Enhancing the role of the libraries in South African Higher Education Institutions through Research Data Management: A case study of Cape Peninsula University of Technology

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature: Signed by candidate Date:

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Dedication

I would like to dedicate this work to the loving memory of my late mother, Msuthukazi Mgqoboka.

Abstract:

Research Data Management (RDM) is one of the top trends in academic libraries. Academic libraries are faced with the challenge of implementing RDM services. Libraries that are not yet offering support for research data may be at the stage of developing RDM services. The main objective of this study was to identify the experiences of one institution, the Cape Peninsula University of Technology (CPUT), in the introduction and implementation of RDM services with the intention of informing other SA HEIs about their offerings and experiences. The Digital Curation Centre (DCC) Lifecycle Model was used to guide the investigation in this study. The model helped to achieve the study's sub-objectives, which were: to establish to what extent RDM services have been adopted at CPUT, to identify experiences of librarians, and to make recommendations for successful implementation of RDM services.

This is a qualitative case study in which data were collected through document analysis and interviews. The study found that CPUT Libraries offer data management planning assistance, storage and management of data, and guidance and training in support of RDM. The experiences of CPUT in the introduction and implementation of RDM that the study highlighted are the crucial role played by library management, the development of staff skills, the challenge of librarian workloads and attitudes, and researcher reluctance to engage with RDM and institutional partnerships. The study recommends among other things: piloting of the RDM project; continuous advocacy for RDM; reaching out to the research community for needs assessments and to provide necessary RDM training; implementation of RDM policy; and institutional, national and international partnerships.

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List of acronyms and abbreviations

ACRL	Association of College and Research Libraries
CHPC	Centre for High Performance Computing
CPUT	Cape Peninsula University of Technology
DCC	Digital Curation Centre
DIRISA	Data Intensive Research Initiative of South Africa
DMP	Data Management Plan
FST	Faculty Support Team
HEI	Higher Education Institution
IBMB	Institute of Biomedical and Microbial Biotechnology
ICT	Information Communication Technologies
IR	Institutional Repository
LIS	Library and Information Studies
NeDICC	Network of Data and Information Curation Communities
NRF	National Research Foundation
OA	Open Access
P1	Participant One
P2	Participant Two
P3	Participant Three
RDM	Research Data Management
RIN	Research Information Network
SDDB	Scientific Drilling Database
SA HEI	South African Higher Education Institution
TUM	Technical University of Munich
UCT	University of Cape Town
UK	United Kingdom
UNISA	University of South Africa
UP	University of Pretoria
USA	United States of America
UoT	University of Technology

Chapter 1

INTRODUCTION

1.1 Introduction and background to the study

Research production has a direct impact on society as it contributes towards growing the economy of a country. Understanding the benefits of investing in research, governments all over the world have developed strategies and policies to stimulate knowledge creation in their countries. As South Africa aspires to move from a resource-based economy to knowledge-based economy, it is investing more in research. The South African National Development Plan 2030 (National Planning Commission, 2012:40) mentions innovation and knowledge production as important aspects for growth and development. The country's National Research Foundation (NRF) is an independent statutory agency that promotes excellent research and provides research funds for higher education institutions (HEIs). The NRF meanwhile defines research as "an original investigation undertaken to gain knowledge and or enhance understanding" (NRF, 2016).

1.1.1 Changes in scholarly communication

The Association of College and Research Libraries (ACRL) defines scholarly communication as "the system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community, and preserved for future use" (Little, 2012:65). Scholarly publishing serves the formal communication needs of scholars or researchers. According to Swan and Brown (2004), ever since the beginning of scholarly journals in the mid-1600s, academic authors have strived to publish and disseminate the results of their work (Correia &Teixeira, 2005:13). Scholarly publishing allows researchers to gain recognition from their peers. Individuals want the respect of their colleagues and want recognition for their contribution towards a research project.

Scholarly communication responsibilities traditionally lie with, firstly, the researcher, or research institutions, as creators of information; secondly, publishers who are responsible for production; and thirdly, intermediaries for distribution to libraries and other information outlets, who disseminate and preserve outputs. However, it has been noted that "the scholarly communication system is shifting under the weight of the open access movement" (Mooney, 2016:203).

Open Access (OA) is a social movement that became prominent in 1990s, influenced by the advent of digital communications, especially the internet (Aliyu & Mohammed, 2013:30), and in response to the 20th century commercial interests that dominated the scholarly communication system (Guardado & Borges, 2012: 235). OA has become an alternative way of publishing and distributing scholarly research. The movement supports and advocates for open and free access to research output. OA in scholarly communication advocates for the removal of price barriers, such as subscriptions, licensing fees, or pay-per-view fees, and permission barriers such as copyright and licensing restrictions to the end user (Neugebauer & Murray, 2013: 86).

The OA Movement is an initiative that is used to share knowledge and scholarly communication freely in this digital era, and is playing a significant role in reshaping scholarly communication. The following are the benefits of OA:

- The OA Movement advocates equal access to information arguing that all people regardless of subscriptions should have equal access to published research.
- Publishing in OA publications increases the opportunity of discoverability; the researcher's work becomes highly visible, and is therefore more likely to be cited. This advocates career progress to the researcher, opening doors for collaborations and recognition in their fields of study, while also motivating for knowledge sharing, and giving back to communities which may perhaps not afford to pay for access.
- Due to the fact that OA content is free, OA publishing has brought some relief to financial constraints that are experienced by libraries all over the world.
- OA is beneficial to universities, as they are rated according to research output, and their contribution towards the research landscape, both nationally and internationally (Neugebauer & Murray, 2013).

The *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* (2003) is an international statement on OA. It emerged from a conference on open access hosted in Berlin by the Max Planck Society in 2003 (Max-Planck Society & European Culture Online, 2003) and led to other OA statements. The NRF's OA statement of 2015, for example, states that authors fully or partially funded by the NRF ought to deposit their peer-reviewed manuscripts that have been accepted by journals into institutional repositories (IRs).

The statement also encourages researchers to deposit data supporting the publication in an accredited OA repository with the provision of digital object identifier (NRF, 2015). The research

funders' messages are clear, namely that "data should no longer be left unattended but rather join the finished scholarly output as a valued and managed component with an extended life and sustained usability" (Corrall, 2012:106).

With data being considered a research output, new developments in scholarly communication, such as the OA Movement, are drivers of Research Data Management (RDM) (Jones, 2012:47).

1.1.2 Research Data Management

There is a growing need for research data to be managed so that it can be accessible and usable. Research data is defined as "recorded factual material commonly retained by and accepted in the scientific community as necessary to validate research findings" (Engineering and Physical Sciences Research Council, 2016). In a research context, data refers to structures, results of experiments, measurements, observations resulting from fieldwork, survey results, interview recordings, images, and others (Research Information Network, 2007).

Shreeves and Cragin (2008) in McLure et al. (2014:140) define data curation as the "active ongoing management of data through its lifecycle of interest and usefulness to scholarship, science and education, which includes appraisal and selection, representation and organisation of these data for access and use over time". RDM is defined by Whyte and Tedds (2011) as "the organisation of data from its entry to the research cycle through to the dissemination and archiving of valuable results" (Berman, 2017:e1104). RDM involves activities related to the creation, organisation, storage, access and preservation of research data.

The research community needs support in managing, storing, sharing, and preserving the data they produce in order to maintain the viability, reproducibility, and re-use of research data (Wittenberg & Elings, 2017:89). Data management ensures integrity, enhances data security and minimises data loss (Koopman & De Jager, 2016:1; Poole, 2015:103).

The Research Information Network (RIN) report (2007) states that the main objective of data management is ensuring that "ideas and knowledge derived from publicly funded research are made available for public use, interrogation and scrutiny as widely, rapidly and effectively as practicable" (RIN, 2007). The ACRL Research Planning and Review Committee (2012:311) identified digital preservation and RDM as being among the top trends affecting academic institutions.

Data management has become a requirement of funding agencies as publicly funded research data is produced for the public interest. Public funders are required to show how their funding

contributes to broad economic growth and how it addresses the needs of society. In addition, funders need to demonstrate that the requirements that they impose on the work they fund makes discovery even more rapid, extensive, and cost-effective (Lynch, 2014:397; Verbaan & Cox, 2014a:211). Well-managed data is easy to use and reuse, and leads to more collaborations for researchers, as well as maximum return on investment for funders (Higgins, 2012:37).

RDM therefore does not only serve the interests of funding agencies and institutions, but is also important to the researcher for reuse of data, helping in both saving time and money, as recollecting data can be costly. One of the aims of digital curation is to ensure that data is accessible, usable, and reusable, where careful consideration should be given to data management from the earliest stages of research (Digital Curation Centre (DCC), n.d.)

Higgins (2012:18) points out that the idea behind data curation and preservation is that users can access, mine, exploit, reproduce, and disseminate research data openly and free of charge. The argument is that, once published, scientific data ought to remain available so that other scientists can do more research or add new science by using the published data. It is therefore important to develop strategies ensuring success and sustainability of RDM. Academic libraries are playing a prominent role in the management of research data as they are expected to provide RDM services to the research community.

1.1.3 Academic libraries

The increase in digital information, including data, has influenced HEIs not to be mere producers of research, or for their libraries to merely disseminate it, but for these entities to also provide long-term preservation of and access to digital knowledge, including research data (McKee, Stamison & Bahnmaier, 2014:189-195).

Koopman and De Jager (2016) have suggested that, as research data is rapidly becoming an international focus, South African researchers and policymakers are obliged to ensure that there are systems in place that support long term preservation, security, and accessibility of data. It is important that HEIs recognise the potential of data by providing management of research data produced in their institutions through open access methods such as data repositories.

Many authors have identified three stakeholders in HEIs that are critical in the implementation of successful RDM, namely the research office, libraries, and Information Technology departments (Verbaan & Cox, 2014a:213; Verbaan & Cox, 2014b:213:285). The introduction of RDM is observed as one among many services that can enhance the role that libraries provide in research support (Rice & Southall, 2016:25; Cox & Pinfield, 2014:300).

1.2 Research problem

Citing Lagoze (2017), Khan & Du (2018:2) have noted that the traditional library was easy to define: “it was the bricks and mortar structure, with a clear and controlled entry point that contained and protected the selected physical resources over which the library asserted control and curatorial responsibility”. Libraries have, however, evolved, and are expected to provide resources and services that are suitable for the digital age (Frank & Pharo, 2016:536).

Academic libraries are undergoing a period of intense change, with new roles and services being created. Faced with increasing demands from funding agencies, faculty members, students, and researchers as well, academic librarians are needing to enhance the role they play in the institution, by providing support around data management (Khan & Du, 2018:6).

According to Mushi, Pienaar, and Van Deventer (2020:1), many institutions in developed countries have implemented RDM services to accelerate research and innovation, however extensive RDM is not common in developing countries. Patterton, Bothma and Van Deventer (2018:14) agree that RDM and its accompanying services and infrastructures are predominantly still in a state of infancy in many African countries, and that little is known about the RDM habits of the researchers from these areas. Many African universities and research institutions are yet to implement the most basic of data management services. Chigwada, Chiparausha and Kasiroori (2017:7) say, for example, that in Zimbabwe, RDM is still considered a new concept.

Avuglah and Underwood (2019) show that academic libraries in Ghana are beginning to provide frameworks for RDM services and that RDM policies are being formulated. South Africa is, however, still lagging behind countries such as the United States of America (USA) and the United Kingdom (UK) when it comes to RDM and accompanying services (Patterton, Bothma and Van Deventer 2018:14), and there are institutions which are still to introduce RDM services fully. There are, however, those that have already introduced RDM services. The Cape Peninsula University of Technology (CPUT), which first reported RDM activity in 2015 (CPUT, 2015a), is one of these institutions.

For this study, it was considered useful to determine those institutions which have already introduced RDM services to help those HEIs in South Africa, and more widely on the African continent, that have not yet introduced them.

1.3 Research objective

The main objective of the study is to investigate the introduction and implementation of RDM services into academic libraries in South Africa. Based on the case of CPUT Libraries, the study will identify practices, experiences, and recommendations for the implementation of RDM services at SA HEIs.

1.3.1 Study sub-objectives

The sub-objectives of the study are therefore as follows:

(a) to identify to what extent CPUT Libraries has adopted RDM services;

(b) to identify experiences of CPUT Libraries in the introduction of RDM services; and

(c) to identify practices, suggestions and recommendations for the implementation of RDM services.

1.4 Research questions

(a) What are CPUT Libraries' current RDM services?

(b) What were the experiences of CPUT Libraries in their introduction of RDM services?

(c) What challenges were encountered by CPUT Libraries when implementing RDM services?

(d) What are the recommended strategies for implementation of RDM services in a higher education institution?

1.5 Motivation for the study

The research output from universities has a direct impact on people's lives; it contributes towards the development of a society, among other things (Pryor, 2012:4). The importance and value of RDM and the role of academic libraries motivated this study. Funding bodies and national governments are seeking return on investment in their funded research, and are demanding transformation in the handling of data. The expectation is that research data be a recognised asset contributing towards more research production. It is important that HEIs recognise the potential of data management by providing services that support research data produced in their institutions. Academic libraries that are currently implementing or intend to implement RDM will be able to refer to this study for data practices and recommended strategies for the implementation of RDM in their respective institutions.

1.6 Overview of the research methodology

A case study research design was chosen for this study, using a qualitative research approach. Document analysis of published CPUT documents on RDM services, and interviews of purposively selected library staff were the research methods used. Chapter 3 will discuss in detail the research methodology of this study and the reasons for the choices made.

1.7 Delimitations of the study

This study is delimited to CPUT, as it seeks to identify the activities of RDM and services provided at CPUT Libraries. CPUT was chosen for this study because it is one of the institutions that has taken initiative in implementation of RDM. As a result, there are no comparisons that have been done in this study. Participants in this study were purposively sampled to meet certain criteria, for example, being knowledgeable about decision-making and policy formulations around the introduction and implementation of RDM, or being involved in the execution of RDM services; the study intentionally did not include all staff in the study. The annual reports of the library that were chosen for analysis for this study were delimited to those produced in the years 2015-2018, because data was collected between the years 2018-2019, and by then the 2019 and 2020 library annual reports were not available on the public domain. Later, when available and upon perusal, there was not much said about RDM, as it was already implemented. As these documents, as well as the formally published article included for document analysis, were produced by the Director of CPUT Libraries, it was decided not to include him as a study participant.

1.8 Outline of the research report

The research report consists of five chapters. The current chapter introduces the study problem and research objectives. Chapter 2 is a literature review and discusses published information related to this study. The Digital Curation Centre (DCC) lifecycle model is discussed in detail as it guides the investigation of the study. Chapter 3 discusses in detail the research methodology used in this study, and includes research approaches, research design, data collection methods, population, sampling, limitations and ethical considerations. Chapter 4 presents the findings, where data from document analysis is discussed, and interviews presented. In Chapter 5, data is interpreted, accompanied by recommendations and conclusions. The limitations of this study are acknowledged, and suggestions for further studies made.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

The reviewing of literature is important, as it helps the researcher become familiar with the available information related to the study, and of current issues, terms and concepts associated with the study (Neuman, 1997:89). The literature review gives the researcher a better understanding of the topic including views, ideas, theories and research approaches identified in the literature (Machi & McEvoy : 2009:1; Bless, Higson-Smith & Sithole: 2013:49).

This chapter starts with a background discussion on HEIs in South Africa, and their role in research production. The data lifecycle models are explained with emphasis on the Digital Curation Centre (DCC) lifecycle model, as it guides the investigation of the study. This is followed by a discussion on the implementation of RDM in HEIs and the role academic libraries play in RDM. Librarians' roles in RDM services are also discussed in this chapter. This chapter ends with a discussion of the RDM landscape in South African HEIs.

2.2 The South African university landscape

After the implementation of the new South African government in 1994, there was a transformation in higher education, which led to the restructuring of HEIs. Three types of universities emerged: traditional universities, comprehensive universities, and universities of technology (UoTs). The changes in the higher education landscape resulted in the term 'university' being applied to all three types of institutions, even to those that were previously known as technikons (Hart & Kleinveldt, 2011:38). The expectations were that all universities would be able to fulfil the traditional role of contributing towards social, political, and economic development (Hay and Monnapula-Mapasela, 2009:12). Along with this was the expectation that all would engage in research, meaning that the nature of some of these institutions, particularly the former technikons, had to change to some extent (Hart & Kleinveldt, 2011:38). Previously, the focus in technikons (which are now UoTs) was to produce career-oriented and vocational programmes. CPUT is an example of a UoT, which is expected to participate in research production. Institutions engaged in research needed to provide relevant services to support their research.

2.3 The role of universities in research production

Knowledge production is one of the primary functions of a university and universities, especially those that see themselves as research-led, have developed policies to promote research production in their institutions (Bleiklie & Powell, 2005:6). Both academic institutions and researchers themselves are rated according to their research output, and their

contribution towards the research landscape. According to Pouris & Inglesi-Lotz (2014:3), in South Africa, universities have been identified as the main repository of knowledge, producing more than 85% of the country's publishable research.

