Adopting research data management (RDM) practices at the University of Namibia (UNAM): a view from researchers

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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: February 10, 2019**

Dedication

To my dearest Dad, whom I loved so dearly and God called before I finished this study. Keep resting dad dearest; this work is for you.

To the two people I love so dearly - Ndiye and Boitumelo.

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Abstract

This study investigated the extent of Research Data Management (RDM) adoption at the University of Namibia (UNAM), viewing it from the researcher's perspective. The objectives of the study were to investigate the extent to which RDM has been adopted as part of the research process at UNAM, to identify challenges encountered by researchers attempting to practice RDM and to provide solutions to some of the challenges identified.

Rogers' Diffusion of Innovation (DOI) theory was adopted for the study to place UNAM within an innovation-decision process stage.

The study took a quantitative approach of which a survey was used. A stratified sample was drawn from a list of all 948 faculty members (the number of academics taken from the UNAM annual report of 2016). The Raosoft sample size calculator (Raosoft, 2004) states that 274 is the minimum recommended sample size necessary for a 5% margin of error and a 95% confidence level from a population of 948, and this was the intended sample size.

A questionnaire administered via an online web-based software tool, SurveyMonkey, was used. A series of questions was asked to individuals to obtain statistically useful information on the topic under study. The paid version of SurveyMonkey was used for analysis while graphics and tables were created in Microsoft Excel.

The results of the study showed that for the group that responded to the survey, the extent to which they have adopted RDM practices is still very low. Although individuals were found to be managing their research data, this was done out of their own free will; this is to say that there was no policy mandating and guiding their practices. The researcher placed most of the groups that responded to the survey at the first stage of the innovation-decision process, which is the information stage. However, librarians who responded to the survey were found to be more advanced as they were seen to be aware of and engaged in knowledge acquisition regarding RDM practices. Thus, the researcher placed them at the second stage in the innovation-decision process (Persuasion).

Recommendations for the study are based on the analysed data. It is recommended, among others, that UNAM should give directives in the form of policies to enhance the adoption of RDM practices and this should be communicated to the entire UNAM community to create awareness regarding the concept of RDM.

Key words: Research data management, data, practices, adoption, innovation, diffusion, knowledge, scholarly communications, awareness and academic researchers.

List of acronyms and abbreviations

AIMS - Agricultural Information Management Standards

COAR – Confederation of open access repositories

CRP – Centre for Research and Publications

DCC – Digital Curation Centre

DIRISA – Data Intensive Research Initiative of South Africa

DMP – Data Management Plan

DOAJ - Directory of Open Access Journal

DOI – Diffusion of Innovation

GOAP - Global Open Access Portal

ICT – Information and Communication Technology

IUM – International University of Management

NCRST – Namibia Commission of Research and Science Technology

NUST – Namibia University of Science and Technology

OA – Open Access

RDA – Research Data Alliance

RDM – Research Data Management

RST – Research and Science Technology

UCT – University of Cape Town

UNAM – University of Namibia

UNESCO – United Nations Educational, Scientific and Cultural Organisation

USA – United States of America

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CHAPTER 1: Introduction to the study

1.1 Introduction

The demand for the management of research data is on the rise as more and more researchers are called to provide access to their research data alongside their research findings. Managing research data has sometimes become a pre-requisite if researchers are to secure funding for their research projects (Koopman & De Jager, 2016:1). There are also several global initiatives such as open data and open access movements urging researchers to make their research data openly available (Chiware & Mathe, 2015; Kahn et al., 2014). This study investigated the extent to which research data management (RDM) has been adopted as part of the research process at the University of Namibia (UNAM).

Research Data Management (RDM) is a broad and multifaceted topic which has recently emerged. Therefore, for a better understanding of the topic, the researcher introduces the study by using subtopics to familiarise the reader with some phrases and words that are commonly used and to provide some specific facts about the topic under study.

1.1.1 Research Data Management

Research data are the basis of scholarship and scholarly communication. Changes in scholarly communication include the need to curate the entire process of research, including the management of data during and after the research project has been concluded (Bryant, Lavoie & Malpas., 2017:5; Kell & Czernierwicz, 2016:97). The preservation and long-term curation of data sets is thus becoming part of scholarly communication practices in many academic institutions and they support the replication of published findings and facilitate the re-use of research data for new research inquiries (Bryant, Lavoie & Malpas, 2017:5). Data sets are preserved and curated through research data management activities.

RDM is “the organisation and description of data from its entry to the research cycle through to the dissemination and archiving of valuable results” (Cox, Pinfield & Smith 2014:300). Some of the factors believed to have influenced the emergence of RDM include: developments in

technology, the interest in data-intensive science, policy changes among research funders and a greater need to organise, manage, store and share research data among individuals and institutions (Cox et al., 2017:2182).

