

STAFF DEVELOPMENT FOR RESEARCH DATA MANAGEMENT SERVICES IN UNIVERSITY LIBRARIES OF PAKISTAN: HEAD LIBRARIANS' PERCEPTIONS

Haseeb Ahmad Piracha¹, Mir Bahader^{*2}, Kanwal Ameen³, Rahim Jan⁴, Haleema Bibi⁵

¹Department of Information Management, The University of Lahore, Lahore, Pakistan,

²Department of Information Management, The University of Lahore, Lahore, Pakistan,

³Government College Women University Faisalabad, Punjab, Pakistan

⁴Department of Library and Information Science, Khushal Khan Khattak University of Karak, KPK

⁵Local Government Rural Development Department, Abbottabad, KPK

¹chief.librarian@library.uol.edu.pk, ^{*2}mir.bahader@doim.uol.edu.pk

DOI: <https://doi.org/10.5281/zenodo.23232062>

Keywords

Research Data Management; Professional Development; Skills and Competencies for RDM; Head Librarians; University Libraries; Pakistan.

Article History

Received: 29 June 2026

Accepted: 20 September 2026

Published: 08 October 2026

Copyright @Author

Corresponding Author: *
Mir Bahader

Abstract

The present study aims to determine the perceptions of head librarians regarding the knowledge, skills, and competencies essential for providing Research Data Management (RDM) services to university research communities. Mixed method research approach was applied in this study based on the questionnaire and interview. The data were collected from librarians of the high-ranking universities/ degree awarding institutions in Pakistan recognized by Higher Education Commission (HEC). Statistical strategies were used to analyze quantitative data and followed qualitative data using thematic analysis with simple frequencies and selected excerpts from the interviewees. The findings reveal that the respondents needed to improve in terms of data curation, data security, the quality of backup and recovery, and support for storage and preservation. Furthermore, informatics professionals and librarians need to understand the contemporary and requirements of the scholarly world and to learn the required skills for effective delivery of RDM services. This study highlights the need for professional development for research data management, informing policy, training programs, and capacity building in university libraries, and supporting effective RDM services for academic research communities.

Introduction

The issue of research data management (RDM) has lately attracted research scholars, data scientists, and library professionals all over the world. University of Leicester (2018) expressed that RDM is about the organization of data, from its emergence to the completion of the research cycle. It is defined by Cox and Verbaan (2028) as “a process of creating, finding, organizing, storing, and sharing preserving data in any types of research”. This process aims to ensure the reliable conforming of results, permits new and innovative research built on existing

information, and may help in the dissemination and archiving of valuable results. University libraries in the USA, Britain, Australia, and other countries are getting increasingly involved in research data management services (Liu & Ding, 2016).

The Digital Curation Centre and Research Libraries in the UK highlighted the necessary skills for RDM professionals in 2015. They emphasized that metadata knowledge, data curation and retention, copyright issues, and designing RDM services are essential to support

RDM projects and services. Additionally, training for research scholars and library staff is necessary, in collaboration with other departments such as IT and administration. A study conducted by Faten et al., (2019) found that staff in academic libraries in Jordan considered a data repository as an integral part of a library infrastructure to support researchers. Therefore, information professionals, especially those working in higher education, need to develop these skills to offer RDM services effectively.

The university libraries in Pakistan also ought to increase the portfolio of their services to meet the scholarly needs of their clients under the prospering research out in Pakistan HEC (2020). A large amount of research data has been produced over the years. However, there is hardly any information available about the ways these research data are kept and curated by the research scholars. Piracha and Ameen (2018) revealed the issues researchers face with RDM and findings reported that the respondents need assistance regarding storage and security of data, improving the quality of backup, and support for storage and preservation. They also agreed with the need for a central repository for the University. Also reported by Piracha and Ameen (2019) are the major challenges in implementing RDM in universities include a lack of willingness and coordination with researchers, a shortage of skilled professionals and support staff, and in some cases, poor infrastructure, and networking.

Against this background, the present study aimed to investigate what type of skills and knowledge are required in the context of a developing country like Pakistan. Furthermore, the research aimed to determine the gaps in initiating suitable RDM services for research scholars.

Literature Review

The literature establishes that the role of a library in managing research data is important and there is a need for repositioning library activities concerning research support. The need to learn the related skills and knowledge is also evident to be able to offer these services. Henderson (2015) stated that librarians could learn from the RDM community to build foundations for RDM services in their organization's setup. Verbakel and Grootveld (2016) reported that "Research Data Netherlands" has trained approximately 170 data supporters who were working in various academic libraries, IT departments, and medical centers in the country who are playing an essential role in RDM advocacy and support now.

SCONUL (2015) recommended that the librarians involved in RDM services must have the skills and attributes such as research data cycle and the stages associated with it; RDM planning, curation, and preservation; open access and data sharing; advocacy, negotiation with researchers and other professional workers; and guidance and training to support. Pryor and Donnelly (2009) visualized the core four roles in data management (Fig. 1).