The South African government has established policies that are meant to encourage and stimulate research production among HEIs. For example, the Research Policy Outputs of 2015 that replaces the Policy and Procedures for Measurement of Research Output of Public HEIs of 2003 is one such policy (Department of Higher Education & Training, 2015). The aim behind this policy is to sustain current research strength among institutions, and to promote research and other research outputs required to meet the national development needs by rewarding quality research output (Department of Higher Education & Training, 2015:7). NRF contributes towards national development by supporting, promoting and advancing research and human capacity development through funding (NRF, n.d.). The NRF has recently introduced a new postgraduate funding policy to enhance equity of access to funding for postgraduate students, where one of its objectives is that the supported individuals become future knowledge producers of the country (NRF, 2020:7).

2.3.1 Institutional support for research

The developments in scholarly communication and the greater focus on research production are challenging institutions to offer a wider range of services and facilities for researchers (Chawinga & Zinn 2021:98; Corrall, 2014:18). HEIs all over the world are addressing challenges and expectations of the 21st century researcher. Academic libraries are enhancing their role, by providing, among other support services, RDM services to their research communities.

2.4 Data lifecycle models

In RDM, lifecycle models are used to ensure effective management of research data. Several models have been developed to guide data management activities (Lee & Stvilia, 2012:31). The DCC's Lifecycle Model (Higgins, 2008), GeoSpatial Data Lifecycle (Faundeen & Hutchison, 2017:e1117) and Data Observation Network for Earth (DataONE) (DataOne, 2018) are just some examples of data lifecycle models. The DataONE Lifecycle Model, as an example, is described as a "data lifecycle model that provides a high-level overview of the stages involved in successful management and preservation of data for use and reuse" (DataOne, 2018). The stages of the model appear in this order: plan, collect, assure, describe, preserve, discover, integrate, and analyse (DataOne, 2018).

Lifecycle models help to focus attention on issues of data quality and documentation, at the same time taking into consideration the activities associated with creation, preservation and sharing of research data by providing guidelines and stages that can be followed (Carlson, 2014:63). Carlson (2014:65) mentions that applying lifecycle models to managing and curating

research data has several benefits. The lifecycle approach, for example, ensures that all the stakeholders involved in scholarly communication processes are doing their part in the management of data. In addition, lifecycle models provide a useful framework to identify and develop data services (Carlson, 2014:65). The Digital Curation Centre's (DCC) Lifecycle Model provides guidelines that address data management issues (Higgins, 2008:137).

2.4.1 Digital Curation Centre Lifecycle Model

A framework is used by researchers in approaching research with certain underlying assumptions arising from their theoretical and conceptual perspectives (Collins & Stockton, 2018:5). The DCC Lifecycle Model is referred to as a "recognised conceptual framework for carrying out digital curation activities" (Hswe, et al. 2011:196) and was used in this study to guide the investigation into RDM services because it "provides a graphical high-level overview of the stages required for successful curation and preservation of data from initial conceptualisation or receipt" (DCC, n.d.).

The model "can be used to plan activities within an organisation or consortium to ensure that all necessary stages are undertaken, each in the correct sequence to define roles and responsibilities, and to build a framework of standards and technologies to implement" (DCC, n.d.). The DCC Lifecycle Model is referred to as 'data-centric model' as it "supports a holistic approach to RDM infrastructure development and optimisation and can be used to help organisations map RDM activities and support across functional and operational units" (DCC, n.d). The DCC Lifecycle Model can be seen in Figure 2.1, with 'Data' depicted as central. Its stages are discussed in detail below.

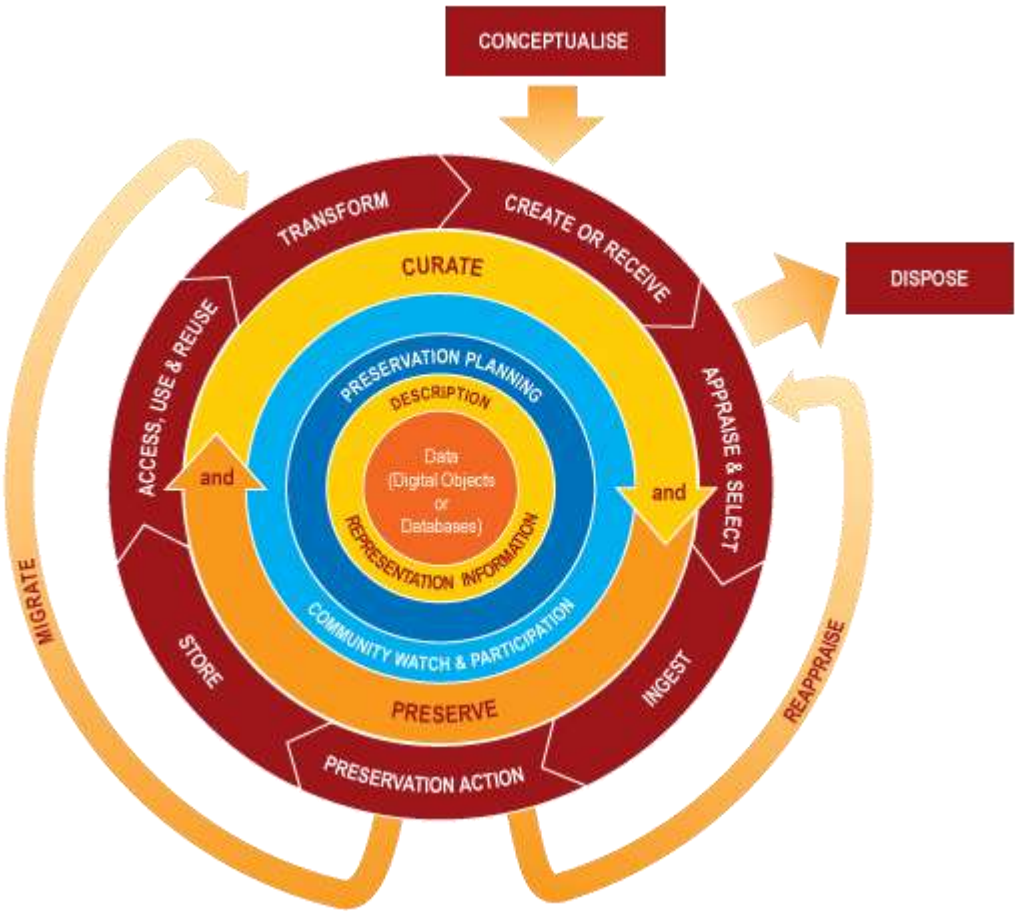


Figure 2.1: DCC Lifecycle Model (Higgins 2008:136)

2.4.1.1 Full lifecycle actions

Full lifecycle actions are those that ought to occur continuously throughout the life of the data. They are presented on the model by concentric circles. These actions include:

(a) Description and representation information

The description and representation of data includes assigning administrative, descriptive, technical, structural and metadata to the data, using appropriate standards. This is done to ensure adequate description and control of data over a long-term period (Higgins, 2008:137).

(b) Preservation planning

This action is planning for preservation throughout the lifecycle of digital material. Preservation planning would include making plans for management and administration of all curation lifecycle actions (Higgins, 2008:137). The preservation action stage is where curators communicate with researchers to develop and document metadata for their specific research data (Lee & Stvilia, 2017: e0173987).

(c) Community watch and participation

This action focuses on maintaining a watch on appropriate community activities, and participating in the development of shared standards, tools, and suitable software for curation (Higgins, 2008:137).

(d) Curate and preserve

The management and administrative actions planned to promote curation and preservation should be maintained throughout the curation lifecycle (Higgins, 2008:137).

2.4.1.2 Sequential actions

These actions are in red on the lifecycle model and as the title suggests, they occur in sequential order. Moreover, as the lifecycle suggests, they are continual as data is transformed or reappraised over time (Higgins, 2008:138; DCC, n.d.).

The order of sequential actions is as follows:

(a) Conceptualisation

The DCC's Lifecycle Model has its critical starting point at the research conceptualisation stage, this stage ensures that all necessary phases of curation are planned and undertaken in the correct sequence (Pryor, 2014:6). This is where workflows and technical issues related to data are addressed (Higgins 2012:23). The conceptualisation stage is designed to identify the following activities:

- how data will be captured
- how data will be identified and described
- how data and its descriptions will be stored and recovered when required (Higgins, 2008:138)

The legal and ethical frameworks, intellectual property, and funder's requirements, such as depositing in a particular data repository, influence decisions about the above activities (Higgins, 2012:23). Discussions between the researcher and data repository staff, for example, ought to take place to address the repository's capabilities of taking care of the data (Higgins, 2014:24). A repository may mandate the use of certain technologies, such as data capture tools, file formats, or metadata standards. A discussion at this stage would ensure that data can be readily integrated into existing systems.

(b) Create or receive

This stage of the model refers to where the actual creation of the digital material including administrative, descriptive, structural, and technical metadata takes place (Higgins, 2008:138). Focus is placed on ensuring that data created is fit for curation (Higgins, 2012:84). This is also where decisions about data accessibility are realised, as data may be private, sensitive, restricted, or public. This is done to protect the organisation's intellectual property as well as the rights of the creators (Higgins, 2007:85).

(c) Appraise and select

The appraisal and selection stage of the model includes the activity of evaluating data, in order to decide which to retain over the long term and which to retain for the short-term, and which to discard (Higgins, 2012:28). Data appraisal and selection is important as it ensures that relevant data will be available for reuse when needed. Data ought to be appraised and selected in an organised and regular manner and this needs to be documented for reference (Higgins, 2008:138).

(d) Ingest

Ingest stage refers to the process of formally transferring and submitting data to a curation environment such as a repository (Higgins, 2008:138; Higgins, 2012:30). Data repositories are particularly concerned with the curation of, preservation of and accessibility to research data and should ensure high quality management of data deposited in them (Lee & Stvilia, 2017:e0173987). The international standard Reference Model for an Open Archival Information System (OAIS), for example, demonstrates an ideal structure for a data repository and many digital repository technologies, or digital asset management systems, are built using this model (Johnston, 2017:133 & Higgins, 2012:30).

(e) Preservation action

The preservation action stage of the model is important to undertake to ensure long-term preservation and retention of data (Higgins, 2008:138). Preservation actions ought to ensure that data remains authentic, reliable, and usable, while maintaining their integrity (Ray 2016:1). The actions include validation, assigning preservation metadata, and ensuring that acceptable data structures or file formats are used (Higgins, 2014:32). Carlson (2014:65) points out that a preservation plan in data curation ought to be reviewed and revised at regular intervals, and that the plan should document actual activities that will be undertaken so as to ensure longevity of data. A major aspect of data curation is preservation work and a survey done at the Hong Kong University of Science and Technology (HKUST) libraries revealed that a majority of data managers reported that their institutions have a policy for preservation of research data (Wong, 2009: 126).

(f) Store

The storage stage of the model is concerned with the technical capabilities of a repository. Ethical considerations, legal issues, and governance frameworks are taken into consideration when storing data in a repository (Higgins, 2008:138). Higgins (2012:34-35) points out that storage facilities, comprehensive backup policies, and disaster recovery plans are all important for the longevity of data. Consideration should also be given to timely refreshment of storage media to protect data against obsolescence, physical decay, and rot (Higgins, 2012:35). The challenge for this stage (as well as the ingest and preservation action stages) is to store, preserve, and manage research data effectively and efficiently to maintain its authenticity and integrity for future users (Higgins, 2012:36).

(g) Access, use and reuse

This stage of the model ensures that data is accessible to both designated users and reusers, on a day-to-day basis. Access controls and authentication procedures may be applied at this stage (Higgins, 2008:138).

(h) Transform

This stage of the model refers to when data is transformed from the original data created, by migrating it into different formats, or creating a subset of it (Higgins, 2008:138). Data transformation results from the previous stage. Use and/or reuse allows data to be transformed in different formats over time whenever there is a need (Heidorn, 2011:668).

2.4.1.3 Occasional actions

The model helps with the process of identifying additional steps that may be required, or actions that are not required, by certain situations or disciplines, and ensuring that processes and policies are adequately documented (DCC, n.d.). These additional steps are referred to as occasional actions and are discussed below:

(a) Dispose

Data that has not been selected for long-term curation and preservation should be disposed in accordance with documented policies, guidance, or legal requirements (DCC, n.d.). When disposing data, the following may happen:

- Data may be transferred to another archive, repository, data centre, or other custodian.
- Data can also be destroyed when not needed and, depending on the nature of data, considerations should be made regarding how it is destroyed (Higgins, 2008:138).

(b) Reappraise

Re-appraise refers to the return of data that has previously failed validation procedures when submitted previously during the appraise and select stage. Data can be submitted again, and further appraisal and re-selection can be done (Higgins, 2008:138).

(c) Migrate

This action involves the migration of data to a different format. This may be done because the storage environment is no longer compatible or to ensure data's immunity from hardware or software obsolescence (Higgins, 2008:138).

The DCC Lifecycle Model stages discussed above are important in the implementation of RDM, as they explain fully the lifecycle of research data. RDM roles and responsibilities can be identified using the model. The lifecycle model brings together all the stakeholders involved in the creation and maintenance of data. It allows institutions to understand and apply the needed strategies when introducing and implementing RDM services.

2.5 Introduction of RDM services at HEIs

Ray (2014:9) acknowledges that HEIs implement RDM in their institutions differently, however "the lifecycle model concept has helped focus attention on issues of data quality and documentation at the time of creation as this is critical to data-driven research, as well as for successful data preservation and sharing" (Ray, 2014:10). At the stage of planning for the introduction of RDM services at an institution, the literature recommends assessing the needs of researchers in relation to data and piloting services before rolling them out in full. Often, the academic library is responsible for these activities.

2.5.1 Assessment of researchers' RDM needs

User needs are important when introducing and implementing RDM services. User needs assessment help to better understand the target audience's needs and motivations for using a curation service (Lee & Stivlia, 2017: e017398). Formal assessments of researchers' RDM needs are conducted by many academic libraries. The assessments are undertaken to understand researchers' data management practices and to identify gaps in data-related services at the institution, with the goal of informing the development of new programs to support RDM (Peters & Dryden, 2011:387 A.R.; Swan & Brown, 2008:20-22). The University of Oregon Libraries, for example, conducted a data services needs assessment which provided insights to the libraries about RDM needs and possible service areas, and also helped to identify potential partners for pilot data curation projects (Westra, 2014: 379).

2.5.2 Piloting of RDM

Piloting services serve to identify those services that are “fit for purpose and to introduce a phased rollout that may be appropriate to ensure RDM uptake” (Jones, Pryor & Whyte, 2013:3-4). The RDM team at the University of Maryland (University of Maryland, 2013) outlined specific activities that libraries could provide to support RDM; running of pilot projects was one of the recommendations put forward by the team. The pilot study done by the University of Oregon Libraries (Westra, 2014:380) provided useful information about important considerations, such as RDM integration with research workflows, technology considerations, and data usability. At the University of Edinburgh, the steering group on RDM services established preliminary pilot studies, namely: one on data management planning, focusing primarily on the use of the DCC’s DMPonline tool, and the other one on research data storage facilities (Jones, Pryor, & Whyte, 2013:4). These pilot activities led to the continued roll-out and maturation of RDM services at the university (University of Edinburgh, 2015).

A study conducted among six academic libraries (Read et al., 2019) showed that piloting RDM services helped librarians to learn about, engage with, and enhance their RDM skills within their research communities. The study (Read et al. 2019) reported that piloting RDM services resulted in finding out about RDM training needs for both library staff and researchers.

The University of South Africa (UNISA) launched a pilot project to deal with data curation activities whereby research data from certain researchers was identified for preservation and access (Macanda, Rammutloa & Bezeidenhout, 2015). At the time of writing the University of South Africa's (UNISA) RDM strategy document is still a work in progress and its RDM policy has recently been approved in August 2021 (Unisa, n.d.).

2.6 RDM services in academic libraries

There are a number of RDM services that support the lifecycle of research data. Through the assessment of needs of their researcher community, institutions are able to choose which services to offer based on researcher needs. They might then choose to pilot some or all at different stages.

In academic libraries, according to Corrall, Kennan and Afzal (2013:645), studies of library engagement in RDM began to emerge in 2008. The emerging need for RDM has prompted library directors to plan for RDM services to be offered by their libraries in their respective institutions (Tenopir et al., 2014: 84). Hickson et al. (2016:253) agree that data has become the new “buzzword” in academic libraries. Libraries around the world have seen the need to ensure that “datasets are managed successfully through proper description, indexing and storage for long-term preservation and availability” (Bracke, 2011:72).

RDM services in libraries support digital curation activities such as planning, selection, preservation, maintenance and archiving, as well as metadata creation and conversion to

allow discoverability (Riley, 2014:150; Tenopir, 2013:70). Cox and Pinfield (2014) identified three levels of service, namely “basic”, “well developed” and “extensive”, thereby emphasising that RDM services can cover a range of different RDM activities.

Yoon and Schultz (2017) conducted a study to examine RDM services in academic libraries in the USA using four main areas of focus: service, information, education, and networking between libraries involved in data management. The study revealed that not all libraries were in the same phase of providing RDM services due to different perceptions and needs related to data management at their institutions, as well as the influence of institutional capacity and policies (Yoon & Schultz, 2017).

