Research Data Preservation Practices of Library and Information Science Faculties

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ABSTRACT

Digitisation of research data is widely increasing all around the world because it needs more and development of enormous digital technologies. Data curation services are starting to offer many libraries. Research data curation is the collective invaluable and reusable information of the researchers. Collected data preservation is more important. The majority of the higher education institutes preserved the research data for their students and researchers. It is stored for a long time using various formats. It is called research data preservation. Without proper research data management plan and implementation cannot curate the research data. The aim of the study is to identify the Asian Library and Information Science (LIS) faculties' experiences in the research data preservation and curation during their research. Data management, curation and preservation all are interlinked. For reuse of the research data; data curation is an essential role. For this research, we adopted a survey method and an online questionnaire was shared with 1400 LIS professionals, belonging to the Asian region but the completed study respondents are 125 university faculties from various Asian countries. The study findings are 76.8 per cent generated statistical data followed by 58.4 per cent textual files. By far, the most preferable data analysis tool is Microsoft Excel 82.4 per cent. Moreover, the result shows that generated data is mostly stored by personal computers and laptop hard disks. This study concludes LIS faculties having adequate skills and knowledge on data curation and preservation even though they are expecting more services from their academic institute libraries.

Keywords: Research data; Research data curation; Research data preservation; Research data management; Research data awareness and practices

1. INTRODUCTION

Research data and management is emerging among academicians around the world[1]. Research data is collected, generated, and processed data preserved for a long time. It contains various formats and media[2]. Preserved data is reusable. Some academic and research institutes maintain the institutional repositories for publishing their research contents for more institutional and research data visualisation. It may be partial or full access based on the research policy they were preserved. The data collected during the survey is both precious and sensitive. Some data is open to all, for example, Indian researchers' thesis and dissertation are openly available on the Shodhganga website. Open data is helpful to avoid the replication of the research. All the research data is not available by open access but some of the data are stored confidentially for many reasons like data that may affect a country's security, medical history of any person, data produced during research on new missiles, technologically advanced robotic soldiers, interview recordings with eminent people of the country and ongoing research[3].

Research data is required to be preserved safely, during and after completion of research, using proper and reliable storage devices that could provide necessary security to the confidential data[4]. While preserving data researchers have to follow metadata standards, which give a detailed description of the work[5]. Research data is collected to conduct a study which is essential to build and support the researcher's project[6]. Also, it supports other researchers to learn more about the work and another benefit is getting the credit for the work. Hence, it is essential up to the same extent, to keep that data safe from misuse and corruption[7].

2. RESEARCH DATA MANAGEMENT

Research data management includes organisation, preservation, storage and curation of collected data to perform research and for future use and sharing[8]. It saves time, effort, resources and energy in the long run and helps to avoid any mistake, misuse, or manipulation of data[9].

2.1 Requirement of Data Management

- It saves resources, keeps data secure and decreases search time in the long run
- It helps in increasing the efficiency of the research and facilitates future discoveries
- Alleviate data control to reduce the loss of research data
- It increases research integrity and permits collaboration.
- Promotes knowledge transfer by maximising data visibility, and increasing research impact
- Perk-up accessibility and improves the life cycle of data
- Ensure compliance with funding agencies

- Decreases duplication and reduces manipulation of original data.

As far now, it is clear that research data is quite important and valuable. Hence, this study aims to get a clear vision of the practices done by faculties of library and information science of the Asian region, to manage, store, use, reuse, preserve, and share research data.

