO) result of 0.833 indicates that the KMO is higher than the recommended 0.5. Likewise, Bartlett's test of sphericity was statistically significant ($p = 0.000$), indicating a sufficient correlation between the variables (Rafi *et al.*, 2020b). Moreover, the largest eigenvalue was obtained on the first component (6.247), whereas the other components showed values of 5.071, 3.429, 1.759 and 1.345, respectively. Based on the above results, it was concluded that the sample size of 1,477 collected from students in public and private sector universities is suitable for factor testing. In the analysis, the first-factor, technology usefulness includes three elements with loads between 0.802 and 0.914 with a total variance of 24.177%. These results show that technology utilization significantly improves the quality of library services and the entire system. The second component, resource utilization, includes three more items, and the load ranges from 0.845 to 0.925, explaining 43.804% of the total difference. This factor estimates how resource utilization affects users' confidence, thereby improving their academic performance and trust in library services. The third component, performance improvement, includes four items with loads between 0.612 and 0.869 and explains 57.078% of the total variance. The elements of this factor relate to the ability and academic improvement of users in using technology to access resources in libraries. Similarly, the fourth component, skilled management, includes five elements with a load of 0.656 to 0.828 and explains 63.886% of

Construct	Statements	M	SD	Loading	α	Sources
Resource utilization	With database resources, we have high hopes for better customization of our services and higher expectations for resource use in universities	M	SD	0.760	0.807	Rafi <i>et al.</i> (2020); Gupta and George (2016), Islam <i>et al.</i> (2020)
	Electronic resources have increased our efficiency and quality of service delivery	3.28	1.216	0.774		
	The availability of database resources has greatly reduced the amount of work required to enter data and meet customer expectations in less time	3.26	1.176	0.759		
Performance improvement	In the past few years, we have promoted the use of online resources and the productivity of academic research	3.32	1.195	0.567	0.848	Islam <i>et al.</i> (2020), Gupta and George (2016); Rafi, <i>et al.</i> (2020)
	The availability of electronic resources has improved the indicators of faculty and students in high-quality educational work	3.46	1.081	0.890		
	We have seen that satisfactory academic performance has largely inspired users to use technology and trust in real information resources	3.09	1.165	0.830		
	We motivate young graduates to use the latest database literature and their awareness is gradually growing	3.18	1.152	0.775		
Technology usefulness	By using the latest technology and online resources, we have gotten rid of traditional library services	3.18	1.141	0.697	0.776	Rafi <i>et al.</i> (2020a, 2020b, 2020c, 2020d); Gupta and George (2016), Islam <i>et al.</i> (2020)
	The latest system provides more options for handling and understanding of hardware and software	3.27	1.196	0.771		
	The best technical skills are conducive to the integration of resources, their use and transparent access to different datasets	3.22	1.204	0.730		
Management skill	We actively encourage employees and users to come up with new service ideas	3.38	1.144	0.727	0.841	Rafi <i>et al.</i> (2020); Gupta and George (2016)
		2.54	1.185	0.784		

(continued)

Table 1.
Descriptive statistics
of constructs and
statement

Construct	Statements	M	SD	Loading	α	Sources
User service	The sharing of ideas and contributions of teachers and researchers helps us to improve the lack of service convenience					
	We pay special attention to the exchange of knowledge between other institutions and discuss it with technical experts	2.61	1.270	0.749		
	We often conduct professional discussions and coordination of innovative services to support academic performance and improve university standards	2.62	1.222	0.710		
	We encourage and emphasize differences in viewpoints to evaluate and select better suggestions to put the system on a standard path	2.65	1.311	0.618		
	Our university library plans joint service projects and discusses them with practitioners and experts	2.77	1.227	0.612	0.799	Gupta and George (2016) Rafi <i>et al.</i> (2020); Islam <i>et al.</i> (2020)
	Based on an open discussion in all forums, we try to ensure that users use electronic resources for quality work	3.42	1.189	0.850		
	The administration and IT department contribute greatly to the successful service operation and participate in the library's decision-making activities	3.23	1.230	0.821		

Table 1.

the total variance. The elements of this factor show how competent managers can bring quality and innovative reforms to the library, increasing user confidence and advanced services. The fifth and final part, service confidence, includes three elements with a load range of 0.710–0.844, representing 69.093% of the total variance. The elements in this section show how technology has improved, maximum management capabilities, user resource utilization trends and user confidence in performance and library services