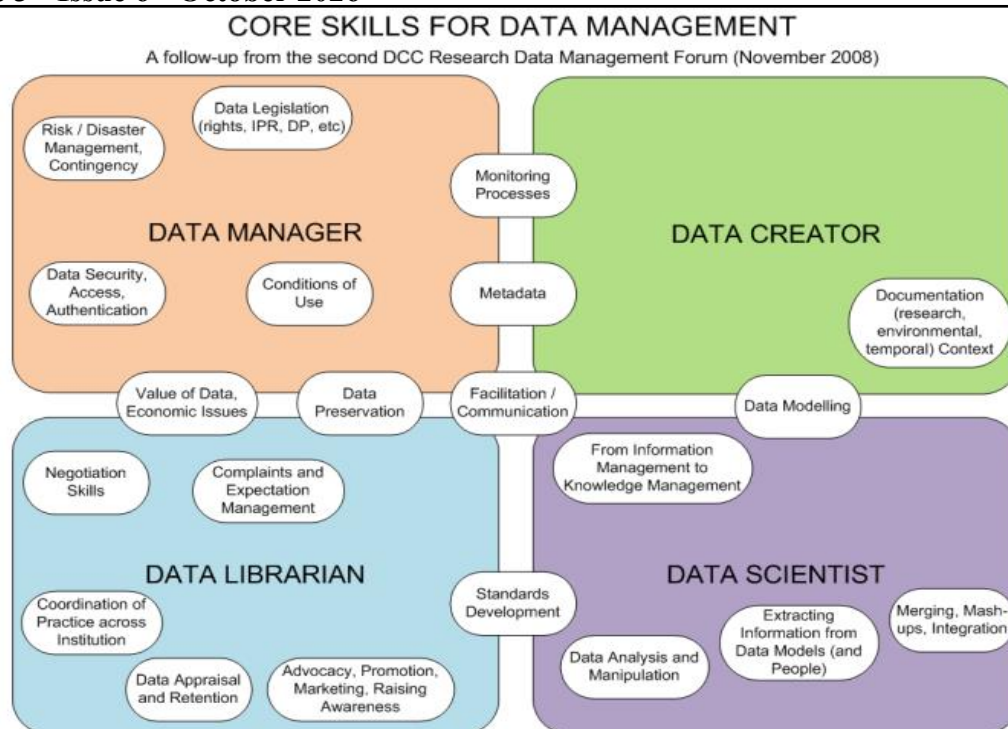


Figure 1. Core Skills for Data Management (Pryor & Donnelly 2009)

The roles depend on the personal profile, their interest, the policy of a library, and the openness of researchers and scientists. Many skills were native to librarians and could be taught as part of basic research training and skills. In addition, the author suggested that there were three following areas in which librarians could play their role in RDM: 1) Training of researchers to be more proactive in data management. 2) Data archiving

and preservation and 3) Training and skills for data librarians.

They further depicted (Figure 2) the training opportunities for data professionals in the UK adding that an alternative solution would be to integrate RDM within postgraduate training programs whether included in the curriculum run by graduate schools. The other solution was via training and development programs.

TRAINING OPPORTUNITIES FOR DATA PROFESSIONALS: THE CURRENT UK LANDSCAPE

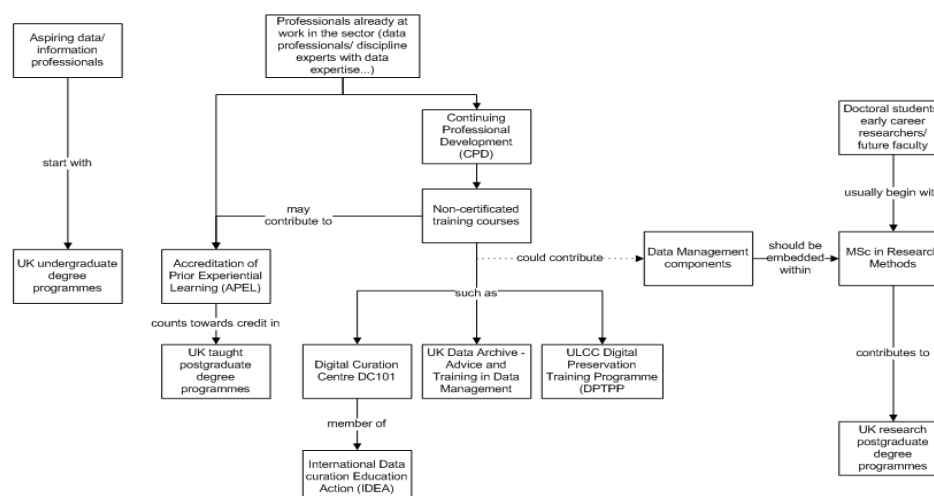


Figure 2. Training Opportunities for Data Professionals

Oliver and Harvey (2016) pleaded that first, a sustainable organizational structure would be required for effective RDM and curation services, followed by the technical infrastructure for a long-term data storage facility to provide continued maintenance and security for the objects digitally stored. The "Association of College and Research Libraries USA" (2018) prepared various modules for the professional development of librarians regarding RDM including scholarly communication, engagement of the campus community (faculty members), data management instruction techniques, creating action plans for individuals, and discussing future activities for liaisons.

