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USE OF KOHA CLOUD COMPUTING IN LIBRARIES OF PAKISTAN: LIBRARIAN'S KNOWLEDGE, SATISFACTION AND ADVANTAGES

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ABSTRACT

Purpose: *The study aims to assess the knowledge and competencies of librarians in Pakistan to implement Koha Cloud in libraries. It also assesses the Koha modules that are functional in libraries, advantages and satisfaction.*

Design/methodology/approach: *The study used a quantitative research design to investigate the research questions and hypotheses. The researcher established a sample frame comprising 113 libraries throughout Pakistan. The survey encompassed all 113 libraries. Researcher developed a survey questionnaire with multiple-choice and Likert-scale items to assess the several aspects of Koha Cloud usage.*

Subsequent to data collection, the study attained a 100% response rate, with all 113 respondents. The researcher validated the data and entered it into SPSS version 23 for statistical analysis. They employed a variety of techniques, including frequency analysis, descriptive statistics, and inferential statistics, to analyse the data.

Findings: *The findings showed a positive attitude of librarians towards adopting Koha cloud computing. The respondents have extensive IT skills, focusing on database administration, barcode, and RFID technology. Popular modules include cataloguing, patron management, circulation, Koha administration, and advanced search. Respondents appreciated Koha cloud computing's technical assistance, email notifications, and full-feature usage. Satisfaction with Koha's usability was high regarding login interface, advanced search, and smartphone compatibility.*

Originality/value: *This is the first comprehensive study of in the area "utilization of Koha cloud computing in libraries across Pakistan". It distinctly analyses the expertise and competencies of librarians, investigates the functionality of Koha modules, and assesses overall satisfaction with the system. The research provides comprehensive insights into various domains of Koha Cloud Computing.*

Keywords: *Koha Cloud, PASTIC Koha Cloud, Cloud Computing, Satisfaction, Library Automation.*

INTRODUCTION

Technology has revolutionized the way people interact and share ideas in the digital era (Akram et al., 2021; 2022; Ma et al., 2024). Particularly cloud computing has become a powerful tool for library operations (Ramzan et al., 2023). This technological advancement has significantly impacted how

information is disseminated (Abdelrady & Akram, 2022), fostering a more interconnected and engaged global community (Akram & Abdelrady, 2023; Akram & Li, 2024). The adoption of information technology, especially cloud computing, is crucial for the modernization of library operations. Technological advancements have led to library automation, enhancing efficiency and facilitating the integration of digital tools (Al-Adwan et al., 2022), online resources, and consortia applications. Cloud computing has emerged as a pivotal technology, offering scalable and economical solutions that facilitate resource sharing and collaboration among libraries (Gosavi et al., 2012; Ramzan et al., 2023).

The extensive use of the Internet has compelled libraries to transition to electronic operations and cloud technology, reducing their reliance on conventional techniques. Cloud computing in libraries offers advantages like cost efficiency, technical advancement, and adaptability, while necessitating sophisticated IT knowledge and proficiency in areas such as OPAC and cloud-based library systems. In librarianship, cloud computing has gained prominence for its ability to enhance resource sharing and facilitate the advancement of technological solutions for information science professionals (Tritt & Kendrick, 2014; Ramzan et al., 2023).

Cloud computing provides enterprises with immediate access to computing resources, encompassing processing power, storage, and networking (Kushida et al., 2015). It includes computer processing, applications, and storage. It is frequently compared to grid computing and is typically used for prepaid network services (Sahu, 2015; Ramzan et al., 2023).

Cloud computing is a technological framework that provides hardware and software resources as a service via interconnected nodes, denoted by the cloud icon. Corporations such as Amazon, Google, and Microsoft implemented this pay as you-go strategy. According to Gosavi et al. (2012b), Kaushik and Kumar (2013), and Swain (2014), cloud computing constitutes a conceptual framework that provides worldwide access to computer, storage, and software services.

Definition of Cloud Computing:

According to Hartig (2008), cloud computing is the virtualization of resources capable of self-management and self-control. The remote storage and retrieval of client data and applications illustrates this notion.

According to Weber (2012), the cloud is extremely credible due to its contribution to technological advancement, improved user-friendliness, and facilitation of standardisation.