Findings of the structural model

In Table 3, the effects of the use of technology have a positive and significant impact on the resource use of PhD students ($\beta = 0.716, p < 0.000$). It shows that accessible technologies on and off-campus stimulate student resource utilization trends. On the other hand, the usability of technology is associated with the use of the latest technologies deployed on campus, training students in the use of technology and more efficient use of database

	Rotated component matrix				
	1	2	3	4	5
TU1	0.891				
TU2	0.914				
TU3	0.802				
RU1		0.925			
RU2		0.845			
RU3		0.910			
PI1			0.612		
PI2			0.854		
PI3			0.869		
PI4			0.839		
SM3				0.775	
SM4				0.828	
SM5				0.810	
SM6				0.777	
SM7				0.656	
SC1					0.710
SC2					0.808
SC3					0.844
Eigenvalues	1.345	1.759	3.429	5.071	6.247
% of variance	5.207	6.809	13.274	19.627	24.177
cumulative %	24.177	43.804	57.078	63.886	69.093
Kaiser-Meyer-Olkin measure of sampling adequacy					0.833

Bartlett's test of sphericity

Approx. Chi-Square

DF

Sig.

11,533.794

153

0.000

Table 2.
Results of exploratory factor analysis

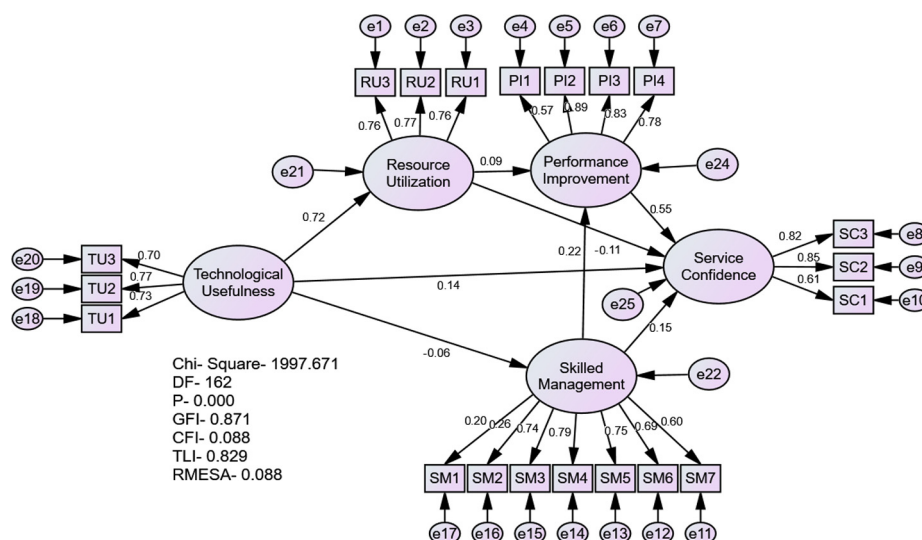


Figure 3.
The path diagram of the research model

resources based on digital literacy skills. In the second hypothesis, resource utilization proved a positive impact on performance improvement ($\beta = 0.099, p < 0.05$). It is clear that fresh literary work enhances students' talents in generating new ideas and developing cognitive skills in academic activities. Resource efficiency is an important aspect of the productive use of resources to create and maintain a competitive advantage. However, despite the important link between efficiency and competitive advantage, careful analysis of resource use is required to further measure efficiency and productivity (Miller and Ross, 2003). In the third hypothesis, skilled management positively impacts performance improvement ($\beta = 0.218, p < 0.000$). In this regard, visionary leaders play a critical role in making the right decisions, which can positively affect the reform of the entire system. Recent research shows that good governance, coordination of technical planning and implementation, skilled personnel, joint projects, efficient service and organization of human resources are essential to ensure the efficiency and effectiveness of employees (Rafi *et al.*, 2020b). More importantly, managerial and technical capabilities are key elements that enable staff to keep the overall library going in the right direction. Similarly, again the fourth hypothesis, skilled management disclosed a significant direct impact on service confidence ($\beta = 0.161, p < 0.000$). Because it enhances the direct impact on the academic productivity of users, resulting in excellent academic and information literacy, improved cognitive skills and effective use of technology in the classroom (Bartol *et al.*, 2018). Finally, improved student performance has had a significant impact on employee confidence in service ($\beta = 0.544, p < 0.000$). The fifth and final hypothesis suggests a positive and meaningful relationship between productivity improvements and service trust ($\beta = 0.544, p < 0.000$). This shows that as soon as their work improves, readers begin to believe and trust management strategies and plan to improve service in libraries, which ultimately improves the library's academic service to researchers. The modified path diagram of the research model based on five factors and eighteen observations has been displayed in Figure 4.