Corrall, Kennan and Afzal (2013) established that there were knowledge and skills gaps as well as a lack of confidence among library staff regarding both RDM and bibliometrics practices. Other competencies were needed such as understanding of the research environment at macro and micro levels, national policy and local goals, and end-to-end understanding of academic and research processes and RDM should be a core part of the LIS curriculum. Kennan (2016) found that the most common set of skills required for RDM were interpersonal skills, understanding of data types, metadata, legal frameworks, advocacy skills, and knowledge of information technologies. Brown, Wolski and Richardson (2015) shared their own experiences, transitioning from a traditional academic librarian to a data librarian. Matlatse (2016) found that the RDM workshop was highly successful in enhancing the perception of and knowledge of RDM, but it was less successful in enhancing the RDM technical skills among library professionals.

Reichmann et al (2021) noted that there was a huge variation between faculties and institutes regarding data amounts, the complexity of data sets, data collection analysis, and archiving. Data sharing practices were inconsistent and RDM was regarded as an administrative task.

Amnanullah (2023) RDM services provided in Malaysian academic libraries were related to basic skills of bibliographic management tools, and institutional repositories rather than to support RDM activities such as data curation, data citation, and data mining services. Although the librarians were aware of RDM and their roles in

research but still RDM services were not offered in a desired manner. The findings of Bahader (2022) indicate that the adoption of CRM services in university libraries in Pakistan is hindered by several key barriers, including limited financial resources, a shortage of qualified and well-trained staff, low levels of staff satisfaction and motivation, inadequate information technology infrastructure, insufficient understanding of CRM among library personnel, weak organizational culture and collaboration, challenges related to library users, and a lack of strong leadership commitment. Rafiq and Ameen (2022) assessed academicians and researcher's attitude, behavior and sharing pattern towards RDM in Pakistani Universities and explored the phenomenon from a developing country's perspective where there were no research data management policies at national and institutional level. The findings revealed some theoretical implications for researchers and practical implications for policymakers of university administrators, librarians, and educationists.

The practices of RDM ensure that research output is clear, findable, and reproducible. The researchers have highlighted the skills, competencies, and roles of library professionals required for RDM. These include training, collaboration with other professionals, leadership, and policy formulation. The academic librarian's involvement is a prerequisite for RDM. RDM requires an extensive range of skills and competencies, extending from interpersonal relationships to technical knowledge, and metadata creation. The studies have acknowledged the training needs of library professionals and that library professionals must be proactive in learning about RDM through every possible media. The literature review established gaps on the subject in the context of RDM services by libraries, specifically in the context of developing countries, where scarcity was found. The study takes Pakistan as a reference assuming that the conditions are similar in this part of the world and it will fill some gap in the literature.

2.1 Literature Gap

Although research data management (RDM) has become an essential component of modern

academic library services, especially in supporting data-intensive research, most studies have primarily focused on technical infrastructure, policies, and general librarian competencies, rather than the specific role of staff development from the perspective of top library leadership such as head librarians. Existing literature shows that university libraries face significant challenges in RDM implementation, including lack of skilled staff, inadequate training opportunities, and limited institutional support (Piracha & Ameen, 2019). Previous studies also emphasize that librarians require continuous capacity building, technical training, and professional development to effectively manage research data services (Sheikh et al., 2025). However, most of these studies are either quantitative surveys of library staff or general reviews of RDM services, with limited attention to how head librarians—who are key decision-makers—perceive staff development needs, training priorities, and institutional readiness for RDM implementation. Furthermore, while some research highlights global trends in RDM staff skill gaps and training needs, there is a noticeable lack of empirical evidence from developing countries, particularly in Pakistan and similar contexts, regarding how leadership in academic libraries views staff development strategies for RDM implementation. Studies indicate that in many developing regions, RDM services are still emerging and are constrained by limited expertise, weak infrastructure, and insufficient professional training programs (Sheikh et al., 2025).

2.2 Objectives and Research Questions

The main objectives of the study were to assess the perceptions of head librarians about the required skills and competencies for RDM, and the challenges faced by the university libraries in offering these services. The following research questions were developed to meet the study objectives.

1. What kinds of skills and competencies are required for library staff to initiate RDM setup?
2. What are the major issues and challenges they face related to staff development regarding RDM

3. Research Methodology

This study is based on an explanatory sequential mixed-method design. During the first phase, the quantitative data was collected through a questionnaire and was analyzed using descriptive statistics. The same techniques were applied in the library and information sciences studies (Bahader et al., 2024; Bahader, 2023; Bahader et al., 2021; Bahader et al., 2020). It was followed by the second phase of collecting qualitative data using an interview guide based on the literature review and gaps identified because of quantitative data analysis.

