Exploration of ICT Applications in Public Sector University Libraries of Interior Sindh: A Mixed Methods Research

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Abstract

Public sector university libraries in interior Sindh are embracing Information and Communication Technologies (ICTs) for their technical and routine work. This study explored the current status of ICTs infrastructure, its application in different areas of library activities, library automation, digitization, and web-based services by employing the concurrent mixed methods approach. The quantitative (QUAN) data were collected from 141 central and seminar libraries of public sector universities in interior Sindh accredited by Pakistan's Higher Education Commission (HEC) using an adopted survey questionnaire. While, an in-depth interview of the heads of purposively selected 14 universities' central libraries were conducted for qualitative (QUAL) data. The findings revealed that the majority of libraries in interior Sindh were lacking in sufficient hardware and other ICT equipment; that most of the libraries didn't have library automation and digital libraries' softwares with no library website and access of HEC digital library resources. Based on the finding and the qualitative data from the respondents, it was suggested that different professional development training programs and workshops on library automation and digitization should arrange for the university library professionals in Interior Sindh arrange This study provides insightful findings for the policy makers to improve the current alarming status of the university libraries of Interior Sindh.

Keywords: ICT Applications, University Libraries, Interior Sindh, Mixed Methods Research

Introduction

Universities are more advanced learning institutions that provide high-quality education and support research through academic programs. By providing trained employees and competent services, university libraries support all university programs and play a critical role in learning, education, teaching, and research. For a long time, university libraries have prioritized providing high-quality services and ensuring user happiness. Prior to the advent of information and communication technologies (ICTs), achieving a set of corresponding goals was extremely difficult. As a result, libraries have changed dramatically as a result of technological advancements, and fantasies have become a reality. It was originally designed to automate library tasks, but with the development of the internet and digital technologies, it was able to broaden its reach. Libraries have now conquered the challenges and constraints, allowing them to gain complete physical and intellectual control over their collections, as well as to improve administrative and operational activities quickly from local to remote locations (Shahzad & Khan, 2023, Shah, 2023). The use of ICTs in libraries is increasingly unavoidable, and these applications have revolutionized all library services around the world. ICTs have presented new problems for libraries, which librarians must accept in order to use ICTs to manage, control, and introduce new formats of electronic documents and new services that go beyond the user's expectations and increase the library's productivity.

Public Sector University Libraries of Interior Sindh

Sindh is Pakistan's third-largest province in terms of territory and second largest in terms of population. All districts of Sindh, with the exception of Karachi, are considered interior Sindh. A number of public universities are operational in interior Sindh. Universities include both multidisciplinary and single-discipline institutions. The usage of ICT in public universities in interior Sindh is still in its early stages. Interior Sindh libraries are embracing this technology and incorporating it into a variety of library activities, including automation of library tasks, digitization of original documents into electronic formats, and the use of barcode technology for optimal resource management. The Higher Education Commission (HEC) Digital Library Program, which provides free access to international academic electronic resources (books and journals), has given these libraries a new lease on life and has become a valuable resource for research scholars.

Information and Communication Technologies (ICTs)

Information and communication technologies (ICTs) are a broad term that refers to both fundamental and advanced technological resources. ICT has made it easier to obtain and retrieve information in a timely manner, and it has created a window for researchers and information seekers to access information based on their needs and curiosity (Rakhimjonovich & Umida, 2023). Information and Communication Technologies (ICTs) are defined by UNESCO (2009) as:

> *a diverse range of technological instruments and resources used to transmit, save, produce, share, and exchange information, these technological tools and resources include Computers, the Internet (websites, blogs, and emails), live broadcasting technologies (radio, television, and webcasting), recorded broadcasting technologies (podcasting, audio and video players and storage devices), and telephony (fixed or mobile, satellite, Visio/video-conferencing, and so on) are all examples of technological tools and resources.* (para.1)

ICTs in University libraries

Information and Communication Technology (ICT) has revolutionized the landscape of library infrastructure, particularly in academic settings, with the internet and the World Wide Web (www) playing pivotal roles in information access and modification. The transformative impact of ICT on the functions of academic libraries in the contemporary knowledge society cannot be overstated (Mairaj & El-Hadi, 2012). University libraries, as critical knowledge repositories, have predominantly employed ICT for automation and digitization purposes, ushering in a paradigm shift in their operational dynamics.

Despite the evident integration of ICT in Pakistani libraries and the global trend towards digitalization, a specific research gap emerges when considering the unique context of Public Sector University Libraries in Interior Sindh. The existing literature primarily focuses on the broader implications of ICT in libraries (Inamdar, 2022), but a dearth of comprehensive studies exists regarding the nuanced challenges and opportunities faced by university libraries in this specific regional subset.

While the adoption of ICT in Pakistani libraries is acknowledged (Mairaj & El-Hadi, 2012), the dynamics of its implementation within the distinctive socio-economic and

infrastructural milieu of Interior Sindh's public university libraries remain unexplored. This critical research gap underscores the imperative for a study that investigates the current status, hurdles, and potential avenues for optimizing ICT applications in these libraries, providing tailored insights crucial for the enhancement of information access and knowledge dissemination in this unique regional context.

Research Objectives for Quantitative Inquiry

There are five following objectives of this research, which are:

1. To explore the nature and current state of information and communication technologies (ICTs) in public sector university libraries in interior Sindh.
2. To determine the impact of ICT on public sector university libraries in Sindh.
3. To assess the level of ICT capability of library and information science (LIS) professionals in public sector university libraries in interior Sindh.

Research Questions for Qualitative Inquiry

4. What are the challenges associated with ICT applications in public sector university libraries of interior Sindh?
5. What are the future strategies for utilizing these ICT applications for public sector university libraries of interior Sindh?