Discussion

Based on the theory of TAM, the authors conducted a survey to identify the structural relationship between technological usefulness, resource utilization, performance improvement, management skill and service confidence among degree students. The main focus of this research was to investigate how technology usefulness impacts the rest of the components in terms of users' service satisfaction. We believe that libraries are an ocean of knowledge, and huge technological advances in library services are changing the tendency for users to use the library. With the continuous development of technology and data resources, the use and access of digital repositories require the ability to discover and disseminate information resources (Li *et al.*, 2019). ICT have made digital libraries more user-friendly and turned them into mobile library applications that make it easier to access resources (Donnelly, 2010). The use of technology has proven to be a driving force behind

Table 3.
Summary of
hypotheses testing

HY	Linkage	β	CR	ES	Results
H1	Technological usefulness → Resource utilization	0.726	18.403	0.831	Accept
H2	Resource utilization → Performance improvement	0.109	3.260	0.066	Accept
H3	Skilled management → Performance improvement	0.228	6.953	0.134	Accept
H4	Skilled management → Service confidence	0.161	5.692	0.118	Accept
H5	Performance improvement → Service confidence	0.544	13.783	0.646	Accept

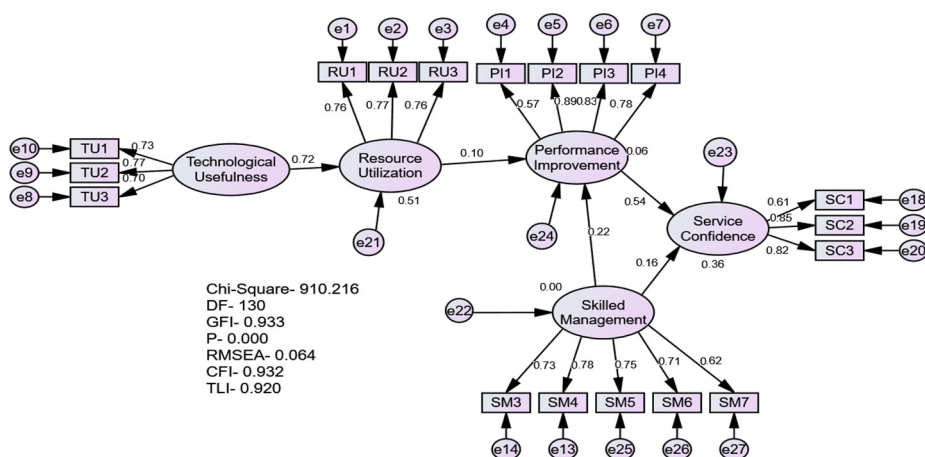


Figure 4.
The modified path diagram of the research model

the integration of various resources and other service components into the organization and development of the learning environment. In addition to enhancing the technical skills and qualifications of teachers, the university library also supports academic research and student learning, collaborates with faculty and administrators and welcomes modern features and activities (Allison *et al.*, 2019). All academic activities of users and researchers are related to the use of technology and their understanding of how it is used. In all the scenarios, the first hypothesis proves that the use of technology has a large impact on the use of resources in academia. On the other hand, the development of technology besides databases has also appeared in the form of mobile internet technologies. In this situation, the development of smart devices has allowed the creation of libraries that provide mobile services, including mobile sites, text messaging services, e-books, catalogs and easy access to resources. It is important to give users the opportunity to express their opinion on which services in the DL should be regularly improved to better meet their expectations (Tammaro, 2008). These services are considered to be an extension of the technology-based services that have replaced traditional library services. This makes it easier for users to browse, search and retrieve information that librarians need to consider for user's performance enhancement. Hence, a dynamic strategy is required to maximize the use of available resources and access, including creating a library association with many promotional activities to improve user productivity (Kinengyere, 2007). Thus, in the second hypothesis, it has been proven that the use of resources positively improves the productivity of users in academic activities. In terms of enhancing the productivity of academic researchers and users, the contributions of digital libraries vary widely, including identifying accelerators and estimating network overheads that improve DL usage (Trnkoczy and Stankovski, 2008). Previous research has shown that technical support significantly improves user satisfaction, resulting in increased productivity and trust in library services (Lee, 2010). The use of resources, therefore, generates new ideas and innovations, and it is through these ideas and innovations that progress in the world becomes possible. Generally, it is assumed that innovation is a set of activities for using technology or data to produce new products, services, work processes, business models and processes (Stvilia and Gibradze, 2019). In addition to recent literature, information resources such as archival materials in the form of texts, graphics, images, sounds, animations and videos are also very valuable to readers and researchers to produce satisfactory