The sample of the study was HEC high-ranking university libraries of Pakistan. The decision to purposively pick high-ranking universities as samples was made on the notion that the idea of RDM is relatively new and only the library heads of high-ranking universities might be able to provide some meaningful content. The HEC's declared 30 high-ranking universities of the year 2016 (10 in the general category and 5 from each special category such as agriculture, business, medical, and engineering) were identified. However, seven were excluded because of being placed in both the categories of subject and general. An interview guide having 11 key themes was developed to collect qualitative data through in-depth semi-structured interviews of the library heads conducted either in their offices or by telephone calls from other cities, after meeting ethical formalities. The interviews were transcribed, and analyses were made manually after devising codes and themes. The qualitative findings have been reported using thematic analysis with simple frequencies and selected excerpts of the interviewees.

4. Results and Discussions

4.1 Required Infrastructure

During the QUAL strand, this interview question was divided into two parts: the required infrastructure for RDM. The status of infrastructure in the responding libraries is shown in table 1. Six of the interviewees claimed having a good infrastructure that might support RDM services. However, huge funds were required in case of having branded software to manage research data, with its long-term backup and retrieval system. The other four interviewees thought that they had an IT department that

provided them with all the facilities. The respondents indicated that at the initial stage of research data management, they could use open-source software such as *Dspace* or *Imprint*, which several world-renowned universities were using to store their research data. Four of the interviewees stated that infrastructure does not mean only hardware and software; there were problems with weak internet, and networking infrastructure as well. All these problems must be addressed

before launching RDM services. A library head of a medical university said that various open-source software was in use, but we still need to train our staff. Several scanners are required to convert print research data into digital form. All the universities involved in this study are HEC high ranking since there was not a big gap in infrastructure such as fast internet, state of art computers, and big IT labs. However, in some cases, these facilities were lacking.

Table 1: Infrastructure (n=15)

Themes	Freq.
IT department supervise library infrastructure	4
Infrastructure was available	6
Funds required for branded software	8
Usage of Dspace or Imprint	4
Insufficient infrastructure	4
Software and internet facility required	4

4.2 ICT Skills Personal

Skilled human resources were required to run an effective RDM and curation service. Table 2 presents a summary of their opinions. Most of the interviewees thought that the non-availability of IT literate, skillful and trained professionals, as well as the support staff was the main challenge for not initiating RDM services. They further added that librarians having data related IT skills should be hired in libraries to initiate RDM services. The respondents also felt that they should train their library professionals to develop skills such as planning, selecting, analyzing, preserving, backup, and dissemination of research data. The other option was to establish a separate section for RDM in libraries. The other three stated that their top problem was the lack of competent staff in both in professional and support categories. One respondent replied that they had just advertised a situation of data

librarian to control research data of their university. Some interviewees mentioned that IT professionals should work under the librarian if they were engaged in research data handling projects. A library head presented his views stating, "There should be a team of skillful professionals having extensive knowledge of managing research data. They should not only train researchers but also library professionals. They must provide research data understanding and tools to select and preserve it". A working group of the Association of European Research Libraries (LIBER, 2012) proposed that libraries should assist faculty in integrating data management into the curriculum of students. Furthermore, it was recommended that re-skilling of librarians was very important because information professionals must be prepared for new roles to support as only a few libraries may hire new specialized staff RDM.

Table 2: Staffing (n=15)

Themes	Freq.
The main issue is of unskilled staff	14
Advertised the position of the data librarian	1
A separate unit in library should supervise RDM	4

SCONUL (2015) proposed that the librarians involved in RDM, and curation services should have skills that include: knowledge of the

research cycle, data management planning, knowledge of preservation, know-how of open access software, advocacy, relations with

researchers, ready-to-perform responsibility of guidance and training to researchers and knowledge of data monitoring and sharing.

Tenopir et al. (2013), along the same lines, reported that 75% libraries of USA and Canada have library staff with the requisite skills and training to provide RDM services. However, they did not provide RDS services though they had the skills to provide the same. Some managerial skills gaps were also identified. The present authors have not found any library where IT experts are working under librarians, whereas there are many projects in the libraries that cannot be run without the help of IT experts. In the QUAN strand respondents were asked about the capacity and capability of their staff

development and its development in this regard. They were also asked to talk about their planning regarding managing human resources to offer such services. Figure 1 shows that only 1 respondent had hired staff for research data services. Five library heads stated that they would re-assign existing staff to the duties of RDM services. Three of the respondents replied that they were planning to hire staff while 2 were going to reassign RDM duties to the existing staff. Six felt that it did not apply to them. It may be interpreted that they were not even thinking of these services. The findings reveal a poor state of the availability of competent enough staff to offer RDM and curation services.