Akers et al. (2014) studied eight research universities, among them, the Cornell University Library, John Hopkins and Purdue University, to report on the state of RDM support at these research universities, and to give an insight into how these support programmes emerged and evolved overtime (Akers et al., 2014:172). All the institutions surveyed provided RDM services and the study found that despite general commonalities, such as data management planning support and data repository services, the timelines of the different universities were clearly very different from one another, and the institutions had their own unique paths toward developing RDM support (Akers et al., 2014:183).

The study done by Tenopir et al. (2014:84) sought to identify practices, suggestions, and recommendations for the successful implementation of RDM services at North American academic research libraries. The intention of the study was to enable practitioners, administrators, and educators to make strategic RDM plans in academic research libraries and guide the evolution of curricula in Library and Information Studies (LIS) education (Tenopir et al., 2014:86). About half of the respondents to the survey had on-campus support units for research data (Tenopir et al, 2014:85).

In the study (Tenopir et al., 2014:85), library directors and librarians that were involved in covering specific RDM services offered or planned to be offered in their institutions were asked questions related to consulting and involvement with technical and hands-on RDM services. The study revealed that RDM development and the importance of RDM services at institutions varied (Tenopir et al., 2014:85). For example, the study found that the most common services offered were extensions of traditional informational or consultative services, such as helping faculty members and students locate datasets or repositories, but that a small, but growing number of libraries were becoming increasingly involved with research data, from helping with data management plans, to preparing and preserving research data for deposit in repositories (Tenopir, 2014:89).

2.6.1 Components of RDM support services

The DCC's guide to developing RDM services (Jones, Pryor and Whyte, 2013) has been used in this section to guide the discussion on the different aspects of an RDM service a HEI could offer. Johnston (2017:1) refers to the guide as a "comprehensive and well-presented overview of the issues" associated with RDM services. The guide can help institutions understand the key aims and issues associated with planning and implementing RDM services (Jones, Pryor & Whyte 2013). The aspects of RDM services will be discussed based on Figure 2.2 before a detailed discussion on actual services that could be offered at libraries in 2.6.2.

2.6.1.1 RDM policy, strategy and business case

Figure 2.2. shows 'RDM policy and strategy' needs to be considered for the implementation of RDM services. According to Chawinga and Zinn (2020:2), planning and policy decisions are considered to be one of the fundamental aspects of implementing RDM at an institutional level. According to Andrikopoulou, Rowley and Walton (2021:2), a majority of UK universities have prioritised the development of an institutional RDM policy. When a policy is developed, it helps in defining the institution's core RDM principles and establishes a framework for the services to be delivered (Jones, 2014:91; Mullins, 2014:25; Rice & Southall, 2016:69). An institution shows commitment to RDM by implementing an RDM policy. The University of Sheffield Data Management Policy, for example, was developed in response to the expectations of researchers about RDM support (Jones et al., 2013:14). The policy states that the University will provide support for RDM, including infrastructure, and that services will be developed in consultation with researchers (Jones et al., 2013:14)

A formal policy provides a clear path for all the stakeholders involved in RDM in an institution (Cox & Verbaan, 2018). Westra (2014:388) suggests that the development of institutional policies for RDM ought to be a collaborative effort. Cox et al. (2017:2182) meanwhile agree that the implementation of RDM policies lies with several stakeholders, such as the library, IT services, the research office, the legal office, academics, and university management.

Cox et al. (2017:2182) reported on an international study of RDM activities, services, and capabilities in higher education libraries in Australia, Canada, Germany, Ireland, the Netherlands, New Zealand, and the UK. The results indicate that libraries have provided leadership in RDM, particularly in advocacy and policy development. As for policy, strategy development ensures that RDM services develop in a coherent way and start from understanding the current position of the institution (Jones, 2014:93).

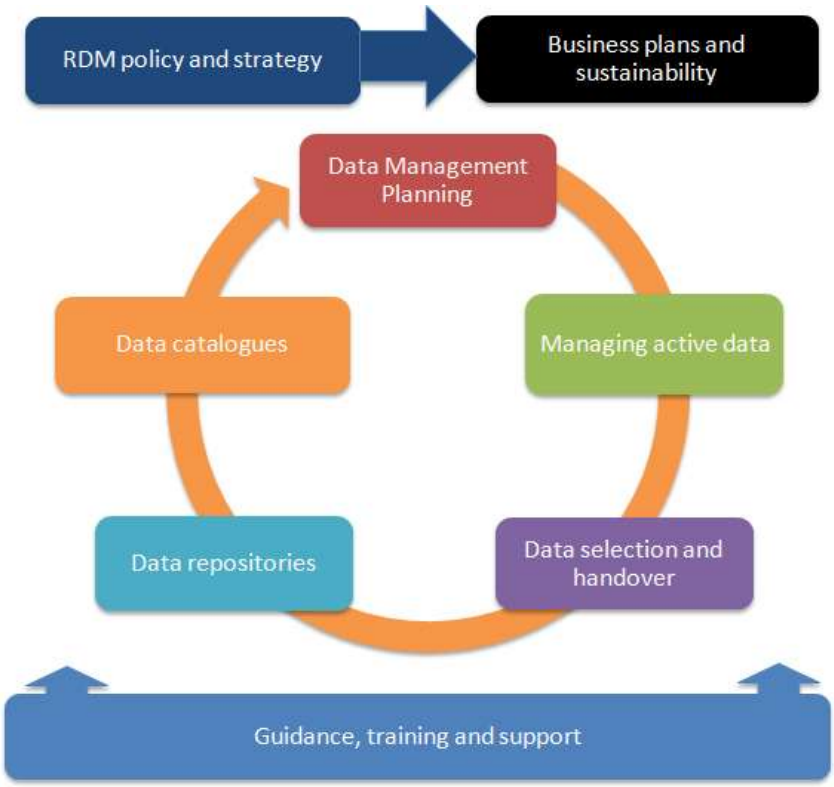


Figure 2.2 Components of RDM support services (Jones, Pryor & Whyte, 2013:4)

The development of a business plan is important, as it helps in acquiring resources and funding needed for RDM implementation in an institution. Dasler, Munoz and Nilsen (2013) emphasised the importance of university management when introducing and implementing RDM in an institution. The business plan provides an opportunity "to win management approval and reach an agreement that resources will be committed to ensure that services can be sustained" (Jones, Pryor & Whyte 2013:10).

2.6.1.2 Data management planning

Data Management Plans (DMPs) are a necessity for grant applications and often a funder requirement for data sharing (Lefebvre, Bakhtiari & Spruit, 2020: 29; Sallans & Lake, 2014:88; Verbaan & Cox, 2014:215). Figure 2.2 shows data management planning as needing to be offered in the beginning of the RDM support services cycle. Fearon (2013) in Kouper et al. (2017:159) noted that many libraries started their RDM services with support for DMPs. DMPs are required, as governments and research-funding bodies have to demonstrate transparency and value for money (Jones, Pryor & Whyte 2013: 10). DMPs ought to include all the relevant data related aspects of a project across its entire lifecycle, from conceptualisation to long-term deposit and disposal if applicable (Pryor, 2014:55; Donnelly, 2012:87).

A survey done by research data services in the ARL revealed that basic DMP assistance tops the list of services concerning research data (Tenopir et al., 2014:85). Researchers at the University of Oregon looked to the library to take a leadership role in educating and supporting scientists who would be formulating their DMPs (Westra, 2014:383).

2.6.1.3 Managing active data

In Figure 2.2., services offered once research is underway relate to managing active data. According to the University of Sheffield RDM Policy (2015), “managing active data starts from the initial drawing-up of a research proposal and grant application.” Once underway, a research project will collect or create raw data, which, during the project, will usually be processed to create processed data (University of Sheffield, 2015). All these sets of data are considered active data, which will need to be quickly accessible and easily shared between collaborators (University of Sheffield, 2015).

During the management of active data, there are two primary concerns for which RDM services can offer support:

- provision of sufficient data storage for researchers to store their data during the active phase of research; and
- provision of relevant applications and functionality for the access, use and sharing of data by researchers and their collaborators during the active phase of research (Jones, 2014:98-99).

2.6.1.4 Data selection and handover

The next aspect of an RDM service, as shown in Figure 2.2, is the selection of which data to keep and which to discard, which happens once the active research phase is over. Data handover is about managing the transition of data into a data repository. Data repositories ought to be clear about what services they offer and researchers need to know what is expected of them during handover (Jones, 2014:102).

2.6.1.5 Data repositories

Data repositories are shown to be the next component of an RDM service. RDM has prompted the development of data repositories in HEIs and other research institutions in support of scholarly research (Gordon, et al., 2015:eP1238; Tenopir et al., 2014:85). A data repository refers to a storage entity of data, and data repositories make data accessible, shareable, and provide secure preservation (Johnston 2017:47). As researchers require infrastructure to ensure maximum reliability and accessibility of research data to facilitate reuse as well as sharing of research data, data repositories have come into existence. The objective of data repositories is sharing and preserving data (Jones, 2014:103; Kimpton & Morris, 2014:234; Walters, 2014:190).

McNeil (2016:15) and Pampel et al. (2013:3) have identified the following different types of research data repositories:

i) National or Government Data Repositories

Countries or regions provide extensive government infrastructures for storing and sharing research data, such as ReShare from the UK Data Service or Zenodo from the European Union. Some have specialised functions as domain repositories, are influenced by the national or funder research affiliation (McNeil, 2016:15).

ii) Project Specific Research Data Repository

These repositories have a specific focus on the research data resulting from particular research projects and are diverse. For example, the Scientific Drilling Database (SDDB) and German Research Centre operates the SDDB. The SDDB focus is on public dissemination of drilling data (Pampel et al., 2013:4).

iii) Domain-Specific Research Data repositories

Data repositories are sometimes domain-specific, or are referred to as disciplinary-specific repositories as they focus on a particular subject realm. These types of repositories are sometimes associated with large data centres, for example, the North American Electric Reliability Corporation, which stores American energy data resources (Pampel et al., 2013:4). The business model of these repositories identifies who is eligible to deposit, or how open is the data for public use, including data curation activities that the repository can provide (McNeil 2016:19).

iv) Institutional Research Data Repositories

Institutional research data repositories are run by an institution such as a university, and store data produced by researchers from that particular institution regardless of subject. The re3data.org is a global registry of research data repositories from different academic disciplines and it began to register repositories in 2012 (Pampel et al., 2013:3).

Repositories are an essential part of the digital infrastructure, and must meet high standards of trustworthiness (Ray, 2014:6). In data curation, researchers need to know what is expected of them during all the phases and should be made aware of the data repository processes and activities concerning their research data (Jones, 2014:99). The challenge in storing research data is to ensure that data is stored in a secure manner and can be discovered by secondary users and be used with confidence, with its authenticity and integrity assured (Jones, 2014:99). Repositories typically allow instant searching, retrievability, linking, and downloading of data (Jones, 2014:99).

The FAIR principles suggest that data must be findable, accessible, interoperable and usable and these are considered basic principles of data management in a repository (Wilkinson et al., 2016).

2.6.1.6 Data catalogues

Figure 2.2 show data catalogues as the next aspect in the RDM services lifecycle. A data catalogue is defined as “a collection of metadata, combined with data management and search tools, that helps data users to find the data that they need, serves as an inventory of available data, and provides information to evaluate the fitness of data for intended uses” (Wells, 2020:5). The Research Councils UK (RCUK) say published results should always include information on how to access the supporting data (Jones, Pryor & Whyte 2013:18*)*.

2.6.1.7 Guidance, training and support

Figure 2.2 shows guidance, training and support at the bottom of the diagram. The aspect of guidance, training, and support indicates that RDM services ought to include support services to researchers throughout the research process (Pinfield, Cox, & Smith, 2014: e114734). RDM support services assist researchers to manage their data proactively, and thereby comply with data sharing requirements from funding agencies and journal publishers (Briney, Goben, & Zilinski, 2017: 61; Keralis et al., 2014).

2.6.2 Role of libraries in RDM services

The traditional library skills that can be transferred to RDM include advisory and support services (data advisory services), information literacy (data literacy), management of repositories (data repositories), and metadata management (Chawinga & Zinn 2021:98). Cox et al. (2018:1433; Antell, et.al, 2014:571) note that the role that libraries can play in RDM services is an extension of traditional library services. The potential data management role for librarians can be informational, instructional, infrastructural, cooperative, collaborative, and/or archival (Keralis et al., 2014). According to Brochua and Burns (2019:52), librarians are becoming increasingly involved with the research process, and provide relevant research support, RDM being one such form of support.

The study done by Yoon & Schultz (2017) was important in order to understand how libraries were supporting the management of research data in their institutions, and how they were planning to develop services in future. Researchers need to know what data services are provided in libraries, and to understand the role that librarians can play in RDM (Scaramozzino Ramírez & McGaughey, 2012:350). Coates (2014:55) mentions that “as research continues to evolve, policy landscape changes, infrastructure advances and interdisciplinary standards emerge data specialists and librarians must stay informed in order to identify new opportunities and recognise when services are no longer relevant.” Whitmire, Boock and Sutton (2015:382)

mention that RDM practices in an institution are critical towards informing progressive development of RDM services.

2.6.2.1 Data management planning support

Giving assistance with DMPs is a basic library support service that serves to ensure researcher compliance with research funders. Supporting data management planning is regarded as a specific aspect of a library's advisory service, but which is often seen as a service in itself, due to its importance (Cox & Verbaan, 2018). Data management planning services include providing templates or guidance on what to include in DMPs (Jones, 2014:95). Some institutions provide data planning checklists. In HEIs, librarians are helping researchers by developing these checklists on their websites to help researchers when compiling DMPs.

Some DMP services have been created to make the creation of DMPs quicker and easier. The DMPTool, for example, includes DMP templates, along with information and assistance to guide libraries through the process of creating a ready-to-use template for their users (Jones 2014:95; Fearon, et al., 2013:14). The DCC's DMPonline tool is similar, helping libraries create, review and share data management plans that meet institutional and funder requirements (DCC, n.d.).

2.6.2.2 Data advice and guidance

The role of libraries in RDM includes providing advice to researchers about data management. This advice can be early in the research lifecycle (Brown, Bruce & Kermohan, 2015:226), or at later stages, such as about data storage, or file security (Berman, 2017: e1104). The advice and guidance role includes consulting with researchers or students on what support and training are needed. Advice and guidance can cover several areas from creating awareness about the importance of RDM, to sharing with researchers best practices concerning the whole data lifecycle (Lee & Stivlia, 2017: e017398).

Librarians provide advice to researchers about data organisation and data sharing, and introduce researchers to data tools available in the institution (Swan & Brown, 2008). The reluctance of researchers in sharing their data can be addressed when advising, supporting and providing guidance to them about RDM (Lefebvre, Bakhtiari & Spruit., 2020:21).

Many university libraries are offering web-based guidance to researchers on best practices (Conrad et al., 2017:65; Yoon & Schultz, 2017).

2.6.2.3 Training and support

Data literacy training among researchers and postgraduate research students is of central importance. The topics taught may include introducing data management concepts, the

creation of DMPs, benefits and advantages related to sharing data, and the services and tools provided by the library in support of RDM (Poole, 2015:124). Brochua and Burns (2019:52) have noted that, "As librarians are on the front lines of data discovery, re-use, collection, and management in all formats, it only makes sense that they should be involved in the education and support of researchers to understand the best way to conduct research."

Training of researchers can be done both formally through a website or in a classroom and informally, as questions from academics come up. Different training options are crucial, as researchers may differ in their RDM support needs (Westra, 2014: 381).The University of Oregon, for example, started its RDM training by holding stand-alone workshops for training researchers in RDM and eventually a data management website was developed (Westra, 2014:382). Other libraries, including the University of Minnesota and the California Digital Library, provide workshops on data management, have individual discussions or consultations with researchers, or host other outreach activities, depending on what is needed (Conrad et al., 2017:65). Depending on individual cases, researchers may require more hands-on and tailored support on RDM (Westra, 2014:382).

2.6.2.4 Repositories and metadata services

Research data need to be properly described in order to be discoverable and reusable (Jones, 2014:104). Data curation services offered by libraries may include the application of metadata to make the data more accessible, easier to understand, or to contextualise it as a part of a larger collection (Carlson, 2014:65). Lee and Stivlia (2017: e017398) refer to metadata creation management as one of the essential components of research data curation. Librarians are metadata experts and so can offer services related to metadata. They can also offer services that include enabling data discovery and citability through assigning permanent identifiers to datasets or developing policies and platforms, so as to ensure the data are preserved for long-term access (Carlson, 2014:65). The international RDM activities, services, and capabilities in higher education libraries in Australia, Canada, Germany, Ireland, the Netherlands, New Zealand, and the UK emphasised technical services such as the provision of a data catalogue (Cox et al., 2017), also a RDM service libraries often offer.

Cox & Pinfield (2013:299) and Jones, Pryor and Whyte (2013) mention data repositories as a component of RDM services. According to a study done in 2015, in about 124 ARL libraries (Kouper et al., 2017:158), the establishment of a repository for data was a common step among libraries offering data services. The technical data services in academic libraries considered as basic services include the running of a data repository.