Cloud computing and libraries:

Academic discourse persists in examining the influence of cloud computing on libraries. Sadeh (2007a) posits that the proliferation of web search engines and platforms such as Google Scholar has diminished users' need for library support for their informational requirements. Vaquero et al. (2011) emphasise that cloud computing and web collaboration are critical for enhancing library automation through improved resource usage, accessibility, and cost effectiveness.

Sadeh (2007b) underscores the necessity of comprehending shifts in user preferences for online tools to efficiently reorganise library services.

According to Yang (2012), cloud-based integrated library systems (ILS) enable libraries to share essential data, including full-text journal titles, from electronic databases. The substantial investments made by libraries in IT infrastructure for online services have fostered a desire for cloud-hosted, subscription-based IT solutions.

According to Khater (2010) observes that cloud computing and digitalisation have revolutionised translation methodologies, transitioning from rule-based to statistical techniques, hence improving multilingual communication and facilitating the surmounting of language barriers.

Wang X. and Huang (2011) commend cloud systems for their ability to manage large data repositories through functionalities such as filtering and analytics, while also providing flexibility and cost efficiency.

Advantages of Cloud Computing for Libraries:

Das et al. (2013a) assert that cloud computing enhances collaboration among institutions and companies, enabling libraries to optimise resource utilisation and minimise redundancy. It provides

several advantages to educational institutions, including augmented research capacities and refined teaching methodologies. Cloud-based services have enabled the transition to digital librarianship; however, the integration of legacy pre-web systems continues to provide a difficulty.

Academic libraries frequently replicate and conserve data ineffectively, leading to increased expenses and disjointed information, according to research by Yuvaraj (2013) and Tritt and Kendrick (2014b).

Adopting cloud technologies can maximise resource utilisation, decrease costs, and improve service delivery. Cloud computing enables libraries to address varied user requirements more efficiently, providing enhanced processing capabilities and scalability. Furthermore, it enables libraries to offer services compatible with a variety of media devices, allowing for easy access to resources and services while accommodating user preferences and promoting innovation.

Statement of the Problem:

Libraries in Pakistan have implemented the Koha cloud service, provided by PASTIC, to improve their operations. This emphasizes the need to assess librarians' current knowledge and skills in adopting Koha Cloud, explore the cloud-based services offered by libraries, evaluate the functionality of Koha modules after adoption, and gauge librarians' satisfaction levels with Koha Cloud. The research seeks to fill a gap in the literature on Koha cloud computing in libraries, making it the first study of its kind in Pakistan.

Research Objective:

1. To assess the current knowledge and skills level of librarians in utilizing Koha Cloud computing for cloud-based library services.
2. To identify the Koha modules that are functional in the libraries after adopting Koha Cloud services by PASTIC.
3. To investigate the advantages of adopting Koha Cloud computing for enhancing the library automation process.
4. To evaluate the satisfaction level of librarians in using Koha Cloud computing services by PASTIC.

Research Question:

RQ1. What are the current knowledge and skills level of librarians when it comes to using Koha Cloud Computing for cloud-based library services?

RQ2. What are the Koha modules that are functioning in libraries after adopting Koha Cloud Computing service by PASTIC?

RQ3. What are the key advantages of adopting Koha Cloud computing for enhancing library automation process?

RQ4. What is the satisfaction level of librarians with Koha Cloud Computing services by PASTIC?

Research Hypotheses:

H1: There is a significant difference in the skills level of librarians in using Koha Cloud Computing based on their professional experience.

H2: There is a significant difference in the skills level of librarians in using Koha Cloud Computing based on their gender.

H3: There is a significant difference in the satisfaction level of librarians in using Koha Cloud Computing based on their professional experience.

Literature Review:

A literature review is an essential component of any research study because it helps to understand the current body of information on the topic. It assists in pinpointing deficiencies in the existing material that necessitate more exploration and enhances understanding of the subject. This section examines both international and Pakistani literature on "Use of Koha Cloud Computing in Libraries of Pakistan: Librarian's Knowledge, Satisfaction and Advantages".

