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Challenges and Practices of Research Data Management in Selected Iraq Universities

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ABSTRACT

Research emphasises the fundamental role of research data management (RDM) in enhancing academic and scientific research. This paper intended to examine RDM in Iraqi Universities, identify the current challenges of RDM and propose influential RDM practices. Data collection employed a self-administered questionnaires distributed to 155 postgraduate students and 20 faculty members from five universities in Iraq. Research findings revealed that there is a lack of proper RDM. Postgraduate students and researchers were managing their own research data. Main challenges of maintaining a good RDM involve lack of guidelines on effective RDM practices, insufficient of adequate human resources, technological obsolescence, insecure and inefficient infrastructure, lack of financial resources, absence of research data management policies and lack of support by institutional authorities and researchers negatively influenced on research data management. Postgraduate students and researchers recommend building research data repositories and collaboration with other universities and research organisations.

Keywords: Research data management; Research data management practices; Challenges; Academic libraries; Iraq universities.

1. INTRODUCTION

The issue of developing, managing and using research data has received a wide recognition from academicians and policy makers. Nowadays, universities are paying attention to research activities to enhance the quantity and quality of research data. Generally, RDM involves all processes and activities required to properly organise, document, store and archive data for future use. In this vein, academic libraries play a fundamental role in research data management in universities and research institutions. Academic libraries play a vital role to maintain and support authority on data management issues[1]. Recognizing the importance of research data and proper RDM, governments and funding organisations encourage researchers to properly store and share data[2]. Proper data management was advocated as essential activity to present and verify research results accomplished by researchers and scholars and thereby making it easier for other researchers to build on the existing research[3]. Hence, librarians play an important role in assisting researchers in their research data practices and plans as researchers are unaware of the importance of preserving research datasets for future use[4].

In Iraqi Context, there is no evidence to show how universities libraries are managing research data despite the attention paid to academic research. Based on our knowledge, this is the first study on RDM in Iraqi context. This research tends to answer three questions:

- How academic libraries in Iraq universities manage research data?
- What are the main challenges of RDM in Iraq universities?
- What are the recommended RDM practices perceived by postgraduate and faculty members in Iraqi Universities?

The findings of this study has the potential to provide solid background information to Iraqi universities management and policy makers for developing and executing effective RDM in academic libraries.

2. LITERATURE REVIEW

This section presents a review of relevant literature on research data, role of academic libraries in RDM, challenges of RDM and the best practices of RDM.

2.1 Research Data

Research data can be found in different forms such as text, images, recordings, simulations, and verbal communications and so on[5] and generated when students and researchers undertake research projects or activities. However, research data may not be confined for research only as the data include we portals, administrative records and log files of learning management systems[6]. In this regard, research data involve a diverse data sources depending on research problem, origin of data and the discipline of the researcher. In physical sciences, experiments, observations, and computer modeling life are usually employed to collect data whereas survey questionnaires and interviews are mostly used in in the social sciences. For

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postgraduate students and researchers, the research data usually involve relevant academic articles, governmental reports and official publications and publication presented by professional research organisations used for conducting their research.

2.2 Academic Libraries and Research Data Management

Academic libraries are a corner stone of universities around the world. Research stress the influential role of academic libraries in RDM[7-9] with a persistent debate about the exact nature and extent of library engagement with RDM activities[9]. Academic libraries improve data management and widen data sharing by transparency and reproducibility-related initiatives among the research community[8]. In this regard, library RDM programs focus mainly on skills training and assisting researchers in complying with data related policies and mandates[9-10]. This study reports the results of a RDM activities and services in Iraqi Universities' libraries in order to contribute to existing literature. RDM represents a valuable resource which demands sufficient money and time for effective data sharing[3]. RDM, especially research data sharing allow other researchers to identify, interpret and reuse the data as well as to sustain the value of the data by enabling others to verify and build upon the published results.

The influential role of university library and librarian in RDM was highly advocated[11]. Majority of librarians believed that they are responsible for providing research data services to patrons and to increase institutional visibility and research impact[12]. Librarians offering research data services were responsible for research data services planning. Accordingly, librarians should be stewards of all types of scholarships including data sets; losing data sets threaten future of scholarship and library needs to offer research data services to remain relevant to the institution[13]. The vital role of librarians in data management was driven by a paradigm shift from primarily focusing on publications as the only important research output as per past tradition towards recognizing that research data are an important output of the research process[11].

Vast research paid attention to identify the essential tools and services required for research data management. For example, researchers at the University of Toronto stated that they need assistance with the secure storage of data and favor tools that are easy to use[14]. Further, they acknowledged that increasing knowledge of best practices in RDM is essential and can be supported by university library. In her investigation of RDM in the humanities in UK and Australian institutions, Catherine stated that effective humanities RDM begins upstream in the data lifecycle with targeted training, active partnerships, and liaison on the data management plan, and requires strategic cooperation between researchers, the library and institutional/data repository, and information technology services[15]. In sum, involvement of librarians in data management is essential as it enhance data discoverability, accessibility, and understandability.