Akers and Green (2014:128) refer to institutional data repositories as being capable of playing a vital role in bridging the gap between amounts of research data hidden by users in personal hard drives, or on university servers. Hansson and Johannesson (2013:233) commented that

the new dispensation of open access has seen libraries taking the role of not only information providers, but also publishers, as many institutions have given libraries the responsibility of building and maintaining open access repositories. Yoon and Schultz's (2017) study found data depositing services to be the most frequently offered service by libraries, with many institutions having a repository link on their library websites to facilitate this service. Data depositing services include encouraging researchers to deposit their data to the repositories and how-to instructions for data depositing (Kouper et al., 2017:158). Data archived in a repository immediately enjoys a number of benefits such as making it accessible via standard searching, having unique persistent identifiers for easy referencing and citing, and providing a collection of data related to research output (Wong 2009:126).

2.6.2.5 Data curation and data citation

Other RDM services related to data include:

- data curation - management of data throughout its lifecycle such as the full lifecycle actions, sequential actions and occasional actions as mentioned above (Henderson, 2017).
- data citation - just like other research output, there should be a practice of referencing data products used in research. Data citation includes key descriptive information about the data, such as the title, source, and responsible parties (Wells, 2020:5). Libraries can play a role in constructing and teaching data citations.

2.6.2.6 Advocacy, development and increasing data-awareness among researchers

The study reported by Cox et al. (2017) mentions advocacy as one of the services on which librarians have taken up the lead in RDM. Librarians are involved in raising awareness about RDM related issues for the research community in their institutions. This includes promoting awareness of policy (Cox & Verbaan, 2018; Poole, 2015:111). Pinfield, Cox and Smith's (2014: e114734) study, which analysed data from 26 semi-structured interviews of library staff from different UK institutions, found the library had an important role to play in advocacy and in articulating the importance of RDM for the institution and its various stakeholders. Simply conducting a study about RDM can help raise awareness, as happened at John Hopkins University (Choudhury, 2014:115).

Librarians are capable of performing all the roles and serviced mentioned above, however, lack of skills in librarians can be an inhibiting factor of providing RDM services in their institutions. Hence, the development of librarians' skills is important.

2.6.3 Development of the library workforce

The development of a library workforce includes the upskilling and professional development of librarians to be ready for RDM (Swan & Brown, 2008:21). The study done on ARL libraries

explored whether libraries provided RDM skills to librarians and found a low percentage of libraries were offering training opportunities for their staff (Tenopir et al., 2014:88). Andrikopoulou, Rowley & Walton (2021:13) mention the skills and competencies needed as one of the topical issues in RDM. It is essential for library management to assist librarians with training opportunities, as well as to support library staff with the development of skills concerning data management. The library staff responsible for RDM support need to be fully updated with the RDM developments and landscape; they should be able to hold conversations with academic staff about RDM (Tenopir et al., 2014:88). Steinhart (2014:310) mentioned the importance of identification and provision of professional development opportunities for existing staff to improve their skills in relation to e-research support.

A knowledge and skills gap limits the ability of librarians to offer RDM services and librarians thus may lack confidence. Sewell and Kingsley (2017:150) mention that Kennan, Corral, and Waseem (2014) identified librarians' lack of knowledge regarding RDM topics and the Brewerton's report for RLUK (2012) that found subject librarians to be often reluctant to develop research support skills, as they did not fully understand RDM services. Flores et al., (2014:82) suggested broader roles of libraries and librarians that include integration of teaching RDM into LIS schools to provide programmes that are responding to the skills gap in the workforce. Librarians need also to develop themselves on the job, through targeted development programmes (Barbrow, Brush and Goldman 2017: 274, Antell, et al., 2014:571). Sewell and Kingsley (2017:151) recommend "on-the-job training" for librarians, who offer RDM support to researchers.

Andrikopoulou, Rowley, and Walton (2021:13) point out that "RDM practices and processes are still in a state of flux, and experience with these services varies considerably between different universities and their academic libraries", noting that "it is [therefore] reasonable to anticipate that practices will evolve further over the next few years" (2021:13). Librarians are redefining their roles by developing new skills to meet the changing institutional needs (Mayernik, 2016:977). Bryant et al. (2018) note that it is no surprise that there are opportunities for the academic library to undertake leadership roles in areas of scholarly communication including RDM, because there is a well-established base for all these activities in the library's expertise. Andrikopoulou, Rowley and Walton (2021:8) agree that "RDM can provide fertile ground for the enhancement of the identity of the modern academic library."

However, according to Westra (2014:388), RDM services are highly dependent on healthy partnerships between libraries, information technology, research support, academic staff, and graduate students. Corrall, (2012); Verbaan & Cox (2014a); Verbaan & Cox, (2014b) and Pinfield, Cox, & Rutter (2017) agree, and mention collaborations within the institution as an important aspect in RDM. Institutional partnerships are also mentioned by Brandt (2014:338)

at Purdue University between the library, IT units and the university research administration to advance RDM.

2.7 RDM landscape in South African HEIs

The literature shows that South African HEIs are beginning to establish to some extent RDM services in their institutions. A number of academic institutions have developed or are in the process of developing policies regarding RDM services. The implementation of RDM in South Africa is influenced by the NRF requirement for open access to research data. As mentioned in the previous chapter, the NRF is a major research funding institution and requires its funded research, including data, to be openly available to the public (NRF, 2015).

South African institutions that have implemented or are in the process of implementing RDM services include CPUT (the current case study), the University of Cape Town (UCT), and University of Pretoria (UP) to mention a few. UCT has an online data repository called ZivaHub, powered by Figshare for institutions. The UCT data repository allows research data to be cited, discovered, and reusable. UCT's RDM policy was approved as from 2018 (UCT n.d.). The University of Pretoria has replaced the UP Policy for the Preservation and Retention of Research Data of 2007 with the Research Data Management Policy of 2017 (UP, n.d.). UP has a research support page on the library website that provides guidance on how to load data to its data repository (UP, n.d.). The development of RDM services in SA HEIs exists at different levels, and the approaches that have been adopted by institutions differ.

The promotion of RDM by entities such as the Data Intensive Research Initiative of South Africa (DIRISA) and ILIFU, which is operated by a consortium of universities in the Western and Northern Cape, have significant plans for the development of RDM infrastructure for big data (Chiware & Mathe, 2015:6). Chiware and Becker (2018:4-5) mention that CPUT Libraries has played a key role in the development of RDM (policies and guidelines) for the regional ILIFU Tier 2 Data Intensive Project.

Chiware and Mathe (2015:4-5) have pointed out that Van Deventer & Pienaar (2015) mentioned that the National Integrated Cyberinfrastructure System (NICIS) is putting systems in place towards the realisation of technical infrastructures and services for data processing and connectivity required to enable data exchange, collaborative work, and remote access. The IT infrastructures and digitisation activities that exist in many South African universities today, together with national initiatives and communities of practice like the Network of Data and Information Curation Communities (NeDICC) (Van Deventer & Pienaar 2015) will provide the basis for the growth and development of RDM services in research and academic institutions in South Africa (Chiware and Mathe 2015:3-4).

The proposed National Innovation Information Portal, the DIRISA initiatives, the High Computing Performance Centre, the NRF, the National Digital Library initiative and NeDICC

are some national strategies that support RDM development in South Africa (Chiware and Mathe 2015:3). In time, the initiatives mentioned will all eventually enable the preservation and storage of research data nationally Chiware and Mathe (2015:3). The developments in RDM, including the provision of effective infrastructure mechanisms such as repositories are vital in research production. HEIs are required to demonstrate commitment in the provision of such services in support of researchers in their respective institutions, especially those not working with big data or data of national importance.

2.8 Summary

This chapter began by discussing briefly SA HEIs and their role in research production. This was followed by discussion on data lifecycle models with particular emphasis on the DCC Lifecycle Model as it guides the investigation of this study. The introduction and implementation of RDM services is then explained based on the reviewed literature, followed by a discussion on specific RDM services in academic libraries. The RDM landscape in SA HEIs rounds off the chapter. The following chapter will discuss in detail research methodology of the study.

Chapter 3

RESEARCH METHODOLOGY

3.1 Introduction

Research is defined by Leedy and Ormrod as “a systematic process of collecting, analysing and interpreting information (data) in order to increase understanding of a phenomenon about which we are interested or concerned” (Leedy & Ormrod, 2010:2). Research involves investigating, and aims to generate knowledge about a particular phenomenon (Williams, 2007:67). This study aims to identify the experiences of CPUT Libraries in the introduction and implementation of RDM services with the intention of informing other HEIs who may be in the process of implementing or intend to implement RDM in their institutions and the methodology described in this chapter reflects this objective.

The Sage Dictionary of Social Research Methods (Jupp, 2006:175) defines methodology as “the philosophical stance or worldview that underlies and informs the style of research”. In simple terms, research methodology is a systematic way to solve a problem and is defined by Rajasekar, Philominathon and Chinnathambi (2006:5) as “the study of methods by which knowledge is gained”. Research methodology is the researcher’s general approach to carrying out the research project and includes research design, data collection instruments, target population, sample size and sampling procedure, and data analysis procedure. Research methodology also includes ensuring the reliability and validity of the study, acknowledging its limitations and remaining cognisant of ethical considerations of the study.

3.2 Research approaches

Research approaches are “plans and procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis and interpretation” (Creswell 2014:31). The selection of research approach is based on the nature of the research problem (Creswell 2014:31). The different intentions of carrying out a research project require different approaches (Williams, 2007:66). Three different approaches to research are commonly used, namely quantitative, qualitative, and mixed methods research.

3.2.1 Quantitative research

Quantitative research generates statistics using methods such as questionnaires or structured interviews (Creswell, 2014:303). Quantitative methodologies address questions about causality, generalisability, or magnitude of effect (Berman, 2017:e1104). The characteristics of a quantitative approach are not suitable for this study, and the qualitative approach was considered more relevant and applicable.

3.2.2 Qualitative research

Qualitative research focuses on discovering and understanding the experiences, perspectives and thoughts of participants (Harwell, 2011:148). It explores these things through such methods as interviews, which could be with individuals or in focus groups, which allow for collection of in depth data from participants (Boyce & Neal, 2006:2). Qualitative research methodologies are used to determine "why or how a phenomenon occurs, to develop a theory, or describe the nature of an individual's experience" (Berman, 2017:e1104). Bless, Higson-Smith and Sithole (2014:13) say that the main aim of qualitative research is to understand deeply the phenomenon under investigation. This study merits a qualitative approach, as it seeks to collect in-depth data on attitudes, behaviour, and experiences regarding RDM services at CPUT to understand current practices and implementation of these services at CPUT.

A characteristic of a qualitative research problem is that the concept under investigation is immature due to a lack of theory or previous research (Dawson, 2002:14). As explained in the previous chapter, RDM is a relatively new concept in academic libraries, and many institutions in Southern Africa are in the process of either developing RDM services as part of their existing services, or as new services.

3.3 Research design

According to Creswell (2014: 25), "research designs are types of inquiry within qualitative, quantitative, and mixed methods approaches that provide specific direction for procedures in research design."

3.3.1 Case studies

Case studies are defined as "designs of inquiry found in many fields especially evaluation in which the researcher develops an in depth analysis of a case, often a program [sic] event, activity, process or one or more individuals" (Leedy & Ormrod 2015:272; Crowe,et al., 2011:1). Case studies are "descriptive and qualitative and are usually bounded by time and activity" (Yin, 2003:19). In a case study, "the researcher needs to collect detailed information using a variety of data collection procedures over a sustained period of time" (Creswell 2014:32).

In this study, the case is CPUT Libraries and a detailed qualitative study about CPUT Libraries' RDM activities was carried out.

Evans, Gruba and Zobel (2014) describe a case study as a "preliminary investigation that seeks to establish an agenda for further research and their focus is on contemporary events." This definition of case study applies to this study in that RDM is a relatively new development in SA HEIs and the in depth analysis and findings from this study can be used as a springboard for further research about RDM services implementation in institutions.

3.4 Research methods

Data collection is the process of gathering information “that enables one to answer stated research questions” (Kabir, 2018:202). In this study, two qualitative methods were used to collect data, namely interviews and document analysis.

3.4.1 Interviews

One research method selected was face-to-face interviews, which involve primarily direct personal contact with the participant, who is asked to answer questions relating to the research problem (Bell, 2010:161). There are different types of interviews, including the unstructured interview, which involves asking respondents to comment on broadly defined issues, and the structured interviews, in which participants are restricted to answer specific questions asked in a particular way (De Vos, 2002:301). The use of open-ended questions is appropriate in qualitative research as it allows the participants the freedom to answer in the way that they feel it is appropriate (Bless, Higson-Smith and Sithole, 2014: 193; 209). The structured interview on the other hand is “mainly concerned with determining the frequency of various answers and find relationships between answers” (Bless, Higson-Smith and Sithole, 2014: 193; 209).

The semi-structured format is used in this study in order to find out views and opinions from the participants. Semi-structured interviews leave the interview with a set of responses that can be recorded (Bell, 2010:162), as done in this study. The focus of the interviews is on data management activities (for example data management planning, data storage and preservation; data sharing practices) and related challenges and issues, researchers attitudes and institutional support. The interviews in this study were conducted over Microsoft Teams platform instead of face- to- face because of distance and lack of resources.

3.4.2 Document analysis

In this study, document analysis was also used to collect data. Document analysis is a systematic procedure for reviewing or evaluating document, and includes both printed and electronic material (Bowen, 2016:28). The documents that were analysed are shown in Table 4.1. Content analysis was used to identify RDM activities as reported by CPUT or as mandated by the institution. Bowen says that when using document analysis, the researcher is expected to include other sources, such as interviews to seek convergence and corroboration (Bowen, 2016:28). In this study, document analysis and interviews were used for the sake of corroborating and supplementing information retrieved from each other.

3.5 Population and sampling

Population is defined as “the entire set of objects or people that is the focus of the research project and about which the researcher wants to determine some characteristics” (Bless, Higson-Smith & Sithole 2014:162).

Sampling is a very important issue in research, as the respondents chosen from the population can have a significant impact on the results (Leedy & Ormrod, 2010:146). A sample is defined as the subset of the population to which questions are administered (Leedy & Ormrod 2015:176). Sampling means “selecting units in a manner that maximises the researcher’s ability to answer research questions that are forthcoming in a study” (Bless, Higson-Smith & Sithole 2014:166).

Sampling can be divided into probability and non-probability sampling. In probability sampling, the inclusion of each element of the population can be determined and in non-probability sampling the inclusion of each element is unknown (Bless, Higson-Smith & Sithole 2014:166; Leedy & Ormrod 2015:179). Different sampling designs are more or less suitable for different situations and different research questions (Leedy & Ormrod 2015:179).

The identification of participants in qualitative research often focuses on a limited number of respondents, who have been purposively selected to participate because the researcher believes they have in-depth knowledge of the issue researched (Mack et al., 2005:5). In this study, purposive sampling has been used. It is a non-probability sampling method and is based on the judgement of the researcher regarding the characteristics of a representative sample (Bless, Higson-Smith & Sithole, 2014:172; Leedy & Ormrod, 2015:183).

A selected number of library staff at CPUT, who had participated in the planning, establishment, and implementation of RDM services, were considered for the study, as were staff members that are providing the services. These members of staff have knowledge and expertise that would help to achieve the research objectives. In the case of document analysis, the documents purposively chosen were published documents that are related to implementation of RDM at CPUT Libraries and authored by the Director of CPUT Libraries.

The selection of the sample in this study, including the sample size, is related to the qualitative approach and the case study design.

3.5.1 Description of the sample

As mentioned above, a consideration was made of library staff at CPUT Libraries who have been involved and participated in the planning, establishment, and implementation of RDM services, as well as those that are currently providing these services as they have knowledge and expertise in this area. CPUT is composed of six campuses, all in the Western Cape Province. It has six faculties spread over the campuses. Each campus has its own library and library staff, many of whom were considered as prospective participants in this study.

The library is headed by the Director. There is one Deputy Director, and three managers of the following portfolios: Research Support, Information Communication Technologies (ICT), and Technical Services and E-resources. These individuals form part of the Executive Management of the library. The research librarian is part of the research support team and the hierarchy is illustrated in Figure 3.1. The Faculty Support Teams (FSTs), illustrated in Figure 3.2 comprise of faculty librarians and senior library assistants, where within each group there is a manager responsible for overseeing the team. It is from these groups that the sample of the study was taken.

3.5.2 Sample of the study

The sample was limited to the categories of Executive Management of the library, the Research support services team and the FSTs. The mentioned categories of library staff are the sample of this study as they are considered responsible for RDM activities at CPUT Libraries in their respective portfolios.