Use of Cloud Computing Services for Libraries:

A computerized library management system allows librarians to electronically oversee everyday operations, mitigating hazards associated with manual paperwork, including file loss, damage, and inefficiency (Dinesh et al., 2015; Akram & Sohail, 2024; Sohail & Akram, 2025). These systems often comprise a relational database, communication software, and two graphical user interfaces—one for users and another for library personnel. Library management systems typically compartmentalise their functions into discrete modules, all interconnected within a cohesive interface. These modules encompass acquisitions (for procurement,

receipt, and invoicing of resources), cataloguing (for resource classification and indexing), circulation (for lending and returning objects), serials (for handling periodicals), and OPAC (the public user interface).
Libraries employ diverse cloud services, encompassing SaaS applications like Open URL resolvers, online references, and research aids; PaaS tools such as integrated library systems and interlibrary loans; and IaaS tools for discovery systems and archive management Shaw (2013). This section will examine the implementation of cloud-based SaaS applications in libraries, featuring examples from our nation.

Use of Open-Source Software:
In 1998, Christine Peterson introduced the term "open source," which led to the creation of the Open Source Initiative later that year. Don't confuse open source software (OSS), sometimes referred to as free software, with software that merely permits users to copy, modify, and redistribute it. To avoid this confusion, some members of the free software community have adopted the term "open source." OSS encourages the collaborative exchange of information, skills, and expertise. The library and information science (LIS) community began acknowledging OSS in 1999 when Daniel Chudnov introduced it in the Library Journal.
Libraries commonly use Integrated Library Systems (ILS), which are databases designed to manage library collections, user accounts, and related operations. These systems typically include modules for cataloguing, circulation, serials, acquisitions, statistical reporting, user accounts, and online public access catalogues (OPAC). Since the late 1990s, several open-source ILS have emerged, including Avanti MicroLCS, Emilda, Evergreen, Gnuteca, Koha, OpenBiblio, PhpMyLibrary, and PhpMyBibli. Among these, Koha and Evergreen are the most widely used. This study explores the global adoption of Koha open-source software in libraries through a web-based survey.

Koha Integrated Library System (ILS):
Koha is a web-based, multilingual integrated library system designed to meet the automation requirements of medium- to large-sized libraries. Exclusively designed for libraries in Pakistan, Koha is a comprehensive MARC-based system. Koha's intuitive interfaces provide comprehensive customising capabilities. Katipo Communications, in collaboration with the Horowhenua Library Trust in New Zealand, developed this open-source library management system under the supervision of an international consortium of developers and library technology specialists. Users attain "joint ownership" of the product, granting them the autonomy to determine the installation of new versions and engage in further development Egunjobi R. and Awoyemi (2012).

Use of Koha in Academic Libraries:
Das (2013b) discusses how cloud computing benefits universities by improving resource management, reducing energy costs, supporting research for industries, and enhancing teaching and learning methods. It also helps students manage workloads and understand emerging technologies. Rafiq and Ameen (2009) examine the challenges of OSS adoption in Pakistani libraries, including cultural differences, the digital divide, and resource limitations. The study identifies Koha as the most suitable OSS for library automation due to its flexibility and cost-effectiveness. It suggests that workshops and seminars be organized to enhance IT skills and promote collaboration. Rehman et al. (2012) explore the free and open-source software (FOSS) movement in Pakistan's library and information science (LIS) sectors. The movement is evolving, with tools like Koha and DSpace being used. The authors recommend integrating FOSS into curricula, encouraging collaboration, and advocating for its use through professional training and workshops. Khan and Zahid (2016) describe the migration from an outdated library management system (LMS) to Koha at Government College University (GCU) in Lahore. The process, completed in three months, faced challenges like configuring servers and managing Linux, but it addressed the need to automate GCU's large Urdu collection effectively.

PASTIC's Koha Cloud Computing Initiatives for Library Automation in Pakistan:
The Pakistan Scientific and Technological Information Centre (PASTIC) provides the inaugural complimentary Koha cloud computing service for educational libraries in Pakistan. The PASTIC

project, titled "Modernization of PASTIC National Science Reference Library for Effective Resource Sharing among S&T libraries in Pakistan" commenced with the creation of PakCat, the union catalogue of Pakistani publications.