3. LITERATURE REVIEW

Unal, *et al.*[11] (2019) conducted a survey study with the researcher's understanding of research data usage and sharing behaviours. They took a sample of the study from the UK, Turkey, and France. The authors concluded that open access to data was not common among researchers, whereas data ethics was significant anxiety. The result shows most respondents lack knowledge and training to manage the research data. Berman[12] (2017) examined and analysed the University of Vermont faculties' data management behaviours. This study author used a mixed method of study. It includes quantitative and qualitative analysis. The author found that faculties have less knowledge on metadata creation, but the majority of them are willing to share their research data findings although they have some issues while sharing the research data they are: legal issues such as copyright and IPR; confidentiality, and proprietary. Challenges faced while preserving the data are mainly organisational issues such as infrastructure, lack of institutional support, lack of guidance and inadequate data preserving facilities for a long time. Furthermore, the study reveals that faculties' expectations are storage facility, data analysis and data security support. In 2015, Schumacher & VandeCreek[13] surveyed five American university professors to examine data management practices and risk factors. They identified professors having a poor awareness of data at risk and loss of digital objects. In addition, the study found that 62.5 per cent of faculties faced data storage system failures. Furthermore, the result reveals that most of the faculties are stored in free devices and accounts so they lost the majority of the data. It shows they have a lack of understanding and knowledge of research data management. According to Van Tuyl, & Michalek[14] (2015), appraise survey with faculties of Carnegie Mellon University had average awareness of data management but they required and expected help for its backup. Faculties are storing their data mostly on their personal computer, desktops and cloud storage. Moreover, researchers lack an understanding of metadata standards, file naming, and formal documentation. The author(s) suggested developing many services that guide researchers. The researcher points out most popular data file formats are used by the researcher as "data tables, documents, code, text files and image formats". Mancilla, *et al.*[15] (2019) assessed the faculties of Delft University and had a data steward to outline RDM practices. Results showed a lack of awareness in faculties regarding research data management services, research data repositories and fair use but most of them were interested to learn about it. In addition, the study reveals a major reason for data loss is the lack of automatic backup facilities. Johnson & Steeves[16] (2019) investigated with New York University faculties how librarians' have to assist the researchers in managing their research data and the expectation of the faculties are discussed. The authors' exploratory study found that more than half were aware of publishers and inclined to share research data; 71 per cent of respondents are not using data repositories and 87 per cent of respondents were oblivious of research data management services offered by the library. More than half of study respondents are faced with challenges in managing their research data such as data management plans, data sharing and reuse, and choice of choosing the appropriate repositories for their research data. Whitmire, *et al.*[17] (2015) expressed the minor usage of campus-wide infrastructure at Oregon State University, found by studying the over-effect of knowledge of local research data management, conducted regarding data types, location of data storage, the role of RDM and associated responsibilities. The faculties maintained their storage database, and the majority of them created metadata, but data sharing was exceptional though support was required to develop standardised metadata.

Cox, *et al.*[18] (2017) studied higher education libraries of seven countries around the globe to know about the RDM services, activities and capabilities and then concluded that libraries were constantly focused on RDM policies where all were facing challenges in resourcing, technical assistance, advisory services and skills for data curation were low. Tenopir, *et al.*[19] (2017) surveyed academic member libraries of LIBER and discovered the type of research data services provided and upcoming services planned: technical research data services, hands-on training skill-related like workshops and consultative services. Also, libraries had provided training to their staff to enhance their skills in research data services. Mohammed & Ibrahim[20] (2019) examined five universities with Postgraduate students and faculties in Iraq to focus on the role of RDM and the challenges faced. The survey reveals improper storage support and services, lack of management support, policies, inadequate technological devices, insufficient human resources, lack of technological knowledge and poor institutional repositories services. The researchers suggest a partnership with other research organisations, funders, and research faculties with other universities this is one of the easy to resolve challenges.

Perrier & Barnes[21] (2018) discussed the development of RDM services. They used a mixed method of the study for finding the results. The respondents are University of Toronto faculties. The result report reveals that researchers are more aware of the importance of the research data, safety, security and preservation at the same time they are expecting universities to give some assistance in reducing the burden of their valuable time. Additionally, the researchers expect universities to procure more storage spaces for preserving the data, as well as have to increase more funds for research-related activities and purchasing some advanced technological and storage devices. Finally, the author suggests that with more data management practices and training needed among the faculty members, researchers still struggle to store and secure the data. Abdullahi[22] (2017) examined reasons for research data sharing. The study was conducted by Nigerian Scholars. It was found that factors behind data sharing's are: Helping others through their research findings, rewards, transparency, showering

research progression, and avoiding the duplication of the work like data fabrication and falsification. Adika & Kwanya[23] (2020) conducted a study to assess the possessed skills and literacy of RDM through lectures at Strathmore University. Investigation shows that faculties accepted they need more training to manage research data as knowledge providers. The result of the study shows most of them are willing to share their research data openly, on-demand basis, and among their team members. Moreover, they have limited literacy on data security; it includes data preservation, data authentication, and data legislation.

Chiware & Becker[24] (2018) conducted a survey within eight South African countries to determine the level of preparedness of university and research libraries in providing RDM services on different points like data archiving, data support services, organisational structure, training, staffing, funding, etc. Some organisations offer training to their staff but not all because still, RDM is at an earlier stage in these countries. The study found that a limited number of institutes only have the RDM services, policies and implementation plans but the majority of them are not initiated for the development of RDM. Marlina & Purwandaria[25] (2019) conducted a systematic literature review to understand the best practices in research data management worldwide. SWOT matrix was used to analyse action plans in implementing RDM services in Indonesia and gave suggestions to bring awareness among researchers for the implementation of national policy and information technology infrastructure. Pasek & Mayer[26] (2019) explored graduate students' and faculty's knowledge of RDM. The study assessment researcher uses 12 different capacities for evaluation. This evaluation involved ethics, data visualisation and a review of its quality. The survey result shows graduate students acquire low levels of skills in data preservation, conservation, curation, metadata, interoperability and reuse. Compared with students, faculties are having more awareness of RDM.