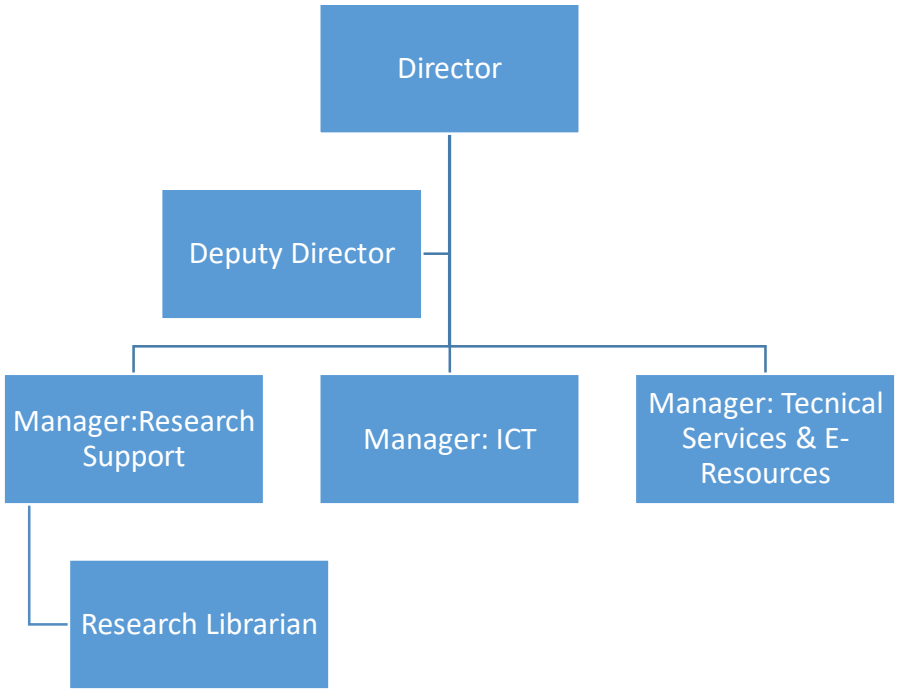


Figure 3.1 Sample of the study: Research Support

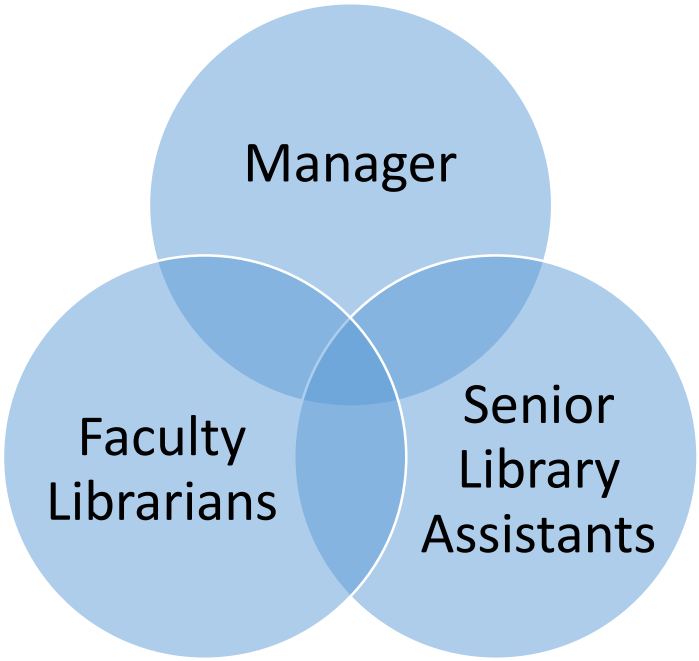


Figure 3.2 Sample of the Study: Faculty Support Teams

The participants were sampled to meet a certain criteria, for example, the management of the library, which is involved in decision making, and may include the deputy director, and the Manager of Research Support, as they are part of the executive management and involved in decision-making about library-related issues in the implementation and provision of RDM

services at CPUT Libraries. The director was not included in the sample as the documents used in the document analysis were authored by him.

The following table shows the categories of participants that made up the purposive sample.

Table 3.1: Sample categories

Categories	Positions
Executive Management (2 from 5)	Deputy Director; Managers
Research Support Services (2 from 2)	Manager; Research Librarian
Faculty Support Teams (15 from 17)	Managers; Librarians and Senior Library Assistants

3.6 Data collection

In this study, three interview guides were constructed to collect data. The interview guides were designed to fit the categories of sample explained above. Based on the objectives of the study, different categories of participants were invited and the interview guides in Appendix A, B and C were used to collect data from the different categories of participants. The interview questions were constructed based on the DCC model as it guides the investigation of the study. Prospective participants were invited by e-mail. The interviews took place through Microsoft Teams, and took more or less one hour each.

3.6.1 Response rate

Despite two reminders sent to the 19 prospective participants after the initial invitation to an interview, few were able to participate in the study and, in total, three interviews were conducted though a fourth was planned, with the prospective participant sending back the signed consent form and scheduling a time for the interview, but then experiencing technological problem on their side at the time of the interview. When I was trying to initiate and schedule another appointment, the novel Coronavirus (COVID-19) happened, which resulted in many institutions putting into place COVID 19 restrictions such as working from home and that made it difficult for me to reach the person. In qualitative studies, samples may be small, as long as those sampled can provided the sort of data that would help to achieve a study's objectives (Crouch & McKenzie, 2006:484). In this study, the small eventual sample is justified by the expertise of those who were interviewed and the in-depth nature of the interview schedule.

3.7 Ethical considerations

Research ethics places emphasis on the humane and sensitive treatment of research participants (Bless, Higson-Smith and Sithole, 2014:28). When research involves collecting data from and about people, researchers need to guard against misconduct and impropriety that might affect the study participants (Leedy & Ormrod 2015:124). The most obvious ethical

problems arise when a research procedure causes harm to those who are asked or forced to participate in the process (Creswell 2014:132). Research participants are required to develop trust in the researcher, where the integrity of the research needs to be ensured. The drawing up of informed consent forms for participants to sign before they engage in research is important as the form acknowledges that the participant's rights will be protected (Creswell, 2009:89). The consent form for this study is attached as Appendix D.

There are published standards or codes of ethics available in research and it is important for the researcher to be aware of ethical considerations when conducting research (Leedy & Ormrod, 2015:124). In this study, in order to ensure that the study was carried out ethically, it obtained ethics clearance from both the Humanities Faculty of UCT (the ethics form is attached as Appendix E) and from CPUT in order to be able to interview its employees. The clearance certificate and permission letter from CPUT are attached as Appendix F.

Participants were assured that the information they provided would be treated confidentially, and that their responses would be reported anonymously. Their participation in this research was voluntary, and there was no penalty should they decide to withdraw from the study. It was only with the consent of each participant that interviews were recorded.

3.8 Reliability and validity of the study

Reliability is concerned with consistency of measures, and the reliability of measurement is the degree to which similar research comes to similar conclusions using the same research design and participants (Bless, Higson-Smith and Sithole, 2014:222; Leedy & Ormord, 2015:114; Creswell, 2009:149). Validity refers to the extent to which a research instrument can be trusted to measure what is supposed to measure. Validity in qualitative research is substituted with the concepts of quality, credibility, and trustworthiness to describe the research (Leedy & Ormord, 2015:106; Creswell 2014:297). Bless, Higson-Smith and Sithole (2014: 235) emphasise the importance of balancing reliability and validity in an instrument, as one cannot be considered trustworthy without the other. This study ensured reliability and validity/trustworthiness by constructing interview guides based on the literature and a trusted model, and posing the questions to participants knowledgeable about those matters under consideration, and who were considered truthful. Care has been taken in describing the study and its results fully and honestly.

3.9 Summary

This chapter explained the research methods used in this study, and the reasons behind their choosing. Reliability and validity and ethical considerations that influenced the study were also discussed in the chapter. The following chapter is presentation of findings.

Chapter 4

PRESENTATION OF FINDINGS

4.1 Introduction

This chapter presents data collected through document analysis and interviews about the introduction and implementation of RDM services at CPUT and the experiences of CPUT Libraries in this regard.

4.2 Document analysis

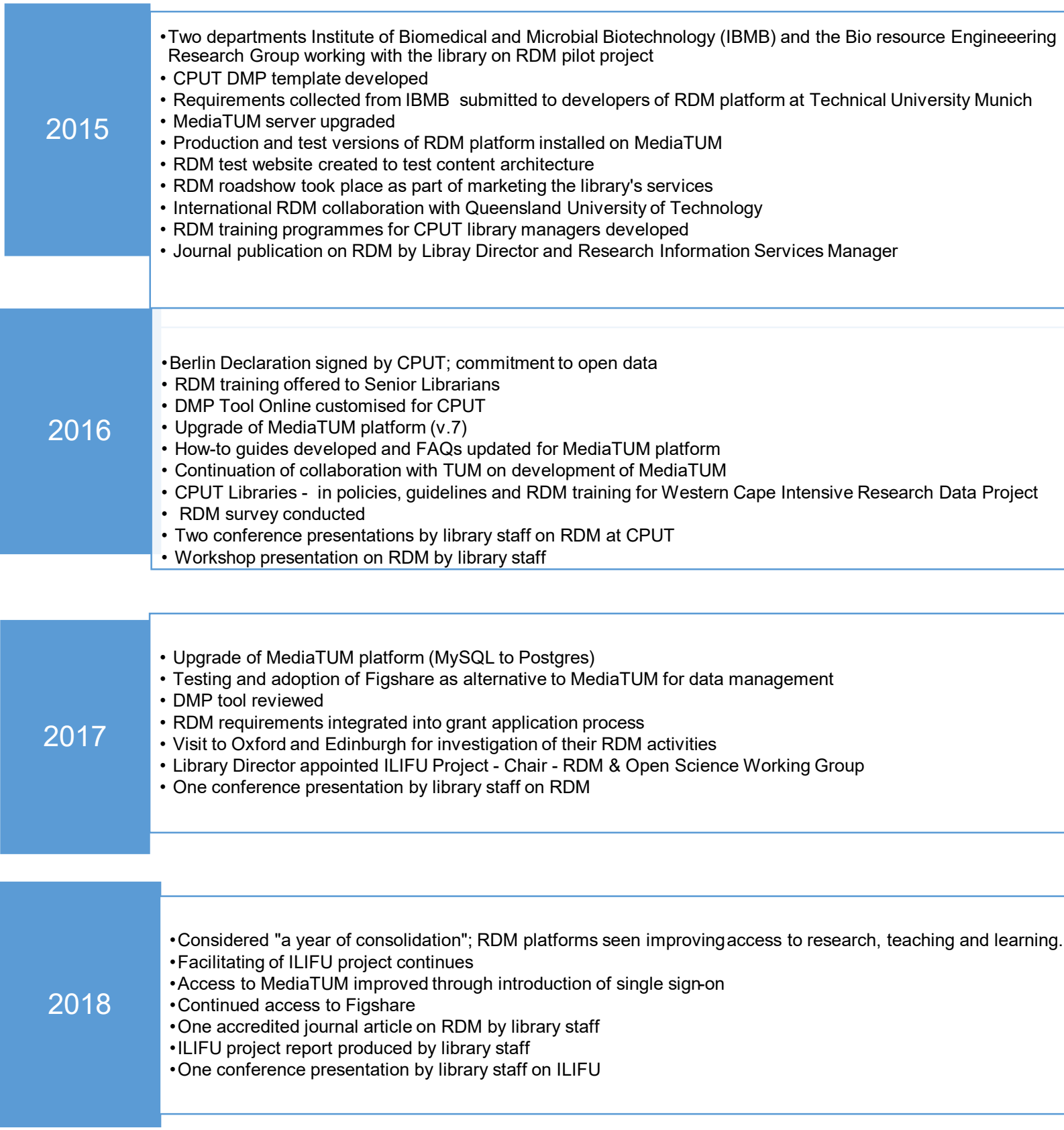
In this study, document analysis was used as one research method. Data was collected from published materials related to CPUT's implementation and development of RDM services and presented by theme. Table 4.1 shows documents that were used in this study, which included the library's annual reports from 2015-2018, CPUT OA and RDM policy documents. Though not an official CPUT publication, like the aforementioned documents, a conference paper by the library director is included as it about RDM services of the library at CPUT. All documents used are available in the public domain. The annual reports of 2019 and 2020 were not used in this study, because data collection had stopped by the time they were published. Data collection took place between 2018-2019, however upon perusal of the documents (2019 and 2020 library annual reports), it was found that they did not provide any new information on RDM.

Table 4.1: Documents analysed

AUTHOR	YEAR	TITLE
CPUT	2015	CPUT Libraries Annual Report 2015
CPUT	2016	CPUT Libraries Annual Report 2016
CPUT	2017	CPUT Libraries Annual Report 2017
CPUT	2018	CPUT Libraries Annual Report 2018
CPUT	2015	Open Access (OA) Policy
CPUT	2015	CPUT Research Data Management (RDM) Policy
CHIWARE, E	2017	Integrating research data management services into institutional workflows: a South African perspective

What follows is a description of the implementation of RDM at CPUT as collated from these documents. A timeline (Figure 4.1) is included for ease of reference.

Figure 4.1 Timeline: showing the implementation of RDM



4.2.1 Policies and initiatives in support of RDM

CPUT has shown a commitment to RDM since at least 2015, by participating in initiatives and implementing policies that promote RDM.

The signing of the Berlin Declaration is listed as one of the major achievements of 2016 (CPUT, 2016a:9). Before this time, the implementation of the CPUT OA Policy in 2015 was significant, as one of its objectives is to "ensure that the university complies with the principle and mandate of making publicly- funded research widely accessible" (CPUT, 2015a:3). OA initiatives like the OA policy indicate CPUT's commitment to implementing RDM support strategies.

The CPUT RDM Policy, signed in 2015, "aims to encourage a positive approach to the management of research data across the institution" (CPUT, 2015b:3). It is explained as a policy intended to provide a framework for the university to provide RDM support "by collaborating directly with key role players for implementation" (CPUT, 2015b:3). The focus of the policy is on data management and the benefit of preservation of data (CPUT, 2015b: 9-10). The CPUT RDM Policy (2015b:2) refers to research data as "data, which is created in the course of funded or unfunded research, and often arranged or formatted in such a way to make it suitable for communication, interpretation and processing, manually or by a computer."

In terms of ownership of research data, the CPUT policy on intellectual property (CPUT, 2016b:9) explains that, where the Copyright Act (Act 98 of 1978) covers work, the copyright normally resides with the author in the first instance, that is, the individual who has created the work. "The ownership of copyright" the copyright holder (owner), which may be the author in the first instance or the owner of the copyrighted material in terms of section 21 of the Copyright Act" (CPUT, 2016b:9).

CPUT's Libraries e-Strategy is mentioned in the presentation 'Integrating Research Data Management Services into Institutional Workflows: a South African Perspective' by Chiware (2017). In the presentation, Chiware mentions that CPUT's Libraries e-Strategy includes a focus on e-Research, which addresses development of RDM infrastructure and services. The e-Research at CPUT Libraries enables the library to "comprehensively support research projects", by being involved in the research life cycle (Chiware, 2017); this includes involvement in RDM activities.

4.3.2 RDM support services implemented

According to the CPUT's e-Research presented by Chiware (2017), the involvement of the library in RDM should include providing support in:

- proposal writing;
- DMPs;

- data collection;
- data analysis;
- data storage and preservation; and
- publication of results and dissemination of scholarly outputs (Chiware, 2017).

The e-Research as part CPUT Libraries e-Strategy is an indication of the efforts by CPUT in developing RDM services (among others). In addition, there has been an intent to "establish adaptive library services in order to provide tailor-made solutions for research projects' data management requirements" (Chiware, 2017).

The annual reports (CPUT, 2015-2018) list the following as RDM services that have been developed and/or implemented over time, responding to a number of the support needs listed above:

- Data Management Planning (DMP) Tool[1]
- Data Repositories (MediaTUM and Figshare)
- Advocacy and Training in RDM

4.3.3 Librarians' RDM related activities

RDM activities among the staff at CPUT Libraries included the following.

4.3.3.1 Reskilling and training of library staff

The training of staff in RDM related activities started in 2015 (CPUT, 2015b:17) and 2016 annual report reiterates that librarian skills for RDM support were identified and developed (CPUT, 2016a:9). Training seems to be an ongoing need, as, in 2017, Chiware (2017) mentions that, "the future includes training librarians in RDM support through institutional, national and international programmes" (Chiware, 2017).

The active participation of library staff in RDM is shown by their research output related to RDM. The research activities related to RDM reflected in the documents analysed included conference presentations and publications in accredited journals, as follows:

[1] The DMPTool allows researchers to create ready-to-use data management plans for specific funding agencies; meet funder requirements for data management plans; get step-by-step instructions and guidance for data; and learn about resources and services available at any institution to help fulfill the data management requirements for a grant. https://nnlm.gov/data/thesaurus/data-management-planning-tool-dmptool

Journal Publications

Chiware, E.R.T. & Mathe, Z. 2015. Academic libraries' role in Research Data Management Services: a South African perspective. *South African Journal of Library and Information Science*, Vol. 81:2 (CPUT, 2015b:26).

Chiware, E.R.T. & Becker, D.A. 2018. Research Data Management services in Southern Africa: A readiness survey of academic and research libraries. *African Journal of Library, Archives and Information Science,* Vol. 28: 1 (CPUT, 2018:22).