The project's objective was to build PakCat using the Z39.50 protocol; however, PASTIC discovered that the majority of Pakistani libraries did not have conventional library automation software that was compatible with this protocol. PASTIC adapted the Koha library automation software to meet local needs, incorporating feedback from Pakistani library professionals. PASTIC organised a gathering of library specialists from Pakistan's Consortium of Science, Technology, and Research and Development (S&T and R&D) libraries to finalise the customisation. Following the consortium's resolution, PASTIC customized, integrated, and delivered the software as a cloud service, facilitating Koha installation and customization for libraries across Pakistan. PASTIC provides cloud-based Koha services to more than 113 Pakistani libraries.

Methodology:

This study used a quantitative research methodology to understand the adoption of Koha cloud computing in libraries of Pakistan. The research design involves formulating research questions and hypotheses, distributing a questionnaire, and implementing a survey of the respondents. Descriptive and inferential statistics were used to interpret numerical data while examining the relationships between variables.

The study population consists of 113 libraries from four provinces of Pakistan's capital region that have adopted PASTIC's Koha cloud service. Researchers used SPSS version 23 to analyse the data for various statistical analyses, such as frequency analysis, descriptive statistics, and inferential statistics.

Interpretation of the Results:

Demographic Information of the Respondents:

The result reveals a predominantly male workforce in libraries, with most respondents falling within the 30-to-39 age range. Librarians constitute the largest group by designation, followed by senior librarians and chief librarians. Professional experience varies, with the majority having 1–15 years of service. The most common qualification is MLIS, followed by M. Phil., with few holding a Ph.D. Libraries have adopted PASTIC's Koha cloud computing in recent years, with a significant number starting in 2022, reflecting growing adoption of this technology.

Table 1: Frequency analysis of demographic information of respondents (N = 113)

Variables	F	%
Gender		
Female	18	15.9
Male	95	84.1
Age		
21–29 years	25	22.1
30–39 years	55	48.7
40–49 years	21	18.6
Over 50	12	10.6
Designation		
Chief Librarian	16	14.2
Deputy Chief Librarian	2	1.8
Senior Librarian	17	15.0
Librarian	59	52.2
Deputy Librarian	3	2.7
Assistant Librarian	12	10.6
Any other	4	3.5
Professional Experience		
1–5 years	32	28.3
6–10 years	24	21.2

11-15 years	26	23.0
16-20 years	12	10.6
21-25 years	11	9.7
More than 25 years	8	7.1
Highest Qualification		
BS (Library Science)	9	8.0
MLIS	57	50.4
M.Phil.	42	37.2
Ph.D.	5	4.4
Which year did your library adopt PASTIC's Koha cloud computing?		
2018	8	7.1
2019	23	20.4
2020	22	19.5
2021	22	19.5
2022	34	30.1

Respondent's option to identify the Koha Modules that are functional in the Libraries after Adopting Koha Cloud Service by PASTIC:

The research indicates that nearly all respondents implemented cataloguing module as the most widely used module. Users were also utilizing the patron management and Koha administration modules, with circulation and advanced search features following closely behind. The respondent moderately utilizes modules such as reports and tools but less frequently uses others, such as lists, authorities, and acquisition. Serials management has the lowest adoption, suggesting variability in module usage based on library needs and priorities.

Table 2: Frequency Distribution of Koha Modules that Were Functional After Adopting Koha Cloud Service by PASTIC

Modules	Frequency	Percent
Cataloguing	104	92.0
Circulation	72	63.7
Acquisition	32	28.3
Reports	64	56.6
Tools	63	55.8
Koha Administration	77	68.1
Patrons	85	75.2
Serials	21	18.6
Advance Search	70	61.9
Lists	46	40.7
Authorities	39	34.5

Respondent's self-assessment of their current knowledge and skills in utilizing Koha Cloud Computing for cloud-based library services:

The result indicates that respondents generally possess a strong foundation in essential library technologies. High mean scores in areas such as barcode technology (4.16), RFID technology (4.13), and database management systems (4.09) reflect proficiency in key tools for modern library operations. Additionally, skills in using Koha modules, such as report generation (4.01) and circulation functions (3.93), show that respondents are well-equipped to manage digital library systems efficiently.

However, lower scores in knowledge of cloud-based applications (3.17) and skills for developing online public access catalogues (3.76) suggest some gaps in cloud technology and OPAC-related competencies.