According to Pinfield, Cox and Smith (2014), RDM addresses a varied range of information needs such as:

- *Security:* research data must be kept confidential to ensure that sensitive data is secured.
- *Preservation*: there is a need for long-term archiving of research data
- *Compliance:* the need to comply with the requirements and policies, for example, those of funders and the legal obligation of data protection. Many research funders' policies, for instance, require a data management plan (DMP) as part of the funding proposal; some funders have as well instructed their individual researchers that they can only fund depending on how the research data will be treated.
- *Sharing:* provide mechanisms and systems to enable free access to data where appropriate, such as a data repository.

It is important to know that the data management practices and activities that researchers can adopt during a research project can be carried out according to a lifecycle (Strasser et al., 2012:2). Higgins (2008) considers a data lifecycle to be important because it helps in making sure that all vital stages of data management are clear, known and planned for before the research project begins, so as to ensure the long-term preservation of research data. One of the activities considered to be important in RDM is the drafting of a Data Management Plan (DMP) which supports how RDM practices are to be carried out (Digital Curation Centre [DCC], 2014).

1.1.2 RDM as a global phenomenon

Researchers across the world are called to provide free access to research data. It is believed that research, especially research which is publicly funded, is a public asset produced in the interest of the public (Bryant, Lavoie & Malpas, 2017:5). Therefore, research data should be made openly available with few restrictions (Bryant, Lavoie & Malpas, 2017:4).

Though RDM recently emerged, it has quickly gained momentum as it is being promoted globally especially in the last few years. There have been many initiatives formulated to encourage good RDM practices. Below are some examples of initiatives which are playing a significant role in addressing the pressing issue of RDM:

- Research Data Alliance (RDA) is an international organisation focused on the development of infrastructure and community activities for data sharing (Research Data Alliance, 2015:4). Members of the RDA include individuals, organisations, and policy makers representing multiple industries and disciplines.
- The Digital Curation Centre (DCC) is a world leading centre of expertise in the digital curation of information. One prominent service it offers is guidance for the writing of Data Management Plans (DMPs) (Digital Curation Centre, 2014).
- Data Intensive Research Initiative of South Africa (DIRISA) was established to give South African researchers an opportunity to share their research data through various tools and services that it offers (DIRISA, 2018).
- Bello et al. (2016:1) recorded 22 data portals from 17 African countries, with Kenya and South Africa taking the lead.

While RDM is still promoted as a new idea, the re-use, management and sharing of research data are fast becoming more and more important, and many academic institutions are increasingly adopting and following the global trends related to RDM practices, particularly the sharing of research data in repositories (Mercury Project Solutions, 2013:1). Some of the global trends in RDM are listed below:

- An interest in RDM by research funders is shown in their demand for the management of research data for the project they are funding (Avuglah, 2016:1).
- The development of RDM skills by researchers. This has been shown by researchers who are making efforts to acquire RDM skills to enhance their practices (Cox & Verbaan, 2018:5).
- The development of data repositories around the world to support RDM during and after research projects are concluded. Among these are: Dryad, COAR (Confederation of Open

Access Repositories), Figshare, OpenDOAR and ZENODO, a free software which accepts any kind of data from various disciplines (Almas et al., n.d.).

- Whyte & Tedds (2011) note the development of standards and mechanisms for citing research data such as Datacite, and for identifying contributors, such as the ORCID.
- Various countries have been developing infrastructure to support RDM practices and services. Pinfield, Cox & Smith (2014:300) recorded many universities which are beginning to try and work out how the management of research data should be supported by policy makers which can be in terms of advice or training (Pinfield, Cox & Smith 2014:300; Whyte & Tedds, 2011:4).

The above is not comprehensive and exhaustive but simply touches on specific trends which the researcher hopes will help to establish a good understanding of the extent of RDM activities globally. The above trends may therefore hasten RDM adoption and help to transform researchers' views of the nature and scope of RDM.

1.1.3 RDM in Africa

RDM in Africa is believed to be in its development stage (Chiware & Becker, 2018:1), as many African countries have not yet made RDM practices a national mandate. In South Africa, for example, RDM is a new concept to most researchers and it is still in the process of emerging, as revealed by van Deventer & Pienaar (2015:34).

Despite the evidence that RDM is still in its developmental stage in Africa, one cannot surely say that researchers are not managing their research data. As van Deventer & Pienaar's (2015:34) journey revealed, some researchers in some South African institutions were already engaged in data sharing both on a national and international level at the time of conducting their research. This is an indication that RDM is indeed being practiced to some extent in some institutions in Africa, particularly in South Africa.

Moreover, there have been some workshops, trainings, meetings, and conferences being held mostly in South Africa, which seek to create an awareness of and partly address the issues related to RDM. Some examples include the 2014 Library and Information Association of South

Africa (LIASA) meeting held in Cape Town, South Africa (LIASA, 2014), and in 2018 the Data Intensive Research Initiative of South Africa (DIRISA) (2018) hosted a national data workshop aimed at enabling the academic and research community to share knowledge and their experiences in data intensive research and RDM.

In April 2016, Namibia hosted a forum on open data and open science in agriculture to discuss the sharing of research data among researchers in Southern Africa and this was made possible with the help of an organisation known as Agricultural Information Management Standards (