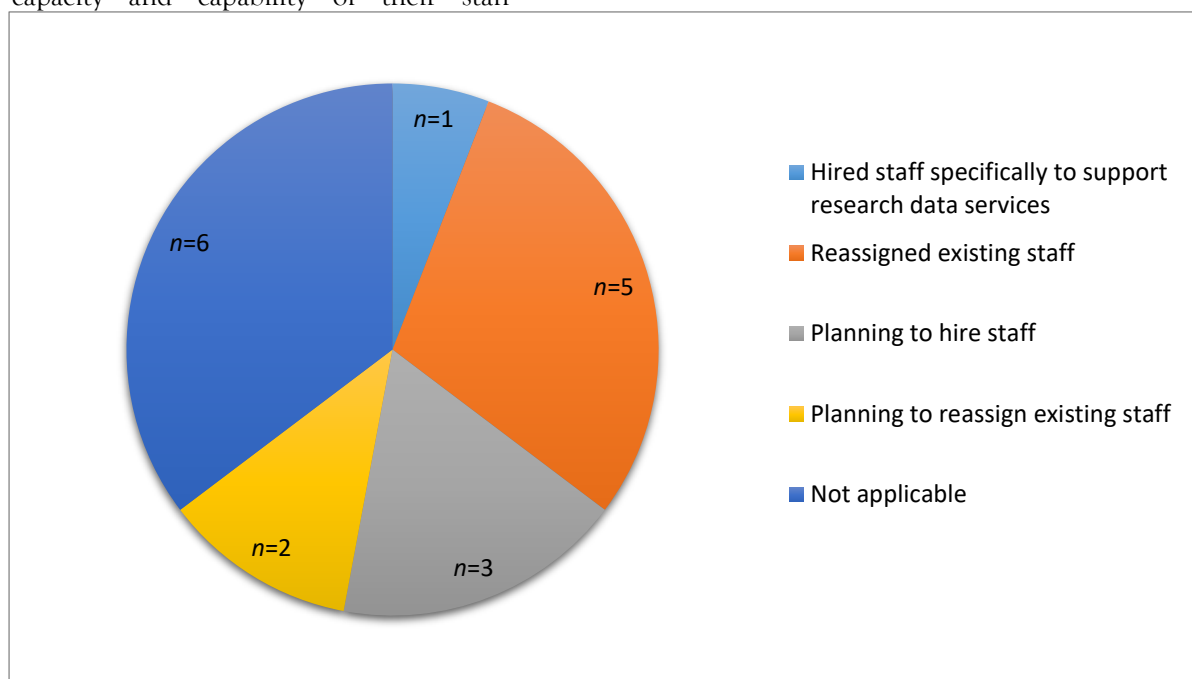


Figure 1: Development of Staff Competencies for RDM Services

4.3 Development of Additional Knowledge and Skills for Library Staff

The respondents were further asked about additional skills and knowledge required for their staff to run a smooth RDM service in their university. Figure 2 reveals that 12 library heads indicated that their staff needed additional knowledge about data curation skills, while 12 indicated that their staff needed legal, policy, and advisory skills, intellectual property, and ethics.

Ten respondents pointed out the skills related to data storage, infrastructure, and architecture, while 11 reported their professional staff needed assistance in different research methods, data analysis, knowledge of the research life cycle, a variety of research methods. The quantitative results showed that most library professionals were not familiar with the technical aspects of RDM and required almost all additional knowledge and skills in this regard.