These areas, along with the moderate variability in the responses, highlight opportunities for targeted training to enhance overall digital literacy and cloud-based skills. The data underscores a generally competent workforce with room for growth in specific technical areas.

The above results provide insight into the respondents' proficiency in various technological and Koha-related skills relevant to library management, with mean values representing the overall level of knowledge and standard deviations indicating variability.

The result reveals a generally high level of knowledge and skills across various domains related to library technologies. Respondents demonstrate the strongest expertise in barcode and RFID technologies, as well as in database management systems, with above-average ratings. Skills related to Koha modules, including circulation, report generation, and administration, also scored well, and indicating strong proficiency. The rating of computer literacy and cloud-based application knowledge was moderate, indicating potential areas for improvement. Overall, the findings suggest that, while foundational and advanced technological competencies are robust, there is still room to enhance knowledge in cloud-based applications and other specialized areas.

Table 3: Descriptive statistics of respondents to evaluate the current knowledge and skills of librarians in using Koha Cloud to develop cloud-based library services.

Variables	N	Mean	Std. Deviation
Computer literacy	113	3.71	.923
Knowledge of cloud-based applications and services	113	3.17	1.026
Knowledge of the Database Management System	113	4.09	.786
Knowledge of Barcode Technology	113	4.16	.819
Knowledge of RFID Technology	113	4.13	.818
Knowledge and skills to use MARC standard	113	3.91	.892
Knowledge & skills to develop Online Public Access Catalogue (OPAC)	113	3.76	.899
Knowledge and skill to use Koha Cataloguing module	113	3.79	.761
Knowledge and skill to use Koha Circulation functions	113	3.93	.810
Knowledge and skill to use Koha Reports generation module	113	4.01	.648
Knowledge and skill to use Koha Administration module	113	3.84	.841
Knowledge and skill to use Koha Multi-lingual interface facility	113	3.93	.853

Note: Very Poor =1, Below Average =2, Average =3, Above Average =4, Excellent =5

Results about the advantages of adopting Koha cloud computing for enhancing the library automation process:

The table presents the perceived advantages of Koha cloud computing among 113 respondents, focusing on various features and services. The mean scores, which range from 1 (strongly disagree) to 5 (strongly agree), reflect the overall agreement of respondents regarding these advantages. The following analysis interprets the results based on the mean and standard deviation values:

The result indicates moderate satisfaction with the advantages of Koha cloud computing services. Respondents rated technical support, email notifications, and the full features of Koha cloud computing as above average. Features like book reservations, smartphone OPAC usage, and self-renewal facilities received similar ratings, reflecting a positive but not overwhelming agreement. However, there was room for improvement. Basic and advanced search functionalities, along with Z39.50 support, garnered relatively lower satisfaction, suggesting areas for enhancement. Overall, respondents recognize the benefits, but certain aspects need further refinement.

In view of the above, users generally find Koha cloud computing services in libraries advantageous, especially in technical support and email notifications. While network connectivity and bandwidth are adequate, there's room for improvement. Users appreciate search options but have moderate satisfaction with tools like Z39.50. While self-renewal and smartphone access offer convenience, users believe they could benefit from further refinement. Koha's free service by PASTIC enhances accessibility and promotes broader library use.

Table 4: The descriptive statistics show the respondents' opinions about the advantages of Koha cloud computing, which PASTIC offers to automate libraries.

Advantages	N	Mean	Std. Deviation
Technical support for implementation of Koha cloud computing	113	3.57	1.179
Fast network connectivity and bandwidth	113	3.36	1.150
Availability of basic search/advance search options	113	3.20	1.103
Availability of Z39.50	113	3.15	1.241
Get email notification about borrowed books from Koha cloud	113	3.50	1.062
Use self-renewal facility of borrowed books through Koha cloud computing	113	3.22	1.155
Use of Koha cloud OPAC through smartphone	113	3.28	1.184
Reserve book through Koha cloud computing	113	3.35	1.034
Use of full features of Koha through Koha cloud computing	113	3.40	.969
Free availability of Koha cloud services by PASTIC	113	3.36	.846

Note: Strongly Disagree =1, Disagree =2, Undecided =3, Agree =4, Strongly Agree =5

Respondent's satisfaction in using Koha Cloud Computing services by PASTIC:

The results reflect a generally high level of satisfaction with various aspects of Koha cloud services. Users find the online Public Access Catalogue (OPAC) particularly easy to navigate, rating it the highest among features. Users also highly appreciate the book check-out and check-in functionalities, as well as the round-the-clock catalogue access. User login design, advanced search capabilities, and smartphone interface use receive strong positive feedback, indicating satisfaction with usability and convenience. However, satisfaction with the auto-email alert service and book reservation features is comparatively lower, suggesting these areas may benefit from enhancements. Overall, the findings highlight strong user satisfaction with Koha cloud services, with some room for improvement in specific functionalities.