Abduldayan, et al.[27] (2020) examined the RDM practice among chemistry researchers in Nigeria, using exploratory research techniques. The result declares that researchers have a good understanding of the meaning of RDM, files, types of data, data analysis software and purposes of research data but have a poor experience with data storage, recovery of data and weak data protection. Moreover, they need orientation and education on the benefits of research management. Further, the researchers shared data loss experiences: malfunction, system error, storage device theft, virus attack, unrecognised file format, system crash, electricity issue, and many more. The faculties give some suggestions: storing the data in multiple locations, regular backup using cloud storage, and proper handling of external storage. In 2020, Chawinga & Zinn[28] studied over RDM at one out of 4 public universities located in Malawi. The research found that researchers are actively participating in research and generating very much data. They are willing to share their research data but its preservation is poor. Also, the result identified they do not have an opportunity to get formal training in their country. Chigwada[29] (2022), surveyed 100 participants who were chosen from articles indexing Google Scholar, Scopus, and WoS. The top 5 respondents were interviewed which resulted in 70 per cent of them being unaware of research data management. Librarians played a wonderful role in creating awareness among researchers about RDM.

4. OBJECTIVES OF THE STUDY

To find out the research data management skills possessed by library faculties.

- To know the type of research data generated and tools used to analyse the RDM.
- To identify storage devices used for research data and its security.
- To know security measures are taken to prevent research data.
- To understand search techniques used and expected services in libraries.

5. METHODOLOGY

The quantitative research study investigated Asian library and information science faculties and professionals in research data management. So far in this study, we used the survey method and a structured questionnaire was adopted using existing research literature-based. For data collection purposes, Google forms and links are shared by their official institute emails. The total number of mail IDs collected is 1400 but more than 600 emails are bounced. Sending several reminders we received 125 completed respondents. This study is a purposive sampling method, and we limited this survey to library and information science faculties of higher education in the Asian region. A survey study questionnaire was shared from August to September 2021. The received data during the survey were analysed and interpreted.

6. DATA ANALYSIS AND INTERPRETATION
6.1 Socio-Demographic Details

Respondents were asked about the location of their belonging university and found that out of 125 respondents, 52 (41.6 %) belong to universities located in the South-East Asian region, followed by 42 (33.6 %) respondents from South Asian Universities. With 14 (11.2 %) West Asia stands above East Asia with 9 (7.2 %) respondents. However, the least faculties 8 (6.4 %) from Central Asian Universities. Based on respondents' designations, data revealed that there were assistant professors/ lecturers with the highest 44%, followed by 32.8 per cent of professors. The associate professors are 16.8 per cent above respondents of other ranks (6.4 %) in the library field.

6.2 Number of Projects Led in Last Five Years and Storage Space Required for Generated Research Data

Faculties were asked about the number of research projects led & the amount of data generated and found that 38.4 per cent of professionals had only led 1-2 research projects, whereas 27.2 per cent had led 3-5 projects, and 20.8 per cent had more than five projects on their table. In contrast, 13.6 per cent had never done any project in the past five years. In terms of storage space required, 40.8 per cent of respondents need more than 1 GB space, followed by 25.6 per cent needing space between 10 GB to 50 GB. However, 12.8 per cent of

professionals cannot share the details of data storage. Few (5.6 %) were looking for 50GB to 500GB of storage, and the last 3.2 per cent of professionals need more than 500GB of data storage for their data.

6.3 Type of Research Data Generated and Tool to Analyse it

Table 1 shows the types of data that get generated during research. With 76.8%, statistical data topped the row, followed by 58.4 per cent of human-readable text files. Presentations and spreadsheets hold around 52 per cent individually, and Images were 44%, followed by 20.8 per cent of computer-readable textual data. Audio and video files generated 20 per cent of the total, 13.6 per cent were binary raw/ processed data, and 12.8 per cent were occupied by physical objects and computer code or scripts.

Table 1. Types of research data generated

Generated research data	Respondents	% (n=125)
Statistical data	96	76.8
Textual files	73	58.4
Presentations (e.g., PPT)	66	52.8
Spreadsheets	65	52
Images	55	44
Computer-readable textual data (e.g., XML files)	26	20.8
Audio files	25	20
Videos	25	20
Binary raw or processed data	17	13.6
Computer code or scripts	16	12.8
Physical objects	16	12.8

Table 2. Standard tools used to create and/or analyse research data

Tools used to create analyse research data	Respondents	% (n=125)
Microsoft Excel	103	82.4
Microsoft Word	91	72.8
SPSS	79	63.2
Microsoft PowerPoint	58	46.4
R	21	16.8
Microsoft Access	7	5.6
Adobe Photoshop	7	5.6
MATLAB	1	0.8
Other	19	15.2

Table 2 explained all about the tools used by researchers to develop and analyse the collected data where the maximum numbers of respondents (82.4 %) use Microsoft Excel. 72.8 per cent of professionals were using Microsoft Word before SPSS had 63.2%. Tool R is being used satisfactorily with 16.8%, and most minor researchers with 5.6 per cent use Adobe Photoshop

& Microsoft Access; however, only 0.8 per cent used MATLAB for the purpose.