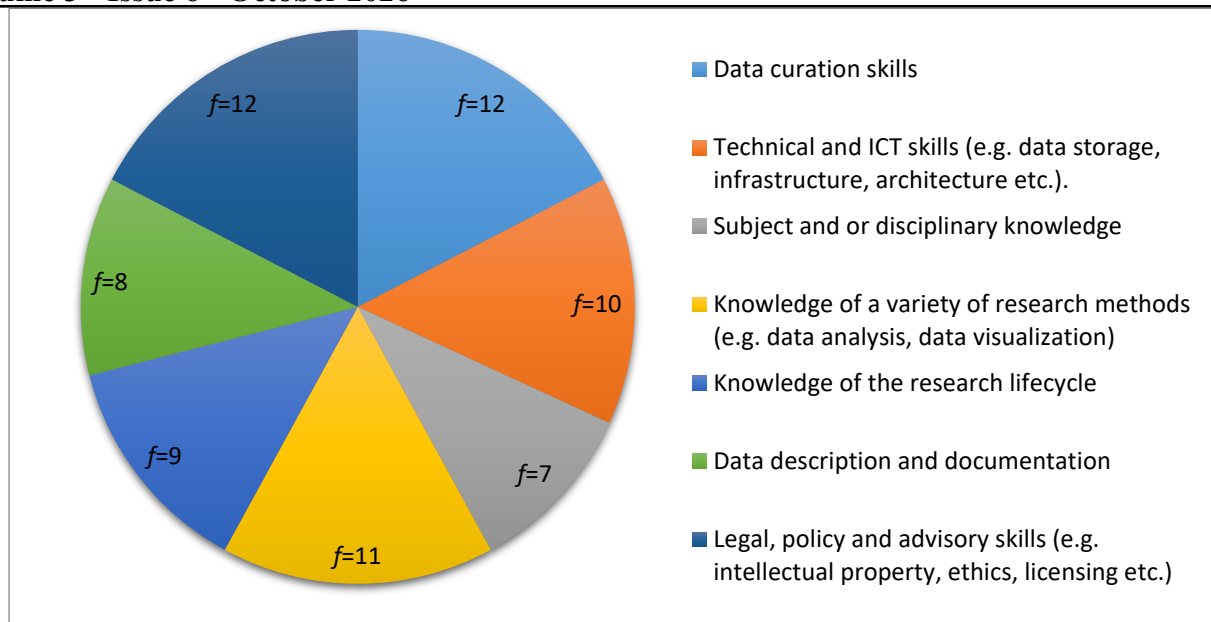


Figure 2: Additional Knowledge or Skills Required by Library Staff

4.4 Staff Development Opportunities and Collaboration with Organizations

They were also enquired about the opportunities available for their staff development and to enhance their knowledge of research data services by providing multiple statements to respond. Figure 3 reports that respondents mainly demand staff workshops presentations and in house learning for staff development related to RDM services. In addition, followed by the opportunities for staff to attend conferences or workshops on research data management related to RDM services. THERE is no mention

of self-learning. Eight respondents replied that they would be provided a chance for in-house learning. The results indicated that library professionals had hardly any opportunities for staff development programs, and they were rather dependent upon self-learning. Only one library head who had better comparative knowledge about RDM recommended that first, we must collaborate with an international organization involved in RDM activities, so we may train our staff or get close insight into how they work and provide service to their users.

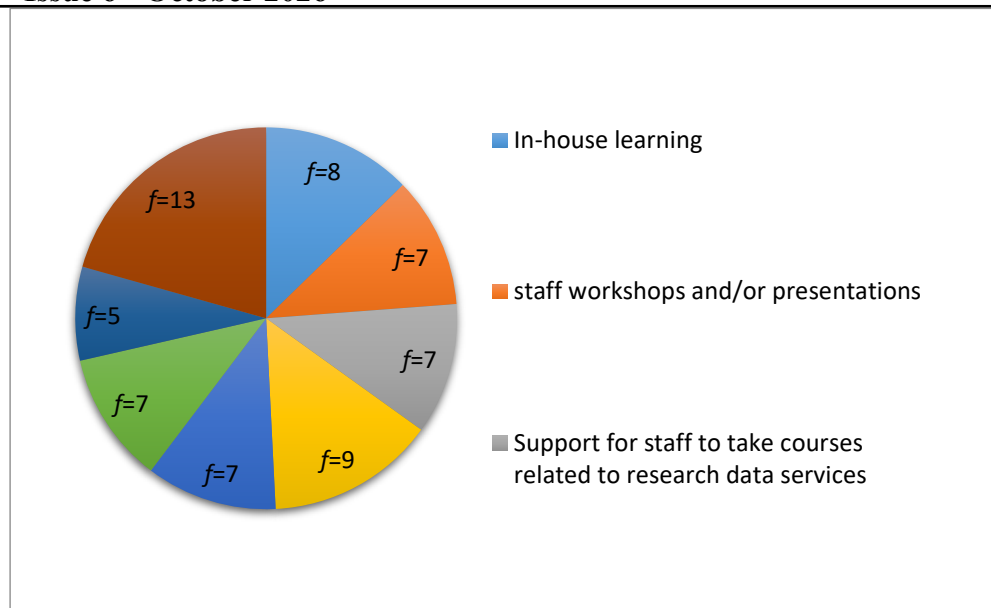


Figure 3: Staff Development Opportunities

4.5 Issues and Challenges Regarding Staff Development

The following section presents the analysis of findings (N=15) according to the frequency of the themes' occurrences in a table followed by its analysis, interpretations, and discussion. The quotations from the interview extracts have been included to enrich the interpretation. An objective of the study was to find out the issues and challenges affecting RDM practices in depth by dividing them into three subheadings: (i) Human Resource (ii) Financial Resources, and (iii) Infrastructure. The relevant pointers were added to the interview guide. The content analysis revealed that several issues and challenges affected RDM services in university libraries of Pakistan including managerial, financial, technical, social, and cultural.