The Koha cloud computing services in libraries have a generally positive user experience, with users finding the interface friendly and efficient. However, there are areas for improvement, particularly in automated notifications and book reservations. Overall, users find the system well-received for its ease of use and accessibility, but addressing these issues could lead to even higher levels of satisfaction.

Table 5: Descriptive Statistics of Respondents the "opinion about the satisfaction with the services of Koha cloud computing service offered by PASTIC"

Satisfaction level	N	Mean	Std. Deviation
Satisfaction with use to access facility of Koha cloud catalog is available round-the-clock.	113	3.90	.906
Satisfaction with use of book check-out (issue) system of Koha is user-friendly	113	3.96	.778
Satisfaction with use of book check-in (return) system of Koha is excellent	113	3.91	.797
Satisfaction with use the online Public Access Catalog (OPAC) of Koha is easy to understand and navigate	113	4.19	.666
Satisfaction with use the user login facility of Koha user interface is attractive	113	3.94	.735
Satisfaction with library usages statistics through Koha user interface	113	3.82	.804
Satisfaction with use the advanced search of Koha cloud	113	3.95	.705
Satisfaction with auto email alert service of Koha cloud	113	3.53	.877
Satisfaction with online interface of Koha cloud from Smartphone	113	3.88	.843
Satisfaction with use the reservation of book through Koha cloud	113	3.64	.814

Note: Highly Dissatisfied =1, Dissatisfied =2, No Opinion =3, Satisfied =4, Highly Satisfied =5

Analysis of Results Related to the Research Hypotheses:

Below is a detailed breakdown of the research hypotheses' outcomes:

Hypotheses:

H1: There is a significant difference in the skills level of librarians in using Koha Cloud Computing based on their professional experience:

- **Accepted Hypotheses**:

Only "Knowledge of cloud-based applications and services" has a p-value of 0.008, indicating a significant difference in knowledge levels based on years of experience. Hence, the hypothesis was accepted.

- **Rejected Hypotheses**:

All other variables (e.g., "Computer literacy," "Knowledge of the Database Management System," "Knowledge of RFID Technology," etc.) have p-values greater than 0.05, indicating no significant difference based on experience level of the respondents. Thus, differences in most areas, except cloud-based applications, are not statistically significant.

Table 6: Skills level of librarians in using Koha Cloud Computing based on their professional experience.

Statement		Mean	F	Sig.
Computer literacy	1–5 years	3.69	1.072	.380
	6–10 years	3.58		
	11-15 years	3.96		
	16-20 years	3.92		
	21-25 years	3.55		
	more than 25 years	3.25		
	Total	3.71		
Knowledge of cloud-based applications and services	1–5 years	3.03	3.294	.008
	6–10 years	3.00		
	11-15 years	3.54		
	16-20 years	3.75		
	21-25 years	3.09		
	more than 25 years	2.25		
	Total	3.17		
Knowledge of the Database Management System	1–5 years	4.22	1.494	.198
	6–10 years	4.00		
	11-15 years	4.19		
	16-20 years	3.92		
	21-25 years	4.27		
	more than 25 years	3.50		
	Total	4.09		
Knowledge of Barcode Technology	1–5 years	4.31	.943	.456
	6–10 years	4.21		
	11-15 years	4.04		
	16-20 years	4.33		
	21-25 years	4.00		
	more than 25 years	3.75		
	Total	4.16		
Knowledge of RFID Technology	1–5 years	4.28	.329	.894
	6–10 years	4.08		
	11-15 years	4.12		
	16-20 years	4.08		
	21-25 years	4.00		
	more than 25 years	4.00		
	Total	4.13		
Knowledge and skills to use MARC standard	1–5 years	4.16	1.503	.195
	6–10 years	3.96		
	11-15 years	3.81		
	16-20 years	3.92		
	21-25 years	3.82		
	more than 25 years	3.25		
	Total	3.91		
Knowledge & skills to develop Online Public Access Catalogue (OPAC)	1–5 years	3.78	.693	.630
	6–10 years	3.75		
	11-15 years	3.81		
	16-20 years	3.58		
	21-25 years	4.09		