Conference presentations:

1. Chiware, E. 2016. Research Data Management at CPUT. Stellenbosch 14th Annual Library Symposium, Stellenbosch, 7-9 September (CPUT, 2016a:36).
2. Chiware, E. & Mathe, Z. 2016. Research Data management at CPUT. UCT Open Access Symposium: Empowerment through open scholarship: Transcending boundaries, iThemba Labs, Faure, Cape Town, 4-9 December 2016 (CPUT, 2016a:36).
3. Tshetsha, V. & Mathe Z. 2016 Research Data Management. Food Science & Technology Postgraduate Research Workshop. 16-20 May 2016 (CPUT, 2016a:36).
4. Chiware, El. 2017. Integrating Research Data Management Services into Institutional Workflows: A South African Perspective. IATUL (CPUT, 2017:29).

The above publications and presentations highlight the commitment of CPUT Libraries' management to the development of RDM.

4.3.3.2 Training of researchers

There is ongoing research support for researchers. In this regard, there has been vigorous marketing of RDM services (CPUT, 2015b:21). In 2016 (CPUT, 2016a:9), there was a continued support of CPUT academic staff by librarians in terms of RDM, and an interest to improve the services for example by conducting an RDM survey (CPUT, 2016a:35). RDM services and tools are regularly demonstrated to researchers and postgraduate students, in order to raise awareness about RDM (CPUT, 2016a:10).

4.3.3.3 Institutional partnerships

The development of an RDM culture, according to Chiware (2017), included the creation of institutional partnerships and the formation of the CPUT RDM working group. The introductory message in the annual report of 2015 mentions strong partnerships and relationships with the Research Technology, Innovation and Partnerships Division. The report states that "through

this partnership the library was able to advance RDM services [among other services and programmes] to the research community" (CPUT, 2015b:3).

4.3.3.4 National partnerships and collaborations

CPUT Libraries are actively involved in the development of the Western Cape Intensive Research Data Project (CPUT, 2017:32). The Libraries' participation in RDM activities includes leading the development of policies and guidelines for the project, as well as developing RDM training for librarians, IT staff and scientists (CPUT, 2015b:24). In its Annual Report of 2017, the director of CPUT Libraries Dr. Chiware is mentioned as ILIFU Project Chair for the RDM & Open Science Working Group (CPUT, 2017:31). CPUT Libraries continues to play an important role in facilitating and providing the technical lead in the ILIFU Project and development of RDM policies and guidelines (CPUT, 2018:1).

4.3.3.5 International collaborations

The year 2015 was mentioned as a year during which the library cemented its RDM collaboration with international institutions. The 2015 Annual Report mentions a visit by Stephanie Bradbury from Queensland University of Technology, Australia, to promote RDM through a roadshow (CPUT, 2015c:24). In 2017, it was said that "CPUT staff continue to support various international initiatives by attending conferences, presenting papers and acting on committees" (CPUT, 2017:32); these included RDM-related conferences, papers, and committees. International partnerships have included visits to Oxford and Edinburgh Universities to investigate RDM activities (CPUT, 2017:33).

4.3.3.6 CPUT RDM development

In conclusion, RDM was one of the library's key focus areas mentioned in the 2015 and 2016 annual reports that was realised in its full potential in the 2018 report. It is acknowledged in the annual report that while a number of milestones were reached in 2018, "the groundwork was being developed to propel the library into the future" (CPUT, 2018:25). The 2018 annual report mentions that for a number of years, "the library has been at the institutional forefront of the drive to digital delivery, researching and implementing various platforms and developing its electronic collections" (2018:25). This statement supports the RDM progress that is shown in the annual reports of 2015 to 2017. In addition, there is continuous expected growth in those areas, as "CPUT Libraries stands ready to support the institution in its move to eResearch and the ultimate goal of a SMART university"[2], based on innovation and technological infrastructure (2018:25).

[2] SMART University: A SMART University is a university that uses technological innovation within its organization to accomplish its mission (Mbombo & Cavus, 2021:13).

4.4 Interviews

Interviews were conducted for the sake of elaborating on what formal documents stated and to identify real-life experiences of the introduction of RDM services at CPUT, including challenges encountered.

The anonymity of participants has been respected as the signed consent forms indicated, however it may be possible to guess the position of the respondent by their responses. The number of questions asked ranged from 10-12 questions depending on the category of respondent and responses from all categories were given equal respect and analysis.

The discussion is presented with verbatim citations, participant by participant. Participants are referred to as P1, P2 and P3. The pronoun 'they' has been used for both singular and plural for the sake of anonymity/confidentiality. Sub-headings divide the discussion into themes that emerged during the interviews.

4.4.1 Participant One (P1)

The interview with P1 took place online through Microsoft Teams on 29/08/2019 and it took one hour to finish.

P1 described their role in RDM as follows:

> *"My role with RDM is on research support systems and tools that support the research lifecycle stages.* […] *It is in connection with faculty librarians; I am involved with teaching faculty librarians.* […] *I have to learn the research support systems and tools and teach these to faculty librarians."*

(a) Introduction of RDM at CPUT

P1 agrees with the information from documents that CPUT Libraries started by piloting RDM offerings. The library introduced RDM through a campus roadshow, specifically for advocacy and training, visitations to departments, and consulting individuals and groups. Advocacy included the use of the website in promotion of RDM and available platforms, such as MediaTUM were promoted as they were introduced. P1 further explained that advocacy remains important, as researchers are still finding their feet to be able to manage research data.

P1 further explained that RDM support services that are provided at CPUT include supporting the following stages of the research lifecycle model: ingest, storage, preservation, and use, but that provision of RDM services begins when researchers are looking for funding and funding opportunities.

- ***Platforms and tools***

A question about existing platforms, tools and resources supporting RDM was asked. P1 gave a summary of the different tools and resources that are available in support of research at CPUT and listed those specifically in support of RDM as the DMP Tool and the two data repositories, MediaTUM and Figshare. These systems allow researchers from all faculties, units, centres and schools around the university to upload their own data to them. P1 elaborated on the DMP Tool as follows:

> *"The funders require data plans, data management, and eventually publishing of data and to support the stage there is a DMP Tool, which was developed to help researchers to compile a DMP for a research project.* […] *The DMP Tool was developed by the library using* [the] *DCC checklist, to make it easy for researchers to capture in their DMPs all the required details which are aligned to funder requirements*."

- ***Data storage***

P1 explained that,

> *"The next step* [after writing a DMP] *for researchers is the collection or creation of data and in that process, they need data storage.* […] *Initially CPUT partnered with a Technical University of Munich (TUM) team based in Germany and developed a data repository known as MediaTUM."*

P1 explained that the data currently kept in the repositories is mostly ready-to-be-published data, where the researchers keep their raw data. P1 mentioned the importance of understanding of various stages and versions of data and its storage: "that data can be raw, complete and published". In addition, even when data is kept in the repositories privately, the system can allow comments and some recommendations from researchers in the same discipline.

P1 continued and said

> *"Later, as data became more of a concern as a funding agency requirement, a Figshare for institutions data repository was introduced."*

> *"The institution started the Figshare data repository in a consortium with other Western Cape academic institutions* […] *so it was a collaborative effort at the beginning, which was helpful in terms of support and learning the system* […] *Both repositories are presently in use for datasets produced by CPUT researchers*."

P1 explained that the difference between the two data repositories is that Figshare is cloud-based and information that is on Figshare becomes automatically available on Google. MediaTUM is not cloud based, but is still being developed to have similar features to that of

Figshare. P1 mentioned that there is some data, which was initially kept in the CPUT IR that still needs to be moved to the available newer platforms, Figshare and MediaTUM.

P1 further explained as follows:

> *"MediaTUM and Figshare data repositories offer a platform for storing, accessing, and sharing of research data during the active phase of research and ensure the long-term preservation of data* […] *The repositories enable academic researchers to store, share, discover and manage all of their research data output.* [Both] *data repositories support the storage, management, and sharing of data."*

- ***Access to research data***

P1 explained that library system developers are responsible for enhancement and configuration of the Figshare system and implemented the single sign-on for Figshare using the university username and password.

The data repositories have additional functionality:

> *"CPUT researchers are able to invite other researchers outside the institution who may be in collaboration with them to participate* […] *The system is designed to allow the internal researcher to invite the external team member to participate* […] [Researchers] *are able to do things such to edit, view or give guidance where needed* […] *For example, a statistician who may assist* [the researcher] *with calculations when necessary*."

P1 explained that there are built-in features within the Figshare system that allow for easier data discovering and use:

> *"The Figshare system, for example, has the standard searching features* […] *The system is able to show metadata records only* [without providing access to the data itself] *when data is stored privately for particular research groups*."

- ***Training and support***

Faculty Support Teams (FSTs) are taught and trained so that they can, in return, teach and train the faculty members they support. The FST departmental visits help to educate researchers about the available data repository platforms and other research data support services offered by the library. P1 mentioned the library's partnership with the Research Directorate Office, which helps to facilitate research support training by receiving requests on researcher training needs through this office.

P1 mentioned that there is one area that the library decided it would not be involved, namely the loading of data onto a repository on behalf of the researchers.

"The reason for this decision was that researchers own and know their data better than the librarians know […] *The library is only involved in training."*

In elaborating on giving guidance to researchers, P1 said:

"There are research support guides. These guides are designed to point CPUT researchers to research support available […] *The list contains faculty guides, databases and journals as well as subject or course guides* […] *LIBGUIDES- subject guides are talking about the available platforms and how to use them*."

P1 mentioned that training was a challenge:

"Training and recordings of the trainings for both FSTs and researchers is important, as not everyone can be present at the same time […] *The sharing with others is essential in the development and understanding of RDM."*

(b) CPUT experiences

- ***Technologies***

As P1 was working closely with the platform developers during early stages of setting up the repository, they were able to mention that there were issues here and there. One example was the issue of users unable to sign in on Figshare. Through the support from Figshare, the option of using single sign-on was decided upon, and it became easy to sign in to Figshare using a university username and password.

P1 also explained that after recognising the need, new features were created, such as those showing statistics of number of views or most-viewed items on Figshare, introduced with the support of the developers. The library IT staff and the Figshare support team worked together by meeting regularly and consulting through weekly webinars to get to know the system better. P1 further explained that the library was able to log tickets on the system requesting assistance whenever there was a problem, and the Figshare support team would respond accordingly.

P1 was of the view that:

"There is no way that the system could be developed completely at one go […] *The system can only be developed as the users of the system experience challenges* […] *As disciplines are different, the system should be able to be tweaked in such a way that it meets all the requirements of the institution*."

P1 mentioned projects with which CPUT is involved, such as the ILIFU project, which is a regional initiative driving research data repositories.

- ***Researcher reluctance***

P1 explained the challenge of researcher buy-in for RDM and for the library's involvement in it:

> *"Initially, researchers were skeptical of the library leading the RDM at CPUT, asking questions such as "what does the library know about data".* […] *But as the time went on and the library was able to provide evidence (such as funder requirements, publisher requirements and registries of data, for example) for the necessity of open data, more and more researchers are becoming aware of the importance of data management."*

- ***RDM policy***

P1 suggested that a well-written policy would drive and stimulate the whole process of research data management. They further explained that the RDM institutional policy has to be aligned with national research policy and government policies so that it complies with the national research initiative. P1 mentioned that it is important to make the researchers "own" RDM, however, according to P1, the researchers are still learning and not at that stage yet.

- ***Library management***

P1 felt that,

> *"The library directors need to invest in RDM* […] *There is a need for a specialist* [to be hired] *to keep up to date with what is happening in the RDM environment and other research support tools and systems*."

(c) Challenges and recommendations

P1 recommended that Library Directors should allow the researchers to be the drivers of RDM, but at the same time, work closely with library staff. The participant highlighted the following:

- ***Sharing of costs***

> *"If RDM is pushed by the academics it will have more weight and will be stronger and in terms of sharing the cost of RDM* […] *There are other annual subscriptions for library resources that the Library has to pay, these subscriptions do not come cheap, and at present, it is the responsibility of the library only to fund RDM* […] *Consideration should be made in sharing the cost between the research directorate and the library in order to be able to survive the cost."*

- ***Space***

> "*The biggest challenge could be space*", said P1, referring to server capacity, and asked the following questions:

"What if all researchers want their data to be available on the repositories? […] *What if the space becomes a problem?* […] *Are we ready for massive data that already exists? ... Is there a system that can handle and manage all this existing data?* […] *Maybe there will be a need to have multiple data repositories that will take care of the data.* […] *Maybe the solution would be to select best and rich data that would be able to produce more research."*

P1 suggested that,

"In order to deal with the challenge of space there will be a need to have policy or guidelines stipulating clearly, which data or systems will be used to accommodate data […] *And the question is which one will it be?"*

P1 also mentioned the problem of previously published research, which is hand written and kept in batches in boxes.

"This data will have to be digitised and described and made available in the present systems […] *This would lead to a need for machines for digitisation and more space on data repositories."*

P1 mentioned that some challenges relate to library staff:

"The attitude of the librarians count a lot, change is not easy, and some librarians may not be comfortable with all these available research tools, and at times may be selective in learning new tools and platforms."

P1 further explained that adapting to change is not the only staff challenge, where workload plays a part:

"The workload may be too much for FSTs who have to deal with information literacy, collection development and management, daily queries, and continued training."

P1 concluded that:

"Though it may not be easy for some librarians, it is important to get everyone involved, so that they can be motivated to learn all the available research tools including RDM, in order to help with research needs of their respective faculties."

4.4.2 Participant Two (P2)

The interview with P2 took place on Microsoft Teams on 02/09/2019 and it took 50 minutes to finish.

(a) Introduction and implementation of RDM at CPUT

- ***Policies and strategies***

P2 mentioned the importance of creating and implementing policies that support management of data, such as the RDM and OA policies. P2 further explained that parts of the policies will need to be reviewed because of new developments. They may be outdated or obsolete and not be able to accommodate new developments. P2 explained the RDM policy as follows:

> *"The RDM Policy is an overarching document that gives guidelines and processes on openness of data and ethical concerns should be addressed in the Policy."*

P2 regarded the following key considerations during implementation of RDM at CPUT:

> *"CPUT is a university in a country, and in a region, and therefore has to support regional and national strategies* […] *As RDM is a national strategy, the University has to consider* [adhere to] *the international and national strategies, guidelines and policies in RDM* […] *To succeed, RDM needs to be managed at a higher level, looking at certain things that are important, for example international and national initiatives."*
>
> P2 mentioned the following initiatives as key considerations in RDM implementation:

- ***Open Access***

The university has signed the Berlin Declaration on Open Access that proclaims open access and access to knowledge.

- ***University research strategy***

The university strategy and a number of other policies of the university need to be taken into consideration because RDM services have to be aligned with them.

- ***National level (The Department of Science and Technology)***

P2 said there must be an understanding of what is happening in terms of RDM on the national level as well as at regional level.

P2 mentioned the following structures as examples of initiatives that support RDM at a national level:

- ***Data Intensive Research in South Africa (DIRISA)***

The data-intensive initiative provides platforms in support of RDM.

- ***NRF statement on Open Access***

The NRF statement says that publicly funded data should be made publicly or partially available. It is important to follow such statements and to make them known to the university community.

- ***The Centre for High Performance Computing (CHPC)***

The national CHPC offers processing capabilities and services to researchers in industry and academia and is part of DIRISA and provides services that support RDM. It also supports the *ILIFU project*, which:

> *"On a regional level in the Western Cape, provides infrastructure specifically for two disciplines, which are Astronomy and Bioinformatics* […] *The amount of data collected in astronomy and bioinformatics is becoming very large, and the university does not have the capacity to deal with it* […] *It is important to let the researchers know about the availability of the CHPC and the ILIFU project to assist* [with data needs] […] *Both are based at University of Cape Town and researchers must be aware of such services."*

(b) RDM practices and support

P2 said the following about their involvement in the technological side of RDM services:

> *"I am involved in the management of a number of platforms and services that are rolled out to faculties and the university community at large."*

They further explained that they are responsible for overseeing the two data repositories, MediaTUM and Figshare, which address storage and publishing of data, as well as the DMP Tool, which has been developed to help researchers when submitting the required research plans to funders. P2 pointed out that this tool is well used by researchers, thus in agreement with P1 who also mentioned that the DMP Tool is widely used by researchers.

P2 explained the staff participation in research support as follows:

> *"The research support unit of the library has a manager who is responsible for overseeing all the platforms and services that support research including managing the staff [*…] *There is a research librarian who is responsible for teaching and training FSTs* […] *The FSTs consist of librarians and senior library assistants, who in turn have to teach and train the members of their respective faculties."*
>
> Here P2 is agreeing with what P1 mentioned above.

- ***Training***

Regarding training of staff in RDM, P2 explained that:

"CPUT is a multi-campus environment so using webinars and platforms such as Microsoft Teams when conducting training for these teams is useful."

P2 agrees with what was said by P1, namely that recording of training about RDM is important, as are constant updates about research support services offered by the library. P2 made an example of 'librarian days' and library meetings as relevant platforms to talk about open data and why it is important.

P2 further explained about staff responsibilities:

"FSTs are the ones integrated within the faculties and they have to go back to the faculties and make RDM services and platforms known, as well as provide training when needed […] *They also provide metric report services related to research impact."*

P2 mentioned that:

"One of the professors recently won a high-level award, because they made their data open and this is also encouraging to other researchers as far as open data is concerned."