Literature Review

Information and Communication Technology (ICT) applications have emerged as transformative tools in the realm of libraries, revolutionizing traditional practices and redefining their role in the modern information landscape. Libraries, once predominantly repositories of print resources, now harness a myriad of ICT tools to enhance accessibility, efficiency, and user experience. Automation, digitization, and the adoption of integrated library systems have streamlined cataloging, circulation, and resource management processes, minimizing manual efforts and maximizing operational precision (Bawden & Robinson, 2012). The internet and web-based platforms have expanded information retrieval possibilities, enabling libraries to provide seamless access to vast digital repositories. Furthermore, ICT facilitates the creation of virtual and electronic libraries, transcending physical constraints and fostering global knowledge dissemination. Mobile applications, online databases, and digital archives enhance user

engagement, offering diverse avenues for information exploration and research. The integration of emerging technologies, such as artificial intelligence and data analytics, holds promise for predictive analytics in collection development and personalized user services. In essence, the dynamic utilization of ICT applications in libraries underscores a paradigm shift, empowering these institutions to evolve as dynamic hubs of information, fostering learning, research, and community engagement in the digital age.

In the following paragraphs, some key studies are reviewed.

According to Sutrisno et al. (2021), ICT applications and facilities in universities are required to improve educational performance and quality. Students seek gratification and satisfaction from their use of ICT facilities as a sole focus. The research plan was organized on the UGT (Uses and Gratification Theory), and a survey of 386 people was undertaken. The findings revealed that, as an intervening variable, students' attitudes, social support, and locus of control influence gratification and satisfaction with usage. The use of ICT apps and facilities also has an effect on gratification and satisfaction, according to the findings. Demographic, community involvement, and credibility characteristics, on the other hand, have no effect on gratification and satisfaction.

Omehia et al. (2021) in Rivers State, Nigeria, investigated the degree of the link between librarians' ICT skills and the use of emerging technologies in university libraries and information centers using co-relational technique. The study was directed by three research questions, three objectives, and three null hypotheses that were created and assessed at the 0.05 level of significance. The survey included 55 librarians from four academic institutions. Rivers State has a number of libraries. For this study, a census sample technique was used, with all 55 participants being included. The findings revealed a strong link between basic computer abilities, information retrieval skills, and web 2.0 skills of LIS professionals, as well as the use of emerging technologies in university libraries in Rivers State, Nigeria.

Oyovwe-Tinuoye et al. (2021) investigated the impact of information and communication technology on work performance among library professionals in Nigeria's south-south universities. The study employed a descriptive survey methodology, with a self-created questionnaire serving as the data collection mechanism. The majority of defendants at university

libraries gain ICT competency through self-sufficiency, according to the findings. It also shows that the vast majority of the defendants lacked proficiency in organizational administration, web application and equipment, such as digital conferencing/webinar instruments, system troubleshooting, website creation, and Web 2.0, virtual communication.

Ahaiuzu and Nsirim (2020) determined the mobile machinery proficiency of library science experts for the adoption of blended learning in Rivers State. The study used a descriptive survey design with a population of 45 people, and a census sampling technique was used to sample all 45 librarians from Rivers' four library schools. The data for the study was gathered using a standardized questionnaire. The instrument was returned 42 times and verified to be valid for analysis. Mean scores and simple percentages were used to examine the data. Despite the fact that library professionals could employ basic computer interfaces, mobile and new media technologies for blended learning, the results demonstrate that they did not do so.

Ahmed and Sheikh (2020) looked at LIS professionals' ICT skills and saw it as a predictor of better library services. His goal was to learn about ICT abilities such as computer competency and data storage competency. As a forecaster, library information workers' information retrieval competency and accessible utility software proficiency will be used to expand library services. For this study, a quantitative research approach was used. To collect data, a questionnaire was employed. The participants in this study were library science experts who worked in public and private university libraries in Punjab, Pakistan. The conclusion of this study supported both assumptions, and a significant association was discovered between library science workers' ICT competencies and enhanced library performance.

Agava and Underwood (2020) assessed the ICT knowledge of LIS professionals working in the Tangaza University College (TUC) Library in Kenya. The method employed was qualitative research. The majority of TUC LIS professionals have a high degree of ICT experience in fundamental ICT skills and only a few digital technologies, according to the results; however, they lack technical ICT abilities.

Oyedonkun et al. (2018) selected university libraries in Kwara State, Nigeria, were investigated for ICT awareness, restrictions, and difficulties. A descriptive survey design of quantitative research approach was used, with a sample size of 122 selected from a population (191). The instrument for data collection was a questionnaire, which was fully completed and

returned by 109 participants (with an 89.3 percent return rate). The findings imply that employing ICT technology; library employees can improve their skills in a variety of library areas. It is obvious, however, that librarians are becoming more aware of how to provide reference services using web 2.0 platforms such as social media, wikis, blogs, and emails.

Bhoi and Kumar (2017) stated that ICT provides direction to LIS professionals and also provides a pathway for library operations, notably cataloguing and categorization, as well as raising awareness of the usage of OPAC and Web OPAC among users and LIS professionals. The research is descriptive in nature. The findings revealed that effective utilization of an IT library might boost user happiness. The current situation necessitates the updating of technology in order to provide speedy library services. It is now unavoidable for LIS workers to keep up with the latest technology.

Research Method and Procedure

A mixed methods research approach was adopted in this study to get an in-depth and comprehensive understanding of ICT implementation in public sector university libraries in interior Sindh. A concurrent mixed methods inquiry has been applied as recommended by Creswell et al. (2011). The goal of utilizing a parallel design was to obtain varied and detailed data on the same phenomenon in order to have a thorough knowledge of the study. To achieve the specific objectives of the research study, a questionnaire was used in quantitative research, while an interview guide was employed in qualitative research to collect data. Quantitative data were collected from total 127 seminar/departmental/faculty libraries of public sector universities in interior Sindh accredited by Pakistan's Higher Education Commission through a questionnaire adapted from the studies of Mirza (2010) and Ramzan (2010) through census sampling. However, the questionnaire was reviewed by three experts from Information and Communication Technologies (ICTs) and two experts from Information Management (Library and Information Sciences) discipline. Necessary suggested recommendations were incorporated accordingly. For qualitative data, in-depth interviews from 16 central libraries of these universities were conducted. To ensure the internal consistency reliability of the 56 items, Cronbach’s Alpha was used and the resulting α value was 0.698. This Cronbach’s alpha result indicated a good level of internal consistency (≥ 0.60) in the statements as recommended by Taber (2018). The section wise Cronbach’s alpha was also calculated which varied from 0.698 to 0.918. For the