performance (Zhou *et al.*, 2019). This is because user satisfaction is a more important factor in the willingness of users to continue to use resources for academic purposes (Dai *et al.*, 2020). When users are satisfied with their academic performance, all credits go toward satisfactory library service; thus, the third hypothesis proved the effect of improved productivity on service satisfaction. In addition, in an era of tight budgets and rapid technological changes, the skilled management of academic libraries has become a hot topic (Harris-Keith, 2015). Because administrative skills stimulate teamwork amongst staff, which contributes to improved student achievement and brings innovation and trust to library services. It encourages and provides more opportunities for further studying to establish a supportive learning environment for students. Administrative competence in deploying technology introducing innovation boosts users' satisfaction in using library services. In addition to academic activities, in difficult situations (such as COVID-19), vigilant leadership formulates emergency measures to continue to provide users with uninterrupted academic services (Rafi *et al.*, 2020a). Thus, the influence of qualified leadership revealed a significant effect on productivity and satisfaction with library services in the fourth hypothesis. On the basis of these rationales, the discussion states that technology is the basis of modern development. It enables the use of resources, improves performance and reforms the quality of top managers, which ultimately improves services and builds trust in library services.

Implication

This research provides a comprehensive theoretical framework for determining the impact of technological dynamics and management capabilities on user satisfaction and trust in library services. Using the TAM, the authors tried to investigate the usefulness of modern technology on resource utilization, improving user's performance, modernizing management and ultimately improving services in libraries. In the past, in addition to TAM, a number of theories have been used to study the use of technology in libraries and drive innovation in management and services. However, TAM, due to its great flexibility, acceptance of modernism and scope in the DL field, was preferred for implementation in academic libraries. TAM can be seen as an influential model used to explain the adoption of information technology by different types of users and is widely used in many fields. In this study, the model helps deploy technology, gain access to resources, improve employee skills, modernize governance and increase e-resource utilization (Xu and Du, 2019). We believe that the financial crisis has prevented developing countries from making it easier for their academies to use technology and reform services. Because senior management is always involved in policymaking and other critical decisions, understanding the deployment and the increasing complexity of technology is imperative. An integrated model based on the five pillars of this study, in addition to filling the existing literature gap, will assist university leaders in building modern administration, deploying technology to increase the use of library resources and promoting quality services in the shortest possible time.

Limitations

This study was conducted to examine user satisfaction with the support provided by the library administration and staff, based on a questionnaire among some university students in the provincial capital. The study summarized results based on a limited population that could be improved by collecting data from university students in remote areas of the province through research questionnaires or in-depth interviews, which are not available in this study. More importantly, research can be innovative if cross-provincial comparative research is conducted to examine the realities of academia. Many other areas could be explored in the future, such as declining faculty and student research productivity in the

Web of Science, challenges in blockchain technology adoption, big data analytics, resource integration and performance evaluation of librarians in academic libraries. In modern times, there is a need to emphasize semantic technology, its application with clustering technology and retrieval. More importantly, in the future, new technologies such as distributed frameworks, parallel computing, big data and artificial intelligence should be part of a technology campaign that needs to be considered.

Conclusion

For the first time, a quantitative study based on primary data from university students in Khyber Pakhtunkhwa, Pakistan, has been conducted to produce fruitful results in long-term academic settings. A conceptual five-factor model based on TAM was developed to understand the robustness of technological utility as an independent variable for various factors in the proposed model. The conceptual model was associated with a number of hypotheses to test the model's suitability using EFA. The EFA results highlighted a hierarchy in which technological utility positively influences resource use, improves student performance, and thereby develops management skills and ongoing services. In addition, it has also been concluded that vision-oriented and skilled management leads to reforms that increase student confidence in resource use and research productivity based on service quality. In conjunction with TAM, the proposed model, therefore, proves to be very useful to support managers in the use of technology and students and researchers in all academic activities of academic institutions.

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Further reading

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