4.5.1 Human Resources

Most of the respondents shared that the lack of technical skills in library staff was the primary issue linked with RDM services with a lack of vision and motivation. Librarians who were involved to some extent in such activities were not appreciated by their universities. There was a lack of dedication to initiate new activities such as RDM and curation services. Interviewees (n=6) described that availability of the competent human resources is the biggest challenge in this regard. We cannot afford to hire trained professionals and must train existing staff. This

strategy also required training opportunities and financial resources. Others stated that there was a not only need for skillful, professional, and proactive staff that would develop our own supporting staff but also guide researchers in curing research data. One interviewee emphasized on developing our support staff as well. Semeler (2019) pointed out that data librarians should know the complexity and novelty associated with RDM. A data librarian need not to become a programmer but should learn programming logic of computers, databases and IR tools. There are numerous opportunities for data librarian to engage with data science. Sinha (2023) stated that major types of RDM services in South Asian and Southeast Asian region provided were data repository, data management training, web resources maintaining, study and analysis of data and reusable data services. However, little attention was provided to RDM advisory services and most respondents agreed that training required in data management planning skills and metadata standards. Cox and Corral (2013) recommended that library professionals who intend to perform RDM services need competencies such as database designing, content management, data mining, and personal, interpersonal, and managerial abilities. Respondents (4) argued that librarians lack managerial and leadership traits resulting in poor

relations with the higher administration, as well as researchers' community. According to them, there is a need to address this issue by providing opportunities for managerial and leadership training to the library heads. The respondents also pointed out that the university administration did not take much interest in such activities. However, the researcher was of the view that if librarians are proactive and the demands are justified, then naturally the administration would come forward for help.

4.5.2 Financial Aspects

Providing RDM services is a costly process and requires a significant amount of funds for infrastructure such as a strong network system, internet facilities, servers, and hardware and software structure. The respondents were encouraged to talk about their issues and challenges regarding financial resources. Most of them (n=10) considered that they required huge funding to offer research data management services in their respective library setup. One respondent replied that our first issue is infrastructure, hard drive equipment for storage and retrieval requires huge finance. The other (n= 4) interviewees did not share the problem of funds. They had a strong IT department behind them and could take care of any kind of data preservation. Most of the interviewees mentioned that they faced financial constraints and were not able to start new projects such as digitization of archival material and research data management.

4.5.3 Infrastructure

The technological infrastructure recommended for controlling research data depends on the data in hand. The responding universities can be divided into two groups: public sector and private. The technological infrastructure of private universities was reported better and upgraded as compared to public sector universities. Most of the libraries were using open-source software to handle their collections and repositories. They did not have powerful hardware and software infrastructure. The analysis reveals that overall libraries were not prepared to initiate RDM activities and their preparedness concerning all three parameters

related to staff availability, infrastructure, and financial resources.

Conclusion, Implications, and Limitations

The study concludes that administrative concerns hinder to initiate services such as RDM. Even the university libraries which were well equipped with state-of-the-art computers and high-speed internet facilities were not engaged in providing RDM services to their users. There was a lack of awareness, willingness, and planning among library heads regarding RDM services, and support staff having adequate knowledge of computer skills. The findings further reveal that the library heads were concerned about IT infrastructure and proper RDM software. There was a need for assistance regarding storage and security of data and there was also a strong response indicating that library heads require adequate funding to run RDM projects.

We propose that certain data-specific knowledge and skills mentioned in the study may be incorporated into the LIS and Information Management curricula while developing also faculty on the subject. There should be continuing professional development of librarians regarding RDM. This study opens new horizons in the field of RDM skills and other knowledge for library professionals to handle day-to-day activities of research data management. Moreover, the study will be helpful for university administration to recognize the need for creating a data management policy.

It appeared that, in the context of a developing country like Pakistan, the subject of RDM was too advanced to have insights of the library professionals as most of them were not well-versed on the subject. Hence, their opinions might lack the necessary understanding of the practices of RDM in the context of a developing country like Pakistan.

REFERENCES

- Amanullah, S. W., & Abrizah, A. (2023). The landscape of research data management services in Malaysian academic libraries: librarians' practices and roles. *The Electronic Library*, 41(1), 63-86.