examination of nominal QUAN data, frequencies and percentages were computed, whereas for ratio-type QUAN data, specifically Likert-type data, the analysis involved calculating the mean (M) and standard deviation (SD). Concurrently, the QUAL data obtained through interviews underwent thematic analysis using MS Excel, with the emerging themes elaborated upon in the subsequent analyses section. Adhering to ethical guidelines outlined in APA 7th, the data collection process prioritized respondent confidentiality, voluntary participation, and the absence of coercion. In the analysis and interpretation of QUAL results, a participant list was generated with alphanumeric codes to protect anonymity, while a separate list containing original names was maintained for record-keeping purposes. These methodological approaches ensured a comprehensive and ethical treatment of both QUAN and QUAL data in the research study.

Results And Discussions

Demographic Profile

The first portion of the questionnaire collects information about respondents' qualifications and library types. Here's detailed information:

Table 1

Qualification of LIS professionals

Demographics	Frequency	Percentage
Qualification		
BS	2	1.4%
MLIS	125	88.7%
M. Phil.	1	0.7%
Other	13	9.2%
Library type		
Central library	14	9.9%
Seminar library	127	90.1%

Table 1 demonstrates that there were 16 Central Libraries in interior Sindh, 14 of which were included in this study and two Central Libraries that did not respond. There were 127 seminar libraries in 14 university libraries. In university libraries, LIS professionals hold various

degrees in library and information science, including 125 (88.7%) MLIS, 2 (1.4%) BS, and 1 (0.7%) M. Phil, while 13 (9.2%) respondents have additional degrees.

ICT Infrastructure of Hardware

ICT infrastructure is a collection of technological instruments, such as hardware, software, and communication protocols, for obtaining, storing, and managing data in order to improve learning, teaching, and research activities while also overcoming time-consuming barriers. The ICT infrastructure of the Central and Seminar libraries was evaluated by gathering data on various fundamental hardware for daily routine operations, as listed below:

Table 2

Hardware in Public Sector University libraries

S#	Name of Hardware	Hardware Exist		Hardware not Exist	
		CL (%)	SL (%)	CL (%)	SL (%)
1	Server	4 (28.6%)	2 (1.58%)	9 (64.2%)	125 (98.4%)
2	Desktop Computer	14 (100%)	116 (91.3%)	Nil	11 (8.7%)
3	Laptop Computer	8 (57.1%)	Nil	6 (42.9%)	127 (100%)
4	Digital Camera	3 (21.4%)	Nil	11(78.6%)	127 (100%)
5	Scanner	8(57.1%)	7 (50%)	6 (42.9%)	120 (94.5%)
6	Printer	14 (100%)	13 (10.2%)	Nil	114 (89.8%)
7	Photocopier	5 (35.7%)	Nil	9 (64.2%)	127 (100%)
8	Barcode Scanner	5 (35.7%)	2 (1.58%)	9 (64.2%)	125 (98.4%)
9	Barcode Printer	2 (14.3%)	Nil	12 (85.7%)	127(100%)
10	Backup Drives	5 (35.7%)	Nil	9 (64.2%)	127(100%)
11	Audio Player	2 (14.3%)	Nil	12 (85.7%)	127(100%)

12	CD/DVD Player	3 (21.4%)	1 (0.8%)	11 (78.6%)	126 (99.2%)
13	Multimedia Projector	7 (50%)	4 (3.1%)	7 (50%)	123 (96.9%)
14	Television	1 (7.1%)	2 (1.58%)	13 (92.9%)	113 (89%)
15	CCTV	7 (50%)	3 (11.1%)	7 (50%)	124 (97.6%)
16	UPS	7 (50%)	1 (0.8%)	7 (50%)	126 (99.2%)
17	Fax	1 (7.1%)	1 (0.8%)	13 (92.9%)	126 (99.2%)
18	Telephone	9 (64.2%)	11 (8.7%)	5 (35.7%)	116 (91.3%)

Note: CL = Central Library, SL = Seminar Library, CL = 14, SL= 127

The results showed in Table 2 that most central libraries' ICT infrastructure was in good working order and was being used by the LIS professionals of central libraries; on the other hand, seminar libraries lacked the necessary hardware to carry out daily routine tasks and were relying entirely on a manual method. The ICT infrastructure of seminar libraries was, without a doubt, in worse form than that of central libraries.

Library Automation

The shift from manual to digital work is what library automation is all about. It is the method of managing library services using a computer system. Libraries nowadays are inundated with raw data. As a result, it is critical for libraries to develop a system that allows them to provide an environment in which users can receive information quickly and without wasting time or energy. In this study, the obtained data from central and seminary libraries shows the following status regarding library automation:

Table 3

Automation of Library Functions & Services

S#	Automated Library Functions & Services	CL (%)	SL (%)
1	Library acquisition	3 (21.4%)	4 (3.1%)

2	Cataloguing	9 (64.3%)	17 (63 %)
3	Circulation	5 (35.7%)	12(9.4%)
4	Serial control	2 (14.3 %)	2(1.6 %)
5	Stock verification	3 (21.4%)	3(2.4 %)
6	Document delivery	4 (28.6 %)	2(1.6 %)
7	Selective Dissemination of Information (SDI)	3 (21.4 %)	1 (0.8%)
8	Current Awareness Services (CAS)	3 (21.4 %)	2(1.6 %)
9	Virtual reference service	3 (21.4 %)	1(0.8%)
10	RFID	3 (21.4 %)	2(1.6 %)

Note: CL = Central Library, SL = Seminar Library, CL= 14, SL= 127

As illustrated in Table 3, the majority of the library functions and services in both the Central and Seminar libraries were not fully automated, and some services in most libraries have been partially automated like: library acquisition in 9 libraries, cataloguing in 26 libraries, circulation in 17 libraries, serial control in 4 libraries, stock taking in 6 libraries, document delivery services given in 6 libraries, Selective Dissemination of Information (SDI) given in 4 libraries, current awareness services (CAS) given in 5 libraries, virtual reference services given in 4 libraries, and Radio Frequency Identification (RFID) installed and adopted by 5 libraries.