6.4 Storage Devices used for Research Data and their Security

Table 3 represents the ways respondents store their data using different devices. Maximum (93.6 %) respondents trust their laptop/PC's, hard drive for storage, but 56 per cent of researchers go for cloud-based solutions, and 45.6 per cent of them use flash drives. However, 26.4 per cent of respondents use shared drives for their data, whereas 20 per cent of researchers write the notes manually to save their data. 14.4 per cent of them go for CD/DVD, and the rest 12 per cent take external data repositories for the purpose.

Table 3. Storage devices used for research data from current project(s)

Storage devices	Respondents	% (n=125)
Laptop/PC Hard Drive	117	93.6
Cloud/Web-Based Solution	70	56
Flash Drive/USB	57	45.6
Shared Drive/ University Server	33	26.4
Handwritten notes	25	20
CD/DVD	18	14.4
External data repository (E.g., Institutional repository)	15	12

Table 4. Security measures taken to prevent misconduct/misuse of research data

Security measures	Respondents	% (n=125)
Restriction on password guesses	79	63.2
Folder level encryption	48	38.4
File-level encryption	32	25.6
Hiding identity of the person, if applied	27	21.6
AppLock	26	20.8
Encrypted data uploading on the cloud	23	18.4

Table 4 shows the security measures taken by researchers to keep their data safe. 63.2 per cent of researchers took restrictions on password guesses followed by Folder level encryption with 38.4 per cent. 25.6 per cent of them used file-level encryption; however, approx. 21 per cent took AppLock, and another similar percentage were Hiding the person's identity if it applied to their research. The remaining 18.4 per cent were using encrypted data uploading on the cloud.

6.5 Search Technique Used and Expected Services at Libraries

Table 5 showed the used search techniques to search research data. 89.6 per cent of respondents use keywords to get the desired result, but 79.2 per cent trust the subject search. 56 per cent of them go for Boolean operators, and the other 28

per cent meet research assistants/ask librarians for help. 20 per cent search using timeline restriction, and the last 4 per cent use none of the mentioned methods.

Table 5. Search technique used to search research data

Search techniques	Respondents	% (n=125)
Keyword search	112	89.6
Subject search	99	79.2
Boolean Operators	70	56
Ask librarian/ research assistance desk	35	28
Search with timeline restriction	25	20
None	5	4

Table 6. RDM services expected to be present at libraries

RDM services expecting from the libraries	Respondents	% (n=125)
Data discovery and access	80	64
Data preservation	79	63.2
Data sharing and dissemination	73	58.4
Metadata	50	40
Data visualisation	49	39.2
I don't know	5	4

Table 6 shows the RDM services that faculties were expecting from libraries. 64 per cent of respondents choose data discovery, and access is required, and 63.2 per cent said data preservation services were needed at the library. Another 58.4 per cent declared the requirement of data sharing and dissemination. 40 per cent detailed metadata and 39.2 per cent wanted data visualisation services at the library, and the remaining 4 per cent were unclear.

7. CONCLUSION

The conducted study is instrumented to know about research data management, focusing on faculties of the LIS field belonging to different universities of the targeted geographical region on the globe. Respondent faculties have varied views on research data management, where most of them led 1 to 2 research projects, but the least have conducted more than five researches. Different kinds of data produced during the investigation are mainly statistical, human-readable files, images, spreadsheets, etc. Also, there are ways/software that faculties use to analyse, store, and curate research data, including (decreasing order) MS Excel, MS Word, and SPSS. Laptops/ PCs are mainly used as devices for storing, managing, & sharing data, keeping it updated, and preserving data for long-term use for curation. Maximum respondents believe in having the best services at universities' libraries, including data discovery, data preservation, data sharing & dissemination, data visualisation, etc. Storage space plays an essential role if research data needs to be kept safe; it varies from less than 01 GB to more than 500 GB of storage. It witnessed that most of them have received training to manage

data generated during the research. However, a few of them still need training. Faculties take backup of their research data at their convenience and receive support from libraries to preserve the generated data. The majority of respondents believe that this should be included in the curriculum of LIS as the upcoming generation would benefit and have the skills to manage and preserve research data.

In comparison to the work done by Abdullahi[22], the users belong to different streams, whereas in this study belong to only one stream, i.e., LIS. Also, the category of users varies from students to research scholars; however, this study focuses only on faculties. Unal[11] mentioned that researchers collaborate in data sharing with other institutions and highest in France likewise the data sharing and dissemination is expected from libraries.

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