2.3 CHALLENGES OF RDM

It was argued that research data management is not a simple task due to the prevalence of various challenges. For instance, University repositories may not afford long-term maintenance of data, data centers may not accept all data submitted to them; more complex research data may be difficult to store and manage and some websites are ephemeral with little sustainability[3]. The use of different vocabulary hinders collaboration between librarians and researchers due to different cultures as researchers speak the language of research not the language of libraries[11].

Further, challenges associated with inconsistencies and complexities in available data are common in many universities libraries[3]. Additionally, numerous challenges in digital data management are derived from lack of guidelines on good practice, inadequate human resources, technological obsolescence and lack of evidence about best infrastructures[6]. Moreover, one of the main challenges in RDM in Zimbabwe is the use of different vocabulary between librarians and researchers[11]. It was indicated that libraries with well-established research data services provide their staff with training opportunities for skills development required for delivering distinguished services[17]. Access to research data was also restricted to selected users to avoid unauthorised access, data loss and corruption.

Researchers may need to possess a data management plan in order to describe the data produced during the research project. This plan outlines the strategies that would be executed during the active phase of the research and after the project is complete. It was reported that the fundamental challenges of RDM involve the lack of adequate human resources to manage data whereas[6] and lack of essential knowledge, skills and training of most of data management staff[12]. Libraries offer opportunities for developing research data services skills through different means: workshops, conferences, research data services related courses, professional development working groups and in house workshops and presentations[17]. In this respect, librarians believe that conferences, Internet-based learning and on-the-job training are essential to prepare them to provide RDS effectively[18]. It is essential to have a marketing plan to the key stake-holders on campus when developing data services on a campus. Accordingly, there is a need for libraries to partner with the campus stakeholders, such as the IT department and those responsible for research on the campus, and a unified front must be demonstrated to researchers[19].

2.4 Practices of RDM

Based on extant literature, this research advocates four fundamental RDM practices: RDM plans, Policies and guidelines on RDM, Development of Research Data Repository and Domain-sensitive institutional policies. It is essential to set a RDM plan to identify how to manage research data and who will be responsible for RDM. It was recommended to have a partnership between library staff and a researcher when drafting a RDM plan[20]. For instance, RDM plans need to be mandatory by universities for its grantees with follow up on maintaining updates of its specifications annually. Such plans are domain-specific which reflect best practices in the applicant's area of research, and it should be appropriate to the data that the project will generate. RDM activities and services are developed through collaboration between libraries and

key stakeholders in the RDM landscape especially IT services department and research support office[21].

Setting policies and guidelines on RDM is viewed as one of the most important RDM practices. A survey on RDM of directors of Association of European Research Libraries found out that almost all libraries collaborate with organisations within and outside the institutions in order to offer or develop policy related to research data services[17]. They reported that Librarians collaborate with researchers, information technology centres, research offices, university archives, and legal offices. Hence, it is essential to maintain effective policies and guidelines on RDM.

Further, developing research data repository is considered as a vital RDM practice. Researchers stressed the need to decide on a specific platform for to identify where the data repository will be hosted and run within a research institution[22]. In this regard, librarians provide data storage facilities, tools for data analysis and virtual community support[17]. Moreover, RDM practices entail the development of domain-sensitive institutional policies. Governments and their respective national funding agencies have requirements around RDM that universities and research institutions need to meet[15]. Institutional RDM policies and procedures are viewed by the Australian National Data Service (ANDS) as fundamental to responsible RDM[23]. Good RDM policies advocate the variety of research data and primary materials and require that research data be actively curated and migrated throughout their lifecycle. Further, good RDM practices require experienced and skilled academic library staff to provide safe, trusted and sustained stewardship of research data[24].