Library Software

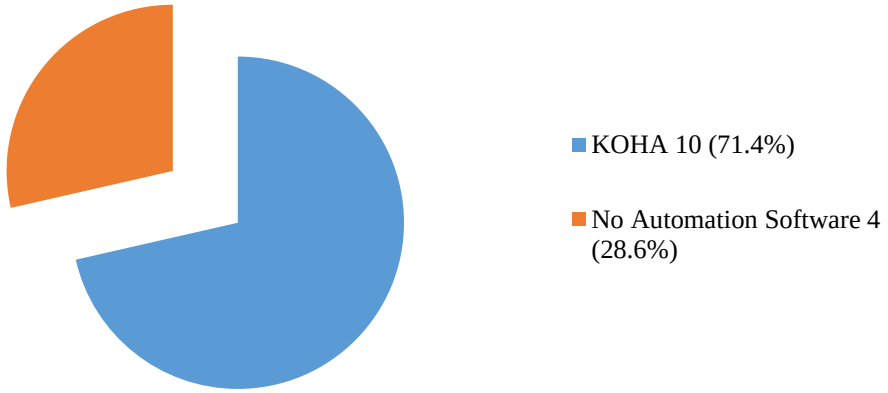
Depending on the size and type of the library, appropriate software is needed to automate library activities, functions, and services. Library software is an important and necessary component of the ICT infrastructure, as it aids in the management and delivery of services in the library. For library software, the data is comprised of pie charts to show the situation regarding software in central and seminar libraries:

Library Automation Software in Central Libraries

Below, Figure 1 shows that 10 (71.4%) of the 14 central libraries used KOHA library automation software, while four libraries did not use any automation software at all.

Figure 1

Library Automation Software in Central Libraries (N=14)

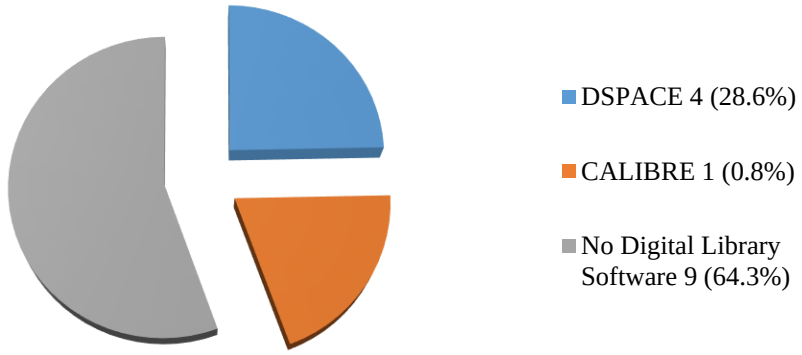


Digital Library Software in Central Libraries

Figure 2 reveals that 4 (28.6%) central libraries use DSPACE, institutional depository software, and 1 (0.8%) Central library uses CALIBRE, e-book management software. While 9 (64.3%) of Central libraries lacked digital library software.

Figure 2

Digital Library Software in Central Libraries (N=14)

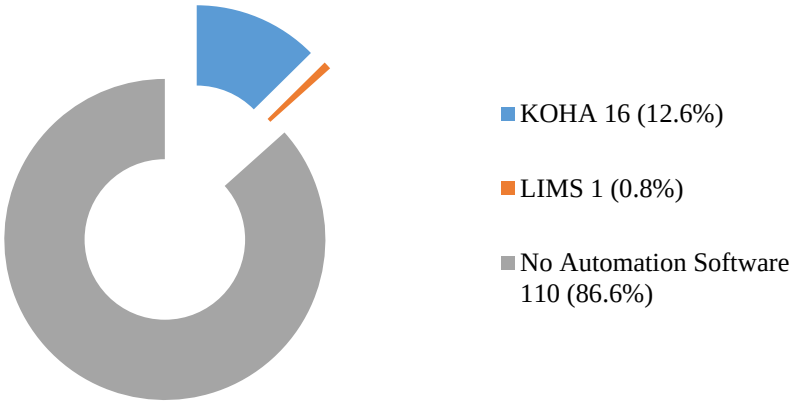


Library Automation Software in Seminar Libraries

Figure 3 shows that 16 (12.6 percent) Seminar libraries used KOHA integrated automation software in their libraries, while only 1 (0.8 percent) of 127 Seminar libraries used LIMS automation software, and 110 (86.6 percent) of 127 libraries did not use any automation software. The following are details:

Figure 3

Library Automation Software in Seminar Libraries (N=127)

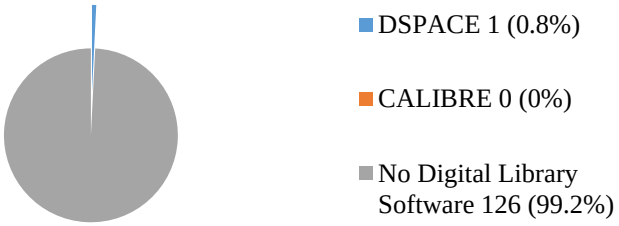


Digital Library Software in Seminar Libraries

Only 1 (0.8%) of 127 Seminar libraries used institutional repository digital library software in its library, whereas 126 (99.2%) of 127 libraries did not use any institutional digital library software. The details are mentioned below:

Figure 4

Digital Library Software in Seminar Libraries (N=127)



Internet and Library Website

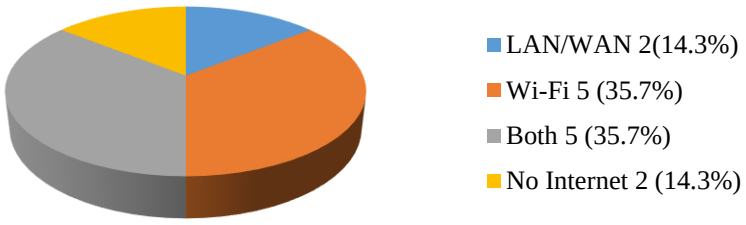
The Internet is a global networking infrastructure that connects huge networks. Academic libraries rely heavily on the Internet, which has now become an unavoidable requirement. The following information comprises on Pie charts to show the actual position of internet facility given in the university libraries of interior Sindh mentioned below:

Internet Facility in Central Libraries

Figure 5 demonstrates that internet access in Central libraries was provided by LAN/WAN in 2 (14.3 %) libraries and by Wi-Fi in 5 (35.7%) libraries, while 5 (35.7 %) of 14 Central libraries provided both LAN/WAN and Wi-Fi access. Only two (14.3 percent) of the Central libraries did not have internet access. Details are mentioned below:

Figure 5

Internet Facility in Central Libraries (N=14)

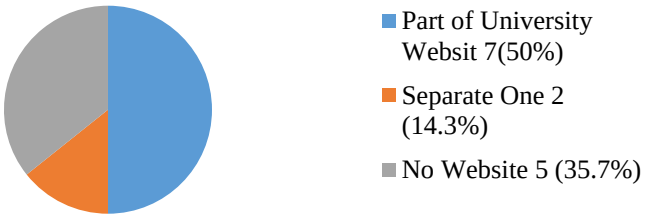


Library Website in Central Libraries

In Figure 6 shows that 7 (50%) central libraries have library website as part of the university website and 2 (14.3%) of 14 central libraries have separate library website and 5 (35.7%) libraries did not have their library website either part of the university website or separate one.

Figure 6

Library Website in Central Libraries (N=14)

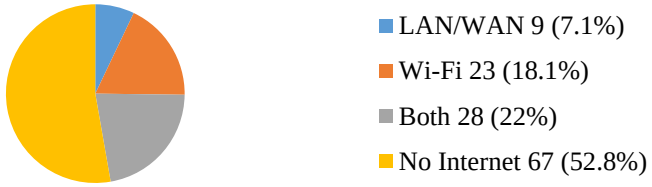


Internet in Seminar Libraries

Figure 7 reveals that 9 (7.1%) libraries provide internet access via LAN/WAN, 23 (18.1%) libraries provide internet access via Wi-Fi, and 28 (22%) libraries of the 127 Seminar libraries provide internet access via both the aforementioned wired and wireless internet access. While 67 (52.8%) Seminar libraries did not have access to the internet in their separate libraries.

Figure 7

Internet facility in Seminar Libraries (N=127)

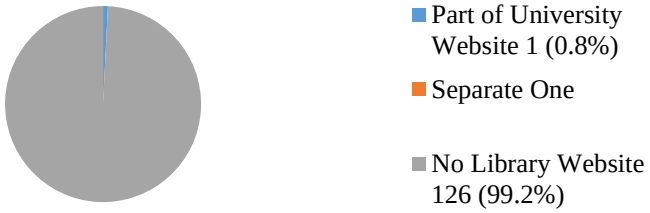


Library Website in Seminar Libraries

The Figure 8 shows that 1 (0.8%) library of 127 Seminar libraries have their library website as part of the university website while 126 (99.2%) of 127 Seminar libraries did not have their library website either part of university website or separate one. The details are mentioned below:

Figure 8

Library Website in Seminar Libraries (N=127)



Web based service

Web-based library services are those that are delivered through the use of web technologies. Web-based library services are given via the use of a specialized website that is available over the internet and allows users to access different databases in one place. Web based Library Services is defined as “library services supplied using the internet as a medium and a library website as a gateway with the support of an integrated library management system”

(Madhusudhan and Nagabhushanam, 2012, p.570). Data on web-based library services was collected from the heads of university libraries, and responses were received, as follows:

Table 4

Web-based services

S#	Web-based services	C.L %	S.L %
1	Library launch a website	4 (28.6%)	0
2	Access to HEC digital library	9 (64.3%)	18 (14.2%)
3	Web OPAC	4 (28.6%)	1 (0.8%)
4	E-Document delivery	4 (28.6%)	0
5	Online Reference services	4 (28.6%)	0
6	Institutional Repository	5 (35.7%)	0
7	Web Chat	2 (14.3%)	0

Note: CL = Central Library, SL = Seminar Library, CL = 14, SL= 127

Table 4 highlights web-based services that are critical for libraries and their users to access library content from a distance or in distant places.4 (28.6%) libraries in the university Central Libraries have launched library websites, 9 (64.3%) libraries have access to the HEC digital library, 4 (28.6%) libraries have their web OPAC, 4 (28.6%) libraries provide E-document delivery services, 4 (28.6%) libraries provide online reference services, and 5 (35.7%) libraries have their institutional repository. Only 18 (14.2%) of seminar libraries have access to the HEC digital library, and only one (0.8%) has a web OPAC. In general, university libraries lag behind in providing web-based services to their patrons.

Respondent's Level of Knowledge in Information and Communication Technology

Information and communication technology play an essential role in every aspect of life, especially in libraries, from information collection to information disbursement and optimal satisfaction of the user's needs and wants. So, for that, it is indispensable for LIS professionals to have good ICT skills so as to cope with the challenges of information access and retrieval. For

this, the questions are distributed among the LIS professionals to know the level of knowledge and expertise in ICT.

Table 5

ICT Acquired Competency of LIS Professionals.