P2 mentioned staff motivation in providing RDM services and the commitment needed for it to succeed and said:

"It is exciting for all the people involved to see the outcome of their RDM efforts […] *Adherence to RDM is a slow process, as it is quite a new thing."*

P2 mentioned that benchmarking of the tools and platforms that are available is important and further elaborated on training and teaching of faculty members as follows:

"The training and teaching of faculties will never be enough; therefore, library staff responsible for training need to use of opportunities such as presenting in various platforms [where researchers] *are available is important."*

(c) Experiences of CPUT in the introduction of RDM services

- ***Institutional collaborations***

As P1 did, P2 explained that the library works closely with the Research Directorate and the Centre for Post-Graduate Studies when it comes to RDM and other research support services.

The Research Directorate is responsible for scheduling training programmes for researchers. The library is included in the Research Directorate programmes, and has modules that it teaches that relate to research (for example teaching and training on RDM platforms). Training for advanced Information Literacy for academics and researchers is done by FSTs and RDM is a component of this training.

- ***Advocacy and awareness***

P2 explained that, “awareness grows by one person at a time, and it is taking a long time as CPUT is a big university.” As far as researchers are concerned, not all are prepared to accept innovations such as open data, where some think their raw data is required to meet the criteria. It is important to take into consideration ethical issues as specified in the policy as well, said P2.

P2 felt that:

> *“The library staff need to be very aware of what RDM is, as they will not be comfortable in teaching something they don’t know well.”*

- ***Data literacy programmes***

P2 explained how they felt about the importance of data literacy in RDM:

> *“Data literacy is required* [for RDM] *as it makes data openness clearer to everyone* […] *They* [researchers] *need to understand that there are different levels of open data, that data can be closed or partially open as well and that ethical issues need to be considered.* […] *There must be an understanding that there are options when it comes to sharing data: metadata record only (and not the entire dataset) can be made available on Figshare, if researchers do not want to make their data open* […] *Peer researchers can then see that data is available and contact the researcher directly and come to an agreement on how data can be used.”*

P2 also mentioned that the Repository Finder link, which is available on the research support webpage of the library website in the ‘Open Data’ information box, helps researchers to easily access repository when choosing ways to make their data open. P2 however said,

> *“The question is, who is responsible for data literacy, as the library can do limited data literacy* […] *Is it the Library’s role, supervisor, or the researcher’s role?”*

According to P2 and echoing the sentiments of P1,

> *“The library can only advise and provide the required services, but the researcher will always know best about their data.*”

- ***Librarians' attitudes***

In agreement with P1, P2 explained that,

> *"The librarians' attitudes differ; some may be keen and want to try cutting edge services such as RDM and new technologies and some may have difficult in dealing with the changes* […] *Managers have to play their part in encouraging and supporting staff, as change is difficult."*

- ***Training or reskilling of librarians***

P2 considers the Research Librarian to be responsible for leading training of librarians on RDM:

> *"The Research Librarian must learn from others* [institutions], *must discover the platforms available, and develop the necessary skills.* […] *The research librarian is responsible for making RDM resources and platforms suitable for the local environment."*

P2 also mentioned the FSTs:

> *"The FSTs, also with the support of the Figshare team staff, use various ways of learning and developing the system, look at webinars, local workshops, develop skills constantly as learning continues."*

P2 explained that

> *"The continuous involvement of Figshare staff in helping those involved in RDM in learning the system* […] *It is imperative to constantly develop Figshare to meet the needs of its users."*

P2 further mentioned forums such as that of the library directors' forums that are able to discuss and generate new ideas that support development of new initiatives in their respective institutions. P2 also mentioned the community of practice research support teams with the University of the Western Cape, for example, that they meet and learn from each other and keep up to date with all the developments in RDM and other research support resources and tools. P2 considered these forums important in advancing RDM.

(d) Recommended strategies in the implementation of RDM

P2 highlighted the difficulties of change as the biggest challenge:

> *"Being a 'change agent' is a big challenge* […] *The need to change people's minds about doing things differently is difficult* […] *For example, data was not published previously, now data needs to be seen, and therefore has to be correct*."

P2 further acknowledged that:

"As much as it is difficult to change, this is the new angle that needs to be taken into serious consideration, as research involves public funding and taxpayers' money therefore data need to be accessible and new research could come out of published the data."

P2 recommended that a university mission and mandate should be in place and everyone involved aware and be able to align these with RDM activities.

P2 recommended the following in terms of awareness of RDM services:

"There must be a high level of awareness of services, constant advocacy through meetings and forums, and, as new people come into the university […] *strategies must be in place to inform and make them aware of RDM."*

The above quote shows that P2 is in agreement with P1 who also mentioned constant advocacy on an individual level more so than at a faculty level, in getting everyone aware.

P2 noted the relationships that are needed for the introduction of RDM to be a success and suggested that,

"The library should work with all stakeholders of the university, understand the unit policies of the university, whether they need to make some changes to be in line with the policies of other units […] *For example Intellectual Property Policy of the university is linked to the Open Access Policy* […] *The Research directorate and Center for Post-Graduate Studies should be made aware of the new developments in RDM*."

P2 added that it is necessary for libraries and academic institutions in general to continue to monitor the research data practices and needs of researchers and that, as they change, most data services will need to adapt quickly in order to remain relevant. The participant concluded by noting that CPUT library management has shown forward and innovative thinking by setting up and paving the way for RDM. Library staff are developing RDM further.

According to P2, RDM will remain important in future and practices will improve:

"The practice of RDM will get better and grow more, the wheels are just slowly starting but in 5 years' time, they can really be in motion […] *There will be a realisation that there would be no research funding if the researchers do not get on board with RDM* […] *The national strategies emphasise the importance of open data, as society benefits from openness of data, and as more research will be produced, [and] as well as the successes of others will influence more researchers to open their data*."

4.4.3 Participant Three (P3)

The interview with P3 took place on Microsoft Teams on 20/09/2019 and it took 1h10 to finish.

(a) RDM practices and services

- ***Partnership with researchers***

P3 started by explaining the importance of the partnership that faculty librarians need to have with researchers, where they need to inform researchers about new developments, new programmes and the role of the library. This serves to ensure, among other things, that their research needs are met. P3 further explained that there is a need for meaningful community engagement by librarians, where the importance of faculty librarians participating in departmental meetings is stressed, as this allows the library to keep up with current research trends, RDM being one of them. P3 talked about the importance of librarians being fully involved in departmental committees, and finding opportunities to talk about RDM at such gatherings:

> *"The librarians have to create awareness whenever a platform is given and constantly advocate in such forums and meetings, showcasing what the library can offer, building up interest and giving the necessary information as much as possible."*

P3 spoke about data discovery and explained it as follows:

> *"RDM include providing services that support discovering, citing data and accessing datasets, such as creating web guides* […] *Data is published in various versions for different reasons and the librarians need to assist in finding or discovery of data for the researchers for their research needs* […] *There are a number of LIBGUIDES and alerts that are available [at CPUT] to assist in the discovery of information including data."*

Similar to what the other participants said, P3 spoke about the need for advocacy for RDM:

> *"Advocacy can also be reactive; librarians need to be ready and provide training workshops on RDM when required at any particular time."*

P3 provided the following examples of how librarians can assist researchers in RDM-related activities:

- ***RDM tools***

P3 summarised the services supporting RDM at CPUT and elaborated on them:

- DMP Tool (template)

"Librarians need to give assistance to researchers with the DMP template in order for the researchers to fulfill the requirement of showing how data is going to be managed when submitting applications for funding."

- Storing, Management and Sharing of data: Platforms available are Figshare and MediaTUM Data Repositories.

All interview participants agreed on the above-mentioned activities and services being the core of RDM services provided by the library.

P3 mentioned that data-related support requests are growing and made an example of the Applied Sciences Faculty which produces a lot of data in laboratories and is therefore one of the faculties that requires a lot of assistance when it comes to RDM.

P3 also mentioned that,

"Researchers need to be made aware that various versions of data can be stored: raw, complete and metadata, depending on whether researchers want their data to be stored privately [records showing only] […] *Different disciplines may require that datasets be published. … And the platform* [Figshare] *provides various levels of open data."*

P3 mentioned the security of data on the different platforms available:

"The platforms available are providing a safe place for storing data […] *They also offer a collaborative space where research groups can share data and make comments*."

P3 mentioned that some researchers ask librarians to load data into the repositories for them. This is contrary to what P1 mentioned, that library decided not upload data for researchers.

(**b) Suggestions and recommendations**

P3 recommended an in-depth understanding of the discipline by the librarian in order to be able to provide an effective RDM service:

"It is important to have background knowledge about the disciplines in your faculty, for example knowing where the researchers are to publish, their next conferences etc."

P3 further explained that being a librarian means one has to serve diverse groups and be able to support any discipline. The librarian is able to support any discipline, irrespective of undergraduate field, however, it is important for the librarians to pursue postgraduate studies in order to understand the 'language of research'.

P3 said,

"It takes time to understand the diverse disciplines and needs of the researchers, programmes being offered and working relationship with the Faculty […] *Such working*

relationships put the librarian in a better position to understand and have knowledge of the researchers' needs, have knowledge of every development in the field and have the ability to advise researchers when necessary."

According to P3, librarians must be familiar with new developments and, essentially, must fulfill the researcher's needs.

P3 emphasised relationships with other university stakeholders as being important when introducing RDM services:

"It takes a lot of hard work in building up interpersonal relationships with researchers, the librarians must participate in departmental meetings, and library services must keep up with the research trends […] *The librarians must market RDM services in these various meetings, get buy-in for training in each of these meetings, send out invitations for training and conduct training as required."*

A challenge for librarians mentioned in terms of introducing new services was that of workload:

"The major challenge facing librarians is that there is too much to do and very little time […] *There is a lot to do and a lot that one would like to do,* [such as] *run workshops for researchers."*

This is agreement with P1, who mentioned that librarians have a lot to do in support of their faculties.

P3 stressed the importance of getting the librarian to be involved in committees and getting invited to talk about RDM at such meetings.

(c) Experiences of CPUT in support of RDM

P3 mentioned the challenge of providing RDM services and said,

"There can be confusion about the library's role […] *The librarians therefore should speak about the library's role in support of RDM in departmental, faculty board and departmental meetings and showcase what the library can offer* […] *Researchers need to be aware of and understand the benefits of having librarians who are able to fully support their research needs by providing much needed services* […] *Attending a meeting and ask for a permission and when given the platform, have a live demonstration, and it doesn't have to be too long, keep it short and make sure that they get the message* […] *Social networking sites as well can be helpful in spreading the word."*

P3 further mentioned that:

"The biggest data challenge is whether the available platforms will be able to accommodate the amount of data that is out there."

P3 recommended that:

> *"Managing data and providing platforms include ensuring that systems and platforms are focused on researchers needs."*

In closing, P3 noted that academics have to be aware that the Library is well positioned in taking up the challenge of supporting data management, and that the Library plays a major role in data management.

4.4.4 Summary

This chapter focused on the presentation of data. It is a presentation of data from the participants and documents used for document analysis. The next chapter presents data analysis, the main findings, recommendations, and conclusions of the study.

Chapter 5

DATA INTERPRETATION, RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

This chapter presents the findings of the investigation into the introduction and implementation of RDM at CPUT and, drawing from findings, makes recommendations for the introduction and implementation of RDM in HEIs in SA more generally. The chapter ends with study limitations, suggestions for future studies and a conclusion.

5.2 CPUT's approach to the introduction and implementation of RDM services

The data gathered for this study shows that CPUT's approach to introducing and implementing RDM services included a number of priorities. They are discussed below.

5.2.1 Piloting of RDM

As a starting point for RDM services, CPUT Libraries decided to run a pilot project with two research groups before rolling out the full RDM service to the University. CPUT Libraries also embarked on roadshows to introduce RDM. These initiatives seem to have been successful in terms of creating initial awareness among researchers about RDM. Jones, Pryor and Whyte (2013) recommended the piloting of services before implementation as they mentioned that piloting is critical in ensuring that services are fit for purpose before wider roll out.

The Read et al. (2019) study showed that a pilot in initiating RDM services within academic libraries helps librarians to learn about, engage with, and enhance skills within their research communities. This study found that the RDM pilot project at CPUT assisted library management in identifying and developing librarians' skills for RDM support.

5.2.2 Advocacy, training and support

At CPUT, advocacy, training and support were considered priorities during the introduction and implementation of RDM. Cox and Verbaan (2018) as well as Cox et al. (2017:2189) and Pinfield, Cox and Smith (2014) mentioned advocacy as part of services that libraries provide when introducing RDM to their institutions.

At CPUT, RDM advocacy included raising awareness of RDM and providing training to researchers. This study found that CPUT Libraries considers constant and continued advocacy to be essential. The participants in this study believe that advocacy is never complete; making everyone aware means advocacy should be done repeatedly. All the participants in this study mentioned the importance of continued advocacy.

- ***Raise awareness***

RDM advocacy at CPUT included the library raising awareness of the RDM services available to researchers throughout their research projects. This study found that raising awareness of RDM among researchers helped in eliminating concerns among researchers about making their data open. CPUT's approach was that of creating awareness about RDM whenever opportunity was presented.

This study indicates that it is important for CPUT Libraries to continue building up interest among its researchers and give them all the necessary information about RDM activities. Librarians at CPUT strive to be fully involved in departmental meetings in their respective faculties and other related platforms in which academics participate so that they can use opportunities to create awareness of RDM wherever possible.

- ***Train researchers***

As befits a university library, training of researchers by CPUT Libraries is done to support researchers in their research projects and promote research production in the institution. The study found that, at CPUT, training of researchers in RDM starts from the beginning of the research project during the development of the research plan, up to the stage where the data is uploaded to the data repository. Brown, Bruce and Kermohan (2015) likewise advised the early involvement of librarians in the research data lifecycle. At CPUT, gaps in training are identified with the assistance of the research office and necessary support provided whenever there is a need. This study indicates that the research office was helpful in informing the library about researchers' training needs and scheduling of training for researchers when needed.

5.2.3 Institutional policies

The study found that CPUT Libraries considered that, in order to develop strong and mature RDM services, these services need to be aligned with the institutional mission and research mandate. One participant was of the view that without a clear university strategy and mission and RDM-related university policies, it would be difficult to implement successful RDM. At CPUT, introduction and implementation of RDM by the library was based on its institutional mandate as a university that must produce, and therefore support, research. The data presented in the previous chapter show that the introduction of RDM services at CPUT was made possible due to the policies approved by the management of the institution. These policies included the CPUT OA Policy, and the CPUT RDM Policy. The literature reviewed agrees that policies are considered important when implementing RDM as policy provides a clear path for all the stakeholders in an institution (Cox, et al; 2017; Cox & Pinfield, 2014; Higman & Pinfield, 2015; Verbaan & Cox, 2014). RDM policy forms the basis of RDM and

should be followed by appropriate implementation procedures and practices of RDM. At CPUT, RDM is part of its e-Research. Jones, Pryor and Whyte (2013) recommend that in RDM services an "overarching strategy is essential to ensure that RDM services develop coherently."

5.2.4 Assessment of researchers' needs

The literature reviewed showed that it is important to conduct an assessment on the needs of researchers in order to provide relevant services (Lee & Stivlia, 2017; Westra, 2014; Swan & Brown, 2008), noting that user assessment needs are important when introducing RDM services. This study found that, in support and promotion of RDM, CPUT Libraries offers services that depend on the specific user needs, whenever there is a need. One of the participants, for example, stressed the importance of partnerships between researchers and librarians, which lead to a better understanding of RDM support needs. This study shows that CPUT Libraries considered providing quality RDM services that match user needs as important. At CPUT, the library allows researchers to take the lead in RDM as they are the producers of data.

5.2.5 Institutional partnerships

This study found that strong relationships with other units on campus are as important as the literature suggests. CPUT Libraries' partnership with the research directorate proved to be effective in the implementation of research support services offered by the library, including RDM. The research directorate is considered a link between the researchers and the library. The importance of collaborations for the successful development and implementation of RDM services within HEIs is mentioned by Brandt (2014:338); Verbaam & Cox (2014); Jones, (2014:106). Academic libraries can and do contribute to supporting the RDM needs of researchers. However, successful collaboration with other academic units may be the most sustainable path for libraries to continue to play a role in supporting research data as mentioned by Pinfield, Cox & Rutter (2017) Westra (2014) and Corrall (2012). Roles, however, should be clear, as once the library's role in RDM, for example, is clear, researchers may be more prepared to work more closely with the library.

At CPUT, the partnership between faculty librarians, in particular, and researchers is also considered important. Participants in this study regarded these partnerships as helpful in the development of RDM services.