3. MATERIALS AND METHODS

This research focused on investigating RDM in Iraqi universities. Iraq has 34 public universities and 50 private universities managed by Ministry of Higher Education and Scientific Research (MoHESR) with a total of 490,000 students (95 % undergraduate and 5 % postgraduate student) and 40,000 faculty members25. A population of 5 universities in Baghdad was purposively selected: University of Baghdad, Al-Mustansiriya University, Al-Nahrain University, Iraqi University and University of Technology, Iraq. Informed consent was sought from the participants. This study emphasised on universities in Baghdad because 50 per cent of Iraqi students are registered in universities located in Bahdad25 . The sample size of this research was 155 of postgraduate students and 20 faculty researchers. For postgraduate students, 400 questionnaires were distributed in graduate schools. The response rate was 38.75 per cent by which 168 questionnaires were returned with only 155 completed questionnaires. On the other hand, four faculty members were selected from each university. we contacted each faculty members via email or phone. A brief summary of research objectives was introduced to each faculty member. The study was conducted using an administered questionnaire focusing on prevailing RDM practices. The questionnaires were translated into Arabic as some of the respondents (45) can't effectively communicate in English language. The design of survey questionnaire was based on studied conducted by 26,9,10 and tailored to Iraqi universities context. The questionnaire was divided into two sections. Section A presented personal and general information. This involved identifying respondents' gender, age, university name, employed research method and professionals responsible for RDM. Section B requested respondents to provide rate their repossesses using 5 Likert scale (1 strongly agree - 5 strongly disagree). Respondents were required to express their opinions on three parts: status or RDM in their universities, challenges of RDM and proposed good practices of RDM. The findings of section A were presented using frequencies and percentages. SPSS was used to report descriptive statistics of section B using means and standard deviation.

Table 1. Respondents profile

	Postgraduate students		Faculty members	
	Freq	**%**	**Freq**	**%**
Gender				
Male	91	59	14	70
Female	64	41	6	30
Age				
25- 35 years	65	42	1	5
36-40 years	59	38	5	25
41-49 years	27	17.5	5	25
50-59 years	4	2.5	7	35
60 and above	-	-	2	10
University				
University of Baghdad	38	24.5	4	20
Al-Mustansiriya University	32	20.5	4	20
Al-Nahrain University	27	17.5	4	20
Iraqi University	30	19.5	4	20
University of Technology, Iraq	28	18	4	20
Professionals responsible for RDM				
Researchers	144	93	17	85
IT personnel	3	2	-	-
Librarians	8	5	3	15

4. RESULTS

Table 1 presents respondents' profile. Majority of postgraduate students are aged between 25-35 years (42 %) and 36-40 years (38 %). It is evident that 93 per cent of postgraduate students and 85 per cent responsible for RDM while only 5 per cent o postgraduate students and 10 per cent of faculty members get RDM assistance from librarians.

Table 2 shows the status of RDM in Iraqi universities. Respondents disagreed that their universities have RDM plans or guidance on organizing files. Additionally, there is no guidance on documentation standards, data storage and

Table 2. Status of RDM in Iraqi universities

Status of RDM	Postgraduate students		Faculty members	
	M	SD	M	SD
University has data management plans (e.g. providing templates or examples)	1.5	0.85	1.7	0.87
University provide guidance on files organization (e.g. creating system to instantly and reliably access your research records)	2.7	0.79	2.9	0.83
University offer guidance on data documentation standards (e.g. creating metadata)	2.0	0.88	2.3	0.89
Data are stored in traditional formats (e.g. text documents, spreadsheets, graphics, and databases)	4.0	0.84	3.8	0.81
University library allow to archive research data for future use	2.0	0.77	2.6	0.85
Data can be safely stored (determining storage and back-up options for keeping your data secure)	1.8	0.85	2.3	0.87
Data preservation for long-term access (e.g. Recommend use of file formats for long term readability and access	1.3	0.76	2.0	0.81
University has helpful data repositories for data sharing	2.5	0.82	2.8	.87

Table 3. Challenges of RDM

Challenges of RDM	Postgraduate students		Faculty members	
	M	SD	M	SD
Lack of policies and guidelines on RDM	4.4	0.90	4.0	.87
Inadequate human resources	4.0	0.83	3.9	.80
Inadequate financial resources	2.7	0.87	2.9	.89
Lack of infrastructure and technological obsolescence	4.2	0.79	4.3	.81
Use of different vocabulary between librarians and researchers	2.1	0.92	2.4	.93
Lack of institutional support and unavailability of software for research data	4.3	0.85	4.4	.90

Table 4. Respondents' views on proposed RDM practices

Proposed RDM Practices	Postgraduate students		Faculty members	
	M	SD	M	SD
It is necessary to have RDM policies and guidance	4.4	0.87	4.5	0.90
Provide training for library staff	4.4	0.79	4.4	0.81
Collaborate with other universities and organizations	4.2	0.85	4.3	0.89
Provide specific repositories for all disciplines	4.3	0.86	4.5	0.88

preservation. This means that research data are destroyed soon after the data are analysed. University Libraries don't allow to archive research data for future use. This means that universities in Iraq Universities don't use software application source code or configuration data in storing research data. Data are stored in traditional formats such as text documents, spreadsheets, graphics, and databases. Further, despite some universities have data repositories; they are not helpful in data sharing due to inadequacy and inconsistences.

Table 3 presents the main challenges faced in RDM in Iraqi Universities. The fundamental challenges reported were the lack of policies and guidelines on RDM, inadequate human resources, lack of infrastructure and technological obsolescence and lack of institutional support and unavailability of software for research data. However, respondents believed that inadequate financial resources and use of different vocabulary between librarians and researchers are not inherent in RDM.