- Association of College and Research Libraries. ACRL (2018). *Research data management*. Retrieved from <http://www.ala.org/acrl/conferences/roadshows/rdmroadshow>
- Bahader, M. (2022). Barriers to Customer Relationship Management practices: A survey of university libraries in Pakistan. *Malaysian Journal of Library and Information Science*, 27(2), 59-70. DOI: <https://doi.org/10.22452/mjlis.v0127no2.4>
- Bahader, M. (2023). Analysis of relationship of CRM-based library services with head librarians' personal and academic variables: a survey of university libraries in Pakistan. *Library Management*, 44(8/9), 546-565. <https://doi.org/10.1108/LM-12-2022-0128>
- Bahader, M., Bano, H., Jan, R., & Khalil, I. A. (2024). Digitization of Library Resources in University Libraries of Punjab, Pakistan: A Developing Country Perspective. *Policy Research Journal*, 2(4), 559-571
- Bahader, M., Idrees, H., & Naveed, M. A. (2020). User relationship management in university libraries of Pakistan: head librarians' perceptions. *Pakistan Library and Information Science Journal*, 51(2), 85-97.
- Bahader, M., Idrees, H., & Naveed, M. A. (2021). Customer relationship management practices in university libraries of Pakistan. *Library Philosophy and Practice (e-journal)*, pp. 1-24. <https://digitalcommons.unl.edu/libphilprac/6039S>
- Brown, R. A., Wolski, M., & Richardson, J. (2015). Developing new skills for research support librarians. *The Australian library journal*, 64(3), 224-234.
- Corrall, S., Kennan, M. A., & Afzal, W. (2013). Bibliometrics and research data management services: Emerging trends in library support for research. *Library Trends*, 61(3), 636-674. doi:10.1353/lib.2013.0005.
- Cox, A. M., and Corrall, S. (2013) Evolving academic library specialties. *Journal of the American Society for Information Science and Technology* 64(8), 1526-1542
- Cox, A.M and Verbaan, E. (2018). Exploring research data management. UK: Facet Publishing.
- Digital Curation Centre and Research Libraries UK (2015). *Data management in perspective: career profile of the academic librarian*. U.K: DCC
- Dorcas, I. I., Jiyane, V. G., Ibinaiye, J. W., & Tijani, R. (2023). Analyses of a Decade of Research Gap in Data Management Practices in Academic Libraries: A Social Science Perspectives. *International Journal of Social Science Research and Review*, 6(5), 271-289.
- Faten, M., Maha A., & Aman A. (2021). Awareness of research data management services at academic libraries in Jordan: roles, responsibilities and challenges, *New Review of Academic Librarianship*, 27(1), 76-96, DOI: 10.1080/13614533.2019.1691027
- Henderson, M.E., Knott, T.L. (2015). Starting a research data management program based in a university library. *Medical Reference Services Quarterly*, 34(1), 47-59.
- Higher Education Commission (2016) Quality and research based ranking of HEIs. Retrieved from <http://www.hec.gov.pk/InsideHEC/Divisions/QALI/Others/RankingofUniversities/Pages/>
- Higher Education Commission (2020). Library support grant. Retrieved from <https://www.hec.gov.pk/english/services/universities/LSG/Pages/default.aspx>
- Kennan, M. A. (2016). Data Management: Knowledge and skills required in research, scientific and technical organizations. In *IFLA World Library and Information Congress: 82nd IFLA General Conference and Assembly* (pp. 1-10). International Federation of Library Associations and Institutions.

- Matlatse, R. (2016). An evaluation of a structured training event aimed at enhancing the research data management knowledge and skills of library and information science professionals in South African higher education institutions (Doctoral dissertation, University of Pretoria).
- Oliver, G and Harvey, R. (2016). *Digital curation*. 2nd ed. U.K: ALA.
- Piracha, H. A., & Ameen, K. (2018). Research data management practices of faculty members. *Pakistan Journal of Information Management & Libraries*, 20, 60-75.
- Piracha, H. A., & Ameen, K. (2019). Policy and planning of research data management in university libraries of Pakistan. *Collection and Curation*, 38(2), 39-44.
- Piracha, H. A., & Ameen, K. (2019). Policy and planning of research data management in university libraries of Pakistan. *Collection and Curation*, 38(2), 39-44.
- Pryor, G., & Donnelly, M. (2009). Skilling Up to Do Data: Whose Role, Whose Responsibility, Whose Career? *The International Journal of Digital Curation*, 4(2), 158-170.
- Rafiq, M., & Ameen, K. (2022). Research data management and sharing awareness, attitude, and behavior of academic researchers. *Information Development*, 38(3), 391-405.
- Reichmann, S., Klebel, T., Hasani-Mavriqi, I., & Ross-Hellauer, T. (2021). Between administration and research: Understanding data management practices in an institutional context. *Journal of the Association for Information Science and Technology*.
- Semeler, A. R., Pinto, A. L., & Rozados, H. B. F. (2019). Data science in data librarianship: Core competencies of a data librarian. *Journal of Librarianship and Information Science*, 51(3), 771-780. <https://doi.org/10.1177/0961000617742465>
- Shah, N. U., Naeem, S. B., & Bhatti, R. (2023). Digital data sets management in university libraries: challenges and opportunities. *Global Knowledge, Memory and Communication*.
- Sheikh, A., Malik, A., & Adnan, R. (2025). Evolution of research data management in academic libraries: A review of the literature. *Information Development*, 41(2), 305-319.
- Sinha, P., & Sinha, M. K. (2023). Research data management services in academic libraries: a comparative study of South Asia and Southeast Asia. *Global Knowledge, Memory and Communication*.
- Society of College National & University Libraries (SCONUL). (2015). *Research data management: briefing for library directors*. England: SCONUL.
- Tang, R., & Hu, Z. (2019). Providing research data management (RDM) services in libraries: Preparedness, roles, challenges, and training for RDM practice. *Data and information management*, 3(2), 84-101.
- Tenopir, C. et al. (2017). Research data services in European academic research libraries. *Liber Quarterly*, 27(1), 23-44.
- Verbakel, E., and Grootveld, M. (2016). Essentials 4 data support: five years' experience with data management training. *IFLA*, 42(4), 278-283.