S#	Statements	Mean	SD
1	Work with different operating systems (e.g., windows, Macintosh, DOS, Linux)	2.93	0.771
2	Use Microsoft office (e.g., word, excel, power point, access, outlook, etc.)	2.77	0.944
3	Search information through social networking sites (Facebook, Twitter, YouTube)	2.67	1.168
4	Select and install appropriate operating system.	2.27	1.101
5	Access information using tools/ search Engines (e.g., Google, Yahoo, etc.)	2.06	1.110
6	Use Koha Library Integrated Software	2.04	1.034
7	Use Adobe Reader	1.76	1.152
8	Share information by creating library Blogs	1.74	1.010
9	Use basic searching techniques to retrieve information	1.67	1.018
10	Access information from meta search engine (e.g., Dogpile.com, Mama.com)	1.63	0.981
11	Retrieve information from Web OPACs	1.55	0.944
12	Access online databases (e.g. ProQuest.com, Emerald, Science Direct and Dialog.com)	1.50	0.875
13	Use advanced searching techniques i.e.,	1.48	0.930

	Boolean Operators, Truncation, etc. to retrieve information.		
14	Use WINISIS library software	1.43	0.821
15	Use DSpace digital library Software	1.40	0.746
16	Use online Drop box as storage device	1.39	0.744
17	Generate reports using library software	1.39	0.725
18	Use LIMS Library Automation Software	1.38	0.851
19	Use Virtua Library Integrated Software	1.38	0.824
20	Use MARC records (Metadata standards)	1.34	0.869
21	Create backup of storage record	1.33	0.779
22	Use LAMP Automation Software	1.32	0.749
23	Use Green Stone digital library Software	1.28	0.599
24	Use ICloud as storage device	1.28	0.611
25	Use Urdu software	1.21	0.619
26	Use online MS SkyDrive as storage Device	1.21	0.615
27	Use Google Drive as storage device	1.19	0.620
28	Use ePrint digital library software	1.11	0.464

Scale: 1= Very Low, 2= Low, 3= Moderate, 4= High, 5= Very High

Table 5 shows that LIS professionals had some level of good ICT knowledge when working with different operating systems, utilizing Microsoft Office, and searching for information through social networking sites such as Facebook, Twitter, and YouTube, and their mean values are 2.93, 2.77, and 2.67, (0.77, 0.944, and 1.168), while the LIS professionals whose knowledge of ICT was low used Microsoft Sky drive, Google drive as a storage device, and used ePrint digital library software, and their mean values are 1.21, 1.19, and 1.11, (0.615, 0.620, and 0.464). The remaining low level of information in ICTs among LIS professionals is reflected in the table above. According to statistics obtained through this survey, the majority of LIS professionals were unfamiliar with the usage of ICTs in libraries.

Required Competencies of LIS professionals

Table 5 has been linked to Table 6 to determine the requisite proficiency of LIS professionals in ICTs. As can be seen from the data in Table 6, the majority of LIS professionals have required ICT training, conferences, and workshops for the following ICT tools and techniques that have been collected and defined in required competency:

Table 6

ICT Required Competency of LIS Professionals

S#	Statements	Mean	SD
1	Use ICloud as storage device	3.76	0.706
2	Generate reports using library software	3.59	0.829
3	Use Google Drive as storage device	3.57	0.730
4	Use online MS Sky Drive as storage Device	3.55	0.797
5	Use advanced searching techniques i.e. Boolean Operators, Truncation, etc to retrieve information.	3.54	0.806
6	Use Urdu software	3.52	0.938
7	Use LIMS Library Automation Software	3.48	0.997
8	Access information using tools/ search Engines (e.g. Google, Yahoo, etc.)	3.45	0.823
9	Use basic searching techniques to retrieve information	3.45	0.929
10	Search information through social networking sites (Face book, Twitter, YouTube)	3.45	0.770
11	Use Koha Library Integrated Software	3.44	0.995
12	Access online databases (e.g. ProQuest.com, Emerald, Science Direct and Dialog.com)	3.44	1.017
13	Share information by creating library Blogs	3.43	0.813

14	Use MARC records (Metadata standards)	3.43	0.839
15	Retrieve information from Web OPACs	3.37	0.857
16	Use LAMP Automation Software	3.36	0.998
17	Use online Drop box as storage device	3.36	0.980
18	Use WINISIS library software	3.35	0.927
19	Use Adobe Reader	3.33	0.937
20	Use Virtua Library Integrated Software	3.31	0.942
21	Access information from meta search engine (e.g., Dogpile.com, Mama.com)	3.31	1.029
22	Create backup of storage record	3.30	1.108
23	Use ePrint digital library software	3.29	1.210
24	Use DSpace digital library Software	3.29	1.131
25	Use Green Stone digital library Software	3.18	1.154
26	Use Microsoft office (e.g., word, excel, Power point, access, outlook, etc.)	2.99	0.922
27	Select and install appropriate operating system.	2.93	1.087
28	Work with different operating systems (e.g., windows, Macintosh, DOS, Linux)	2.86	0.761

Scale: (1= Very Low, 2= Low,3= Moderate, 4= High, 5= Very High)

LIS professionals were in desperate need of training in utilizing ICloud as a storage device, generating reports using library software, using Google Drive as a storage device, and using online MS Sky Drive as a storage device, and their mean values were: 3.76, 3.59, 3.57, and 3.55, (0.706, 0.829, 0.730, and 0.797), while the LIS professionals were well versed in the use of Microsoft office (e.g. word, excel, power point, access, outlook, etc.), selecting and installing the appropriate operating system, working with different operating systems (e.g. Windows, Macintosh, DOS, and Linux), their mean values were: 2.99, 2.93, and 2.86, (0.922, 1.087, and 0.761). According to a statistical study, the majority of LIS professionals required training and seminars on ICT in order to effectively and efficiently integrate and use it in libraries in order to deal with difficulties.

Impact of ICTs on Libraries' Functions and Services

Library acquisition, cataloguing, circulation, serial control, categorization, technical processing, reference service, resource sharing, document delivery, and other traditional library tasks have all been transformed by ICT. In today's age of information explosion, ICT has become a crucial source for library operations and services. Automation, digitization, E-collection, and the library's security system are all examples of the impact of information and communication technology on libraries. On closed-ended questions, data was obtained from the heads of central and seminar libraries, and the responses are listed below:

Table 7

Impact of ICT on library functions and services

S#	Library Functions and Services	Responses				
		Easy (%)	Time Saving (%)	Cost Effective (%)	Efficient (%)	Productive (%)
	ICT applications have made:					
1	Library Acquisition	0 (0%)	1 (0.7%)	0 (0%)	2 (1.4%)	2 (1.4%)
2	Cataloguing	6 (4.3%)	6 (4.3%)	6 (4.3%)	6 (4.3%)	7 (5%)
3	Circulation	1 (0.7%)	1 (0.7%)	1 (0.7%)	1 (0.7%)	3 (2.1%)
4	Serials Control	1 (0.7%)	0 (0%)	0 (0%)	0 (0%)	2 (1.4%)
5	Classification	0 (0%)	0 (0%)	0 (0%)	3 (2.1%)	0 (0%)
6	Stocktaking/verification	1 (0.7%)	2 (1.4%)	2 (1.4%)	2 (1.4%)	1 (0. 7%)
7	Document Delivery	1 (0.7%)	2 (1.4%)	1 (0.7%)	1 (0.7%)	3 (2.1%)
8	Selective Dissemination of Information (SDI)	2 (1.4%)	1 (0.7%)	1 (0.7%)	1 (0.7%)	3 (2.1)
9	Current Awareness Service (CAS)	2 (1.4%)	1 (0.7%)	1 (0.7%)	1 (0.7%)	3 (2.1%)
10	Reference Services	1 (0.7%)	1 (0.7%)	1 (0.7%)	2 (1.4%)	3 (2.1%)
11	Bibliographical Services	0 (0%)	1 (0.7%0	0 (0%)	2 (1.4%)	0 (0%)

12	Indexing Service	0 (0%)	1 (0.7%)	0 (0%)	0 (0%)	2 (1.4%)
13	Abstracting Service	0 (0%)	1 (0. 7%)	0 (0%)	2 (1.4%)	0 (0%)
14	Translation Service	0 (0%)	0 (0%)	0 (0%)	1 (0.7%)	2 (1.4%)
15	Reprographic Service	0 (0%)	0 (0%)	1 (0.7%)	2 (1.4%)	0 (0%)
16	Preservation and Conservation	0 (0%)	0 (0%)	1 (0.7%)	0 (0%)	1 (0.7%)
17	Work performance.	1 (0. 7%)	1 (0.7%)	1 (0.7%)	1 (0.7%)	4 (2.8%)
18	to answer the queries of multiple User at a time	1 (0.7%)	1 (0.7%)	1 (0. 7%)	2 (1.4%)	3 (2.1%)
19	to manage the work load of staff	1 (0.7%)	2 (1.4%)	1 (0.7%)	3 (2.1%)	1 (0.7%)
20	to save the time of users	1 (0.7%)	1 (0.7%)	1 (0.7%)	1 (0.7%)	3 (2.1%)
21	the users self sufficient by user education	1 (0.7%)	1 (0.7%)	1 (0.7%)	2 (1.4%)	3 (2.1%)
22	Library Security System	1 (0.7%)	1 (0.7%)	2 (1.4%)	1 (0.7%)	3 (2.1%)
23	Librarycollection surveillance/Vigilance	1 (0.7%)	1 (0.7%)	1 (0.7%)	2 (1.4%)	3 (2.1%)
24	theft detection	1 (0.7%)	1 (0.7%)	1 (0.7%)	2 (1.4%)	3 (2.1%)

As shown in Table 7, the influence of ICT on library functions and services was not adequate. The impact of ICT on library services is classified as easy, time-saving, cost-effective, efficient, and productive. According to statistical analysis, the majority of libraries were not well equipped with ICT tools and techniques, and LIS professionals were not well versed in the aforementioned information communication technology, resulting in an inappropriate overall impact of ICT on library functions and services.

Qualitative Data Analysis

The qualitative data was collected from the heads of the central libraries of public sector universities in interior Sindh. To maintain the anonymity of the respondents, the list of participants has been created with alphabetic codes, while the list with original names has been kept for record-keeping purposes. An interview guide was used to collect data, and two research questions were developed. The following were the qualitative data questions:

4. What are the challenges associated with ICT applications in your library?

5. What are your future strategies for ICT applications in your library?

RQ4 - Challenges Associated with ICT Applications

The central libraries of public sector universities have 14 out of which 10 heads of the central libraries responded. As previously stated, the chiefs of the central libraries were questioned about the problems related to ICT applications in their individual libraries. The responses varied greatly from library to library, as seen in Table 8:

Table 8

Challenges Associated with ICT Applications

S#	Challenges	Number of respondents who mentioned
1	Lack of ICT infrastructure	4
2	Unawareness in selection and purchasing of hardware and software.	4
3	Lack of ICT skills	4
4	Poor attitude of LIS professionals towards ICT application.	4
5	Lack of continue professional development training programs	3
6	Administrative barrier and lack of financial support	3
7	No challenge in using ICT	1
8	Challenge of a huge amount of data entry in newly adopted automation program	1

9	User name and I.D connectivity issue	1
10	Maintenance problem	3
11	Maintenance problem because of not having I.T expert	1
12	Problem in troubleshooting	4
13	Server system lay down occasionally because of heavy load and rush of students	1
14	Challenge is data management because of staff shortage	1
15	Challenge is digitization (scanning size of the picture increase)	1
16	Slow internet speed	2
17	Very high costs in maintenance of ICT infrastructure	1

A group of four respondents, (A), (B), (C) and (G), responded that in their library there was a lack of ICT infrastructure, unawareness in selection and purchasing of hardware and software, lack of ICT skills in LIS professionals, and a poor attitude of the LIS professionals towards ICT applications. Another group of three, (A), (B), and (G) also responded that there were administrative barriers, a lack of financial support from the authorities, and a lack of professional development training programs.

Respondent (D) mentioned that there was no challenge in using ICT in the library, while respondent (E) responded that there were user name and I.D recognition issues in the connectivity of users alongside hardware and software maintenance problems in the absence of an I.T expert.

Respondent (F) responded that there was a huge amount of data entry in the newly adopted automation program, which was a great challenge. A group respondent (E) and (F) mentioned the problem of internet speed as a challenge. A group consisting of respondents (E), (F), (H), and (J) responded that troubleshooting and maintenance of software was a challenge.

Respondent (H) responded that their server system goes down occasionally because of the heavy load and rush of students. They also face difficulty in data management because of staff shortages.