	more than 25 years	3.38		
	Total	3.76		
Knowledge and skill to use Koha Cataloguing module	1–5 years	3.72	.100	.992
	6–10 years	3.83		
	11-15 years	3.81		
	16-20 years	3.75		
	21-25 years	3.82		
	more than 25 years	3.88		
	Total	3.79		
Knowledge and skill to use Koha Circulation functions	1–5 years	4.09	.465	.802
	6–10 years	3.79		
	11-15 years	3.88		
	16-20 years	3.83		
	21-25 years	4.00		
	more than 25 years	3.88		
	Total	3.93		
Knowledge and skill to use Koha Reports generation module	1–5 years	4.19	.999	.422
	6–10 years	3.96		
	11-15 years	3.88		
	16-20 years	4.00		
	21-25 years	4.09		
	more than 25 years	3.75		
	Total	4.01		
Knowledge and skill to use Koha Administration module	1–5 years	4.00	.548	.740
	6–10 years	3.75		
	11-15 years	3.73		
	16-20 years	3.67		
	21-25 years	4.00		
	more than 25 years	3.88		
	Total	3.84		
Knowledge and skill to use Koha Multi-lingual interface facility	1–5 years	3.97	.080	.995
	6–10 years	3.88		
	11-15 years	3.96		
	16-20 years	3.83		
	21-25 years	3.91		
	more than 25 years	4.00		
	Total	3.93		

H2: There is a significant difference in the skills level of librarians in using Koha Cloud Computing based on their gender:

This data compares male and female respondents' competencies across various technology-related skills, with T-values and significance (p-values) indicating statistical differences:

Based on a significance threshold of $p<0.05$, only the variable **"Knowledge of cloud-based applications and services"** (Sig. = 0.044) shows a statistically significant difference between male and female respondents, thus accepting the hypothesis for this variable. All other variables show no significant difference ($p > 0.05$) between genders, leading to the rejection of their respective hypotheses.

Table 7: Skills level of Librarians in using Koha Cloud Computing based on their gender.

Statements	Mean		T-value	
	Female	Male	(Equal Variance Assumed)	Sig. (2- tailed)
Computer literacy	3.44	3.76	-1.326	.188
Knowledge of cloud-based applications and services	2.72	3.25	-2.040	.044
Knowledge of the Database Management System	4.28	4.05	1.116	.267
Knowledge of Barcode Technology	4.33	4.13	.983	.328
Knowledge of RFID Technology	4.28	4.11	.819	.415
Knowledge and skills to use MARC standard	4.06	3.88	.746	.457
Knowledge & skills to develop Online Public Access Catalogue (OPAC)	3.89	3.74	.656	.513
Knowledge and skill to use Koha Cataloguing module	3.78	3.79	-.060	.953
Knowledge and skill to use Koha Circulation functions	4.11	3.89	1.040	.301
Knowledge and skill to use Koha Reports generation module	4.11	3.99	.729	.468
Knowledge and skill to use Koha Administration module	3.89	3.83	.264	.792
Knowledge and skill to use Koha Multi-lingual interface facility	3.94	3.93	.082	.935

H3: There is a significant difference in the satisfaction level of libraries in using Koha Cloud Computing based on their professional experience.

This data analyzes the relationship between qualifications and knowledge/skill in various library-related competencies. Here's a brief interpretation:

With a significance level of $p<0.05$, **"Knowledge of cloud-based applications and services"** (Sig. = 0.013) shows a statistically significant difference among educational qualifications, thereby accepting the hypothesis for this variable. All other variables do not show significant differences across educational levels ($p > 0.05$), resulting in the rejection of their respective hypotheses.

Table 8: Satisfaction level of librarians in using Koha Cloud Computing based on their professional experience.