Table 4 shows respondents' views on suggested RDM

practices. Respondents agreed that it is essential for universities to have a clear RDM policies and guidance, library staff need to be trained, universities need to collaborate with external universities and organisations and universities need to offer specific data repositories for all disciplines.

5. DISCUSSION

Both postgraduate students and faculty members have reported almost the same viewpoints on status, challenges and recommendation of RDM. The research findings showed that RDM practices in Iraq is still beyond the limits especially when compared with western and developed countries. Postgraduate students and faculty members are managing their own research data whereas universities' libraries play a limited role in RDM. The research findings showed that RDM practices in Iraq is still beyond the limits especially when compared with western and developed countries. Iraqi Universities have no data management plans, no guidance is provided on files organisation, data documentation and access to research records. Further, universities' libraries don't allow to archive research data for future use, safe data storage and data preservation for long-term access. Finally, despite the availability of data repositories for data sharing, respondents reported that they are not helpful. Postgraduate students and faculty members are managing their own research data whereas universities' libraries play a limited role in RDM. Such findings contradict the extant literature as libraries in Europe and America take RDM as a key component of their responsibilities and duties by[11,17,36]. Most of the research data were presented and stored in textual, spreadsheet and graphical formats while limited data were reported in audio, video, database and software applications formats. However, researchers advocated that librarians are actively involved in research data management making access to research data easier and collaborating with researchers, information technology personnel, legal offices and university archives in research data management in European and American academic and research libraries[17]. Similar research in the context of US academic libraries have emphasised on four main areas of focus: service, information, education, and network[28,35]. Authors argued that libraries need to advance and engage more actively to provide services, supply information online, and develop educational services. In European context, researchers revealed that the main RDM services are offering consultative and reference technical or hands on research data services, provide staff training and collaborate with other organisations inside their institutions or with outside institutions[28].

In identifying the main challenges faced by postgraduate students and faculty member, there were no specific policies and guidelines on RDM, inadequate human resources, inadequate financial resources, lack of infrastructure and technological obsolescence, use of different vocabulary between librarians and researchers and lack of institutional support and unavailability of software for research data. The key challenges associated with digital data management: technology obsolescence; technology fragility; lack of guidelines on good practice; inadequate financial and human resources to manage data well; and lack of evidence about best infrastructures[16]. More recently, RDM is depicted as a continuous, iterative, and embedded process throughout the course of a research project[29].

Respondents argued that influential RDM practices involve the availability of RDM policies and guidance, provide training for library staff, collaborate with other universities and organisations and provide specific repositories for all disciplines. Effective RDM practices make the research process more efficient, facilitate collaboration, and help prevent the loss of data[30]. Effective RDM is also crucial to establishing the accessibility of data after a project's conclusion, which is increasingly required by data stakeholders including research funding agencies and scholarly publishers[31]. In general, available data would be useful when it is documented, formatted and organised in a manner that enables examination and reuse by others[32-33]. Librarians offer different RDM services such as assisting researchers to improve their data management practices, developing data management subject guide, teaching data management to researchers, and assisting in supporting funding agency and publisher data requirements[36]. Libraries need to provide written policies for RDM and encouraging researchers to get Researcher ID (Web of Science) or Open Researcher and Contributor (ORCID) to be distinguished as individual researchers[5,34]. Further, investing in capacity building and continuous updating library staff with new technologies and tools of data analysis and visualisation is essential to provide effective RDM services[5,37]. Universities have adopted several approaches when initiating their RDS. Universities conduct a pilot in order to provide curating services for the data that graduate students produce leading up to their electronic dissertations and theses can be a starting point for some universities[38].

6. CONCLUSIONS AND RECOMMENDATIONS

This paper revealed that RDM is still a relatively new concept in Iraqi Universities as compared to other universities in developed countries. It is evident that Iraq universities fall behind the developed world in collecting and curating research data. Universities in Iraq have been late investors in new technologies, the research data space today is fragmented, and catch-up investment in e-research infrastructure, which includes academic libraries, is needed to maintain a good research impact. The results of this study will assist academic librarians in Iraq to develop and maintain best practices of RDM policy and services for researchers and justify the need for catch-up investment in e-research infrastructure. Based on the findings of this study, it is essential to develop a research data repository for each university or making use of currently available research data repositories to ensure that RDM standards are adhered to when doing research. In order to solve the main challenges of RDM faced by Iraqi Universities, there is a need to include all the data management stakeholders: researchers, Universities, data repositories, users, funders, and publishers from the initial stages of the research to ensure that there is order throughout the research lifecycle. Further, Iraqi universities need to build a partnership with foreign universities and international data organisations such as research Data alliance and DataCite to implement effective and professional RDM.

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