Respondent (J) responded that in digitization the scanning size of the picture increase it seems as a challenge along with it. Respondent (I) responded that there were very high costs in maintenance of ICT infrastructure as a challenge.

RQ5 - Future Strategies for ICT Applications

The following replies were received in response to the second question posed to the heads of central libraries about the future strategies of ICT applications in their libraries (Table 9):

Table 9

Future Strategies for ICT applications

S#	Future Strategy	Number of respondents who mentioned
1	Work on automation and digitization	1
2	Arrange continuous professional development training programs	3
3	Convince authority for financial support	2
4	Fully computerize library	2
5	Adopt/install RFID and Barcode	1
6	Digitize rare material of the library	1
7	No future strategy	1
8	Two future strategies: 1. To launch an application of online system to control and monitor central and seminar libraries. 2. To create a digital library of the soft copies of e-books because we get more that 500 e-books each year.	1
9	No future strategy	1
10	To build new building of the library for that 500 million has been approved, after completion of this work we will work on RFID and Drop box	1
11	Auto circulation and complete RFID system	1
12	Completely go through RFID and develop a good digital resource	1

	and to ensure its accessibility also while our mission is to remove physical resources somewhere else and to digitize whole library material in near future.	
13	To establish two centers that are: 1. Innovation center: we will give facilities of printing, scanning, photocopy etc. 2. Makers room	1

Two respondents (A and G) responded that they would arrange professional development training programs and work on automation and digitization along with it. Respondents (B) and (G) responded that they will convince the authorities to support them financially as they may be able to computerize the library completely, while respondents (B) responded that they will install an RFID system in their library in the near future with it. Group (G) also responded that they would digitize the rare materials in the library.

Respondent (C) responded that they do not have any future strategy and depend on authority to take personal interest in ICT implementation in the library.

Respondent (D) responded that we will have two future strategies*:*

"To launch an application of an online system to control and monitor central and seminar libraries; to create a digital library of the soft copies of e-books as they get more than 500 e-books each year".

Respondent (E) responded that they were satisfied with whatever they had and that they had not planned so far for the future strategy. Another respondent viewed that they will build a new building for the library for which 500 million has been approved. After the establishment of the library building, they will install RFID and Drop Box in their library. Respondent (H) responded that they would install auto circulation and a complete RFID system in their library. Respondent (I) responded that they will completely go through RFID and develop good digital resources and ensure their accessibility as well, while our mission is to remove physical resources somewhere else and to digitize whole library materials in the near future. Respondent (J) responded that they will establish two centres in the near future that are:

1. At the Innovation center, we will provide facilities for printing, scanning, photocopying, etc.
2. Maker's room.

Discussion

The evaluation of Information and Communication Technology (ICT) infrastructure in Central and Seminar libraries sheds light on critical disparities, revealing distinct challenges and opportunities in these academic settings. Central libraries demonstrate a relatively robust ICT infrastructure, effectively utilizing hardware for daily operations. In contrast, Seminar libraries lag behind, relying predominantly on manual methods due to a lack of essential hardware. This discrepancy underscores the need for targeted interventions to bridge the digital divide between Central and Seminar libraries aligning these findings with Mirza (2010). The shift from manual to digital operations, encapsulated in library automation, is pivotal for streamlining library services. While Central libraries exhibit commendable progress in automation, Seminar libraries face significant gaps. Library functions in both settings are not fully automated, with partial automation observed in areas such as acquisition, cataloging, circulation, and document delivery services. The prevalent use of KOHA library automation software in Central libraries highlights a standardized approach, while Seminar libraries lack uniformity, with a majority not employing any automation software.

The study also delves into internet infrastructure, emphasizing its indispensable role in modern libraries. Central libraries generally boast internet access through LAN/WAN or Wi-Fi, with some employing both. In contrast, Seminar libraries exhibit a significant digital divide, with over half lacking internet access. This divide extends to the presence of library websites, with Central libraries showcasing better integration compared to their Seminar counterparts. Web-based services, crucial for remote access to library content, reveal a similar trend. Central libraries are more adept at providing services such as digital libraries, web OPAC, and online reference services. In contrast, Seminar libraries lag behind, particularly in offering web-based services, indicating a need for targeted improvements in this area. The study assesses the ICT knowledge of Library and Information Science (LIS) professionals, highlighting areas of proficiency and deficiency. While there is a commendable level of knowledge in operating systems and Microsoft Office, there is a noticeable gap in utilizing cloud storage and specific

digital library software. This knowledge gap emphasizes the necessity of tailored training programs to enhance the ICT skills of LIS professionals. These findings are also eco with the findings of Ramzan (2010).

Despite the acknowledged benefits of ICT in libraries, the study reveals a general lack of awareness and utilization among LIS professionals. This deficiency impacts the overall efficiency and effectiveness of library functions and services. The majority of LIS professionals express a need for training in utilizing ICT tools, emphasizing the urgency of addressing this knowledge gap. In conclusion, the research findings underscore the disparities in ICT infrastructure, automation, internet access, and ICT knowledge between Central and Seminar libraries. The identified gaps necessitate targeted interventions, including standardized automation practices, improved internet access, and comprehensive ICT training for LIS professionals. Addressing these challenges will contribute to the overall enhancement of library services, aligning them with the evolving demands of the digital age.

Conclusion

The rapid technological change has a great impact on libraries. The ICT now is playing a pivotal role in the development of libraries. Due to shrinking resources and financial problems, the university libraries are not utilizing ICT resources with full potential and not yet been fully deployed and exploited in interior Sindh. Insufficient funds and avoiding attitudes have been a serious obstacle in the course of ICT acquisition, adoption, utilization, and management. In public sector universities libraries of interior Sindh, the ICT infrastructure, application, and skill proficiency are varying from library to library. In most libraries the use of ICT is in beginning level and they have only just started to use while in some libraries, ICT is used to some extent at satisfactory level. Same way the library professionals are not equally proficient in all areas of ICT skill. Most seniors have an avoiding attitude while junior have positive attitude in adopting in ICT. Strategically to stay alive and dynamic, these libraries may need immediate attention from administrative and professional side to overcome the difficulties and expedite towards ICT applications.

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