Statement		Mean	F	Sig.
Computer literacy	BS (Library Science)	3.22	1.670	.178
	MLIS	3.65		
	M.Phil.	3.83		
	Ph.D.	4.20		
	Total	3.71		
Knowledge of cloud-based applications and services	BS (Library Science)	2.67	3.780	.013
	MLIS	3.00		
	M.Phil.	3.38		
	Ph.D.	4.20		
	Total	3.17		
Knowledge of the Database Management System	BS (Library Science)	4.22	2.245	.087
	MLIS	3.91		
	M.Phil.	4.31		
	Ph.D.	4.00		
	Total	4.09		
Knowledge of Barcode Technology	BS (Library Science)	4.33	.561	.642
	MLIS	4.07		
	M.Phil.	4.21		
	Ph.D.	4.40		
	Total	4.16		
Knowledge of RFID Technology	BS (Library Science)	4.33	1.361	.259
	MLIS	3.98		
	M.Phil.	4.26		
	Ph.D.	4.40		
	Total	4.13		
Knowledge and skills to use MARC standard	BS (Library Science)	4.00	.995	.398
	MLIS	3.77		
	M.Phil.	4.05		
	Ph.D.	4.20		
	Total	3.91		
Knowledge & skills to develop Online Public Access Catalogue (OPAC)	BS (Library Science)	3.89	1.966	.123
	MLIS	3.56		
	M.Phil.	3.98		
	Ph.D.	4.00		
	Total	3.76		
Knowledge and skill to use Koha Cataloguing module	BS (Library Science)	4.00	1.356	.260
	MLIS	3.65		
	M.Phil.	3.93		
	Ph.D.	3.80		
	Total	3.79		
Knowledge and skill to use Koha Circulation functions	BS (Library Science)	4.33	1.430	.238
	MLIS	3.81		
	M.Phil.	3.98		
	Ph.D.	4.20		
	Total	3.93		

Knowledge and skill to use Koha Reports generation module	BS (Library Science)	4.22	.997	.397
	MLIS	3.91		
	M.Phil.	4.10		
	Ph.D.	4.00		
	Total	4.01		
Knowledge and skill to use Koha Administration module	BS (Library Science)	4.00	1.134	.339
	MLIS	3.75		
	M.Phil.	3.98		
	Ph.D.	3.40		
	Total	3.84		
Knowledge and skill to use Koha Multi-lingual interface facility	BS (Library Science)	4.33	1.920	.131
	MLIS	3.75		
	M.Phil.	4.07		
	Ph.D.	4.00		
	Total	3.93		

Conclusion:

The majority of librarians demonstrated advanced proficiency in critical areas of knowledge and abilities, including computer literacy, database management systems, barcode and RFID technology, and the MARC standard.

The majority of librarians have shown exceptional competency in the development and utilization of Online Public Access Catalogues (OPAC), along with experience in Koha cataloguing, circulation, report production, administration, and multilingual interface modules.

Library modules predominantly focus on cataloguing and circulation, with core operations like circulation, patron management, and administrative modules widely used. Advanced search functions and reporting tools enhance the user experience. Acquisition and serials management modules are less frequently implemented, possibly due to different practices or budget constraints.

The majority of librarian's reflects overall high satisfaction with Koha Cloud's accessibility, ease of navigation in OPAC, and user-friendly check-out and check-in systems. Users are less satisfied with features like the auto email alert and book reservation functionalities, suggesting areas for potential improvement.

The majority of librarians greatly recommend Koha Cloud's capacity to receive email notifications about borrowed books from the cloud.

The advancement of Koha cloud computing necessitates the improvement of network connectivity and bandwidth, search functionalities, accessibility of the Z39.50 protocol, a self-renewal feature for borrowed materials, optimization of the Koha cloud OPAC for smartphones, and enhanced efficiency in book reservations.

Recommendations:

The following recommendations are made for the practical use of the findings.

1. It is recommended that Pakistani library schools and library associations should provide comprehensive training sessions to enhance knowledge and expertise in cloud-based applications and services.
2. It is recommended that experienced Koha specialists should offer the trainings for librarians regarding use of Koha cloud computing.
3. To ensure the effective implementation of all Koha cloud computing modules, librarians should receive training and support.

PASTIC should address the network difficulties caused by the big data volumes or restricted bandwidth.

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