5.2.6 National partnerships

National partnerships have played a role in supporting development of RDM at CPUT. Regional partnerships in particular have contributed towards development of RDM services, either by providing infrastructure or resources. The study discovered that CPUT has in fact been recognised for taking a lead in RDM activities and given a key role to develop policies and guidelines for the Western Cape Data Intensive Research Project. Their involvement nationally has resulted in CPUT Libraries:

- being involved in the development of policies, guidelines and RDM training for Western Cape Intensive Research Data Project; and
- Library Director appointed ILIFU Project – Chair – RDM & Open Science Working Group

5.2.7 International partnerships

The study found that international partnerships contributed to the starting up of RDM at CPUT:

- The collaboration with MUT for example contributed to the creation and development of the RDM platform (MediaTUM);
- Staff exchange with international institutions, for example, the visit by Stephanie Bradbury from Queensland University of Technology, Australia to promote RDM as part of a roadshow; and
- Visits to Oxford and Edinburgh Universities to investigate RDM activities.

This study shows that when starting up RDM, CPUT partnerships with international institutions were utilised.

5.3 RDM services at CPUT

CPUT has adopted a number of RDM services. These cover all the stages of the data lifecycle applicable to libraries. As indicated by one of the participants, the services start from finding and advising on funding opportunities for researchers and taking into consideration research funder requirements. RDM services provided include the following research lifecycle stages, in accordance with what is mentioned by Tenopir et al. (2013:70).

5.3.1 DMP assistance

At CPUT, the DMP Tool was considered crucial to RDM support, having been implemented in the early days of CPUT's RDM service. The DMP template at CPUT assists researchers to plan how to manage their research data during the research cycle, which includes the curation, preservation, and provision of access to the research data for reuse (in doing so fulfilling funder requirements). The provision of this service is in line with the practices of libraries

worldwide, as research shows that most libraries provide DMP assistance and is considered one of the basic RDM services.

5.3.2 Storage and management of data

Data repositories are the cornerstone of RDM at CPUT. Four of the seven stages of the DCC lifecycle model (ingest, store, preserve and use) are addressed by a repository. CPUT is making its research data accessible, sharable, and secure through data repositories. The MediaTUM and Figshare platforms store research data securely and ensure long-term preservation, where data can be made private or public. The repositories are upgraded whenever needed to ensure that they are operating optimally. Help is provided to users in the form of how-to guides. The literature agrees that development of a repository for data is a common second step for libraries offering data services (Kouper et al., 2017; Akers et al., 2014 & Wong, 2009).

5.3.3 Data support services

This study found that data support services provided at CPUT included the following discovering, citing data and accessing data sets. At CPUT, there is a dedicated website on research support on which RDM is listed, where there are web guides about RDM, and alerts about RDM services sent to researchers. All the participants agreed that, at CPUT, there is ongoing support of researchers by librarians. The FSTs are directly responsible for teaching and educating researchers about RDM and this training takes place continually.

5.4 CPUT's experiences in the introduction of RDM services

Through interview data, the study is able to highlight the following as experiences of note in the introduction of RDM at CPUT. Challenges encountered are incorporated into the discussion.

5.4.1 Library management taking the lead

CPUT Libraries' management paved the way for RDM at CPUT. The leadership of library management in this regard can also be shown in the number of research outputs (published papers and conference presentations) that the library has produced on RDM and its involvement in national RDM initiatives.

5.4.2 Staff skills development

The library management offered the library staff opportunities to gain RDM-related skills. This study found that, at CPUT, the existing skills that librarians possessed that were associated with RDM services were identified, and upskilling provided. The study by Cox et al. (2017:150) mentions appropriate skills and knowledge as one of the challenges facing librarians in offering RDM services. This study discovered that there is an ongoing need for training and

reskilling of librarians. “On the job training” is recommended by Sewell and Kingsley (2017:150) and Barbrow, Brush and Goldman (2017:274) mention the competencies of librarians as important in RDM services.

5.4.3 Librarians’ workload and mind-set

The study revealed that the library faces the challenge of adjustment to librarian workload, and changing of mindset in order to accommodate RDM services. This challenge is also mentioned in the literature, where Sewell and Kingsley (2017:150), for example, mention subject librarians’ reluctance to develop research support skills, as they did not fully understand the nature of their contribution. It is important to consider librarian skills and interests, including how other responsibilities are modified to free up the necessary time (Westra, 2014:387).

5.4.4 Researcher reluctance

This study found that, in the beginning, CPUT’s researchers were reluctant to participate in RDM as the publishing and sharing of data was new to them. Researchers needed to be convinced, and provided with evidence about the importance of data management. Cox et al. (2017:2188) reported problems in convincing some academics and researchers of the importance and worth of RDM and Lefebvre, Bakhtiari and Spruit (2020:21) mentioned the reluctance of researchers in disseminating curated data. At CPUT, researchers were made aware of things such as funder requirements, publisher requirements, and the importance of sharing data for visibility, as well as for building of relationships among peers both nationally and internationally, in the hopes that the advantages of RDM would dispel any reluctance they might be feeling.

5.4.5 Sharing of RDM cost

Financial resources are scarce for all academic units within an institution, libraries included. However, the sharing of RDM costs between the library and other units such research directorate would make a difference to the RDM support an institution can offer. Coates (2014:56-57) says, “resources and support provided by the library and institutional administration will largely determine the approach of RDM service development.”

5.5 Recommendations for the implementation of RDM services at an academic library

In light of these findings, the following can be recommended to institutions considering implementing or growing their RDM services, based on the experiences of CPUT:

- Piloting an RDM project with one or two research units to test the effectiveness of proposed RDM services.

- Raising awareness when first implementing RDM services but also advocating for RDM on an ongoing basis.
- Training and supporting researchers continually in any format from tailored one-to-one training to workshops, short courses, webinars, online tutorials, generic FAQ webpages, and web guides.
- Assessing researchers' general RDM needs as well as more specific needs that can be considered in the development of more specific services suitable for researchers.
- Implementing institutional policies and strategies in support of RDM. RDM policy paves the way for RDM as it specifies what is expected to happen and provides a framework of services to be implemented.
- Collaborating within the institution – the library cannot work alone; there is a need for institutional partnerships.
- Being involved in national initiatives that contribute towards building and development of RDM in South Africa.
- Being involved in international collaborations when there is an opportunity to do so as RDM is still a developing area in academic libraries and there is always something new to learn.

5.6 Study limitations

Limitation in research refers to the lack of adequate information on a given subject due to variables, therefore it can be said that all research has limitations (Leedy & Ormord, 2015:353). One limitation of this study is that it is a case study involving one case, which is CPUT Libraries. In single case study research, findings may not apply in other situations (Leedy & Ormrod 2015:353). In this study, however, the case was chosen because of its experience that may be applicable to other SA HEIs.

This research was purely qualitative, and employed interviews to gather some of its data. A limitation of interviews is that, in asking for opinions from participants, there is the possibility of bias in response. This possibility was taken into consideration when presenting the data.

The sample size in this study is small. Despite the small number, the interviews were conducted with experienced staff members knowledgeable about RDM and RDM services and were robust, providing robust data for analysis. The use of a second set of data (the documents) allowed for some triangulation.

The use of Microsoft Teams as compared to face-to-face interviews is a potential limitation on this study, though, except for the potential participant who experience technological difficulties, the online interviews appeared to be unaffected by technology.

5.7 Future studies

The research limitations of this study can be addressed in future studies, as it is expected that RDM activities are to mature, and services in general will continue to increase. Future studies might consider comparing developments in RDM activities in different academic institutions. Librarians' deployment and skills development regarding RDM services can be given exclusive consideration in future studies.

5.8 Conclusion

This chapter presented the findings of the study according to study objectives. As can be seen in this study, implementation and development of RDM services ought to be based on the needs of researchers, the identification of necessary technologies, as well as the expertise of staff to manage the platforms and workflows.

Academic libraries play a large part in scholarly communication and in the OA movement. This extends to their role in the management of research data. The findings of this study show that RDM services require strong leadership and support from relevant stakeholders, especially those of academics and researchers of the institution, where there needs to be a clear understanding of the role played by the library.

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Appendices

Appendix A

Interview Guide (Managers: Research Support & ICT)

This study is conducted by Bulelwa Ntja, a student at the University of Cape Town, Department of Knowledge & Information Stewardship, for the fulfillment of a Master's degree in Library and Information Studies (MLIS)

Topic: **Enhancing the role of the libraries in South African Higher Education Institutions through Research Data Management: A case study of Cape Peninsula University of Technology.**

This study is intended to identify to what extent CPUT has adopted RDM services, to identify the experiences of CPUT in the introduction of these RDM services and to identify practices, potential challenges and recommendations for the successful implementation of RDM services at SA HEIs.

1. Introduction:

1.1 Confirmation of name and position

2. The extent to which CPUT has adopted RDM services and current practices

2.1 Were you involved in setting up any of the policies and procedures associated with RDM?

2.2 How are you involved the management or participation in technology infrastructure that support RDM?

2.3 What technological infrastructure did you require in support of RDM?

2.4 What are the data curation services offered by your library? What data lifecycle stages are addressed by the services being offered?

2.5 Who is responsible for performing these services?

3. Experiences of introducing IR and RDM services

3.1 Is there collaboration with other units or departments on campus regarding RDM for example the research office, departments or other?

3.2 How well developed is the understanding of data curation in your institution? In your opinion, are researchers aware of what is expected of them during data curation?

3.3 Does the library offer any data literacy programmes to address research data management related issues?

3.4 What are librarians' attitudes regarding the importance of RDM services?

3.5 Is there any training or some reskilling provided to librarians involved in RDM services?

4. Challenges, suggestions and recommendations

4.1 In light of your expertise, what are your suggestions or recommendations in starting up RDM services?

4.2 What is the vision of the library about its RDM services in 5 years if there is any?

4.3 What have you found to be the biggest challenges of providing data management services at CPUT?

4.4 What would you like to add about providing RDM services?

4.5 Do you have any questions?

Thank you for your time and affording me the opportunity to conduct this interview.

Appendix B

Interview Guide (Digital Knowledge Librarian & Researcher Librarian)

This study is conducted by Bulelwa Ntja, a student at the University of Cape Town, Department of Knowledge & Information Stewardship, for the fulfillment of a Master's degree in Library and Information Studies (MLIS)

Topic: **Enhancing the role of the libraries in South African Higher Education Institutions through Research Data Management: A case study of Cape Peninsula University of Technology**

This study is intended to identify to what extent CPUT has adopted RDM services, to identify the experiences of CPUT in the introduction of these RDM services and to identify practices, potential challenges and recommendations for the successful implementation of RDM services at SA HEIs.

1. Introductory Questions:

1.1 Confirmation of name and position

1.2 Describe your involvement in RDM services provided in the Library?

2. Providing support for RDM and Services

2.1 What are the current practices of RDM at CPUT?

2.2 Are you responsible for the management, the authorisation and access of your research data? In what ways?

2.3 What are the existing platforms, tools and resources on documentation and description of data? What information need to be captured in order to help others discover, understand and make use of data?

2.4 At what stages of the process do you keep data and in what form / formats (e.g. raw data, processed data, publications, digital / non-digital)?

2.3 What do you see as your main IT-related or data problem (if any)?

2.4 Are there current access restrictions applied to your research data? If there are access restrictions, please specify:

3. Challenges, suggestions and recommendations

3.1 In light of your expertise, what are your suggestions or recommendations in starting up RDM services?

3.2 What have you found to be the biggest challenges of providing data management services at CPUT?

3.3 What would you like to add about providing RDM services?

3.4 Do you have any questions?

Thank you for your time and affording me the opportunity to conduct this interview.

Appendix C

Interview Guide (Faculty Support Staff)

This study is conducted by Bulelwa Ntja, a student at the University of Cape Town, Department of Knowledge & Information Stewardship, for the fulfillment of a Master's degree in Library and Information Studies (MLIS)

Topic: **Enhancing the role of the libraries in South African Higher Education Institutions through Research Data Management: A case study of Cape Peninsula University of Technology**

This study is intended to identify to what extent CPUT has adopted RDM services, to identify the experiences of CPUT in the introduction of these RDM services and to identify practices, potential challenges and recommendations for the successful implementation of RDM services at SA HEIs

1. Introductory Questions:

1.1 Confirmation of the position

1.2 Describe your involvement in RDM services provided in the Library?

2. RDM Services provided

2.1 What data reference services do you provide or assist in consulting with faculty staff

- Support for finding or discovering and citing data sets
- Accessing for example creating web guides

2.2 Does the in-depth understanding of language of the discipline helps?

3. Challenges, suggestions and recommendations

3.1 In light of your expertise, what are your suggestions or recommendations in starting up RDM services?

3.2 What have you found to be the biggest challenges of providing data management services at CPUT?

3.3 What would you like to add about providing RDM services?

2.4 Do you have any questions?

Thank you for your time and affording me the opportunity to conduct this interview.

Appendix D Consent Form

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

Consent Form for the Interview

Title of research project: Enhancing the role of the libraries in South African Higher Education Institutions through Research Data Management: A case study of Cape Peninsula University of Technology.

Name of Researcher: Bulelwa Ntja Telephone: 0822020882 E-mail: NTJBUL001@myuct.ac.za	Name of Supervisor: Michelle Kahn Department of Knowledge & Information Stewardship Telephone: 021 650 1851 E-mail: Michelle.Kahn@uct.ac.za

Nature of Research: This study is intended to identify to what extent CPUT has adopted RDM services as part of its library, to identify experiences of CPUT in the introduction of RDM services and to identify current practices, suggestions and recommendations for the successful implementation of RDM services.

Participant's involvement:

Confidentiality: Information provided would be treated confidential and the study has received ethical clearance from UCT

Benefits: There are no known benefits that would result from your participation in this research; however this research may assist in better understanding of RDM in academic libraries

I have read this consent form and the information it contains and had the opportunity to ask questions. I agree to participate in this research project under no obligations and can withdraw at any stage.

I agree to my responses being used for education and research on condition my privacy is respected and subject to the following: I understand that my personal details will be used in aggregate form only, so that I will not be personally identifiable. I understand that this research might be published in a document that will be available to readers in a university library in printed and/or electronic form.

Signature of Participant: ----------

Name of Participant: ----------

Signature of person who sought consent: ----------Date: ----------
If you have any questions or concerns about this study or if any problems arise contact either the researcher or the supervisor using contact information above.

Appendix E Ethics Clearance: UCT

Department of Knowledge & Information Stewardship
University of Cape Town
Upper Campus

Private Bag X1, RONDEBOSCH, 7701 South Africa
Level 6 Hlanganani, The Chancellor Oppenheimer Library
Tel: +27 (0) 21 650 4546 Fax: +27 (0) 21 650 2529
E-mail: lisc@uct.ac.za
Internet: www.lib.uct.ac.za/lisc

Ref No.: UCTDKIS201906-05 17 July 2019

Bulelwa Ntja

Department of Knowledge & Information Stewardship
Chancellor Oppenheimer Library
University of Cape Town

Ethics approval for Master's research

Dear Bulelwa,

I am pleased to inform you that ethics clearance has been granted by an Ethics Review Committee of the Department of Information & Knowledge Stewardship, Faculty of Humanities, for you to proceed with collecting data for your Master's study on '**Research data management: Enhancing the role of the library in South African higher education institutions**'.

As a next step, please ensure that you obtain approval from the relevant ethics committees to collect data at your data collection site(s), as necessary.

We wish you well with your data collection and the completion of your research.

Yours faithfully,

Dr. Mzwandile Shongwe Chair: Department (DKIS) Research Ethics Committee

Appendix F Ethics Clearance: CPUT

Cape Peninsula

University of Technology

P.O. Box 652 cape Town 8000 South Africa 0Tel: +27 21 469 1012 Fax +27 21 469 1002 80 Roeland Street, Vredehoek, Cape Town 8001

Office of the Research Ethics Committee	Faculty of Informatics and Design

The Faculty Research Ethics Committee has granted ethics clearance to Ms Bulelwa Ntja for research activities related to the Master of Arts degree in the Faculty of Humanities, University of Cape Town. Ms. Njta seeks permission to conduct research at the CPUT Libraries and requires formal written consent from the Office of the Deputy Vice-Chancellor in this regard.

Title of thesis:	Enhancing the role of the library in South African higher education institutions

Comments

Research activities are restricted to those detailed in the ethics application that was submitted to the committee.

Signed: Faculty Research Ethics Committee	1/8/2019 Date

RESEARCH ETHICS COMMITTEE
INFORMATICS AND DESIGN
ETHICS APPROVAL GRANTED

01 AUG 2019

Cape Peninsula University of Technology

Cape Peninsula University of Technology

Office of the Deputy Vice Chancellor:
Research, Technology Innovation & Partnerships
Bellville Campus
P O Box 1906
Bellville 7535
Tel: 021-9596242
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02 August 2019

Ms Bulelwa Ntja
Department of Knowledge and Information Stewardship (DKIS)
Private Bag X3
Rondebosch
7701

Email: NTJBUL001@myuct.ac.za

Dear Ms Ntja

RE: PERMISSION TO CONDUCT RESEARCH AT CPUT

The Institutional Ethics Committee received your application entitled: "Research data management: Enhancing the role of the library in South African higher education institutions" together with the dossier of supporting documents.

Permission is herewith granted for you to do research at the Cape Peninsula University of Technology.

Wishing you the best in your study.

Sincerely

APPROVED
Chair Senate Ethics Committee
02 AUG 2019
Cape Peninsula University of Technology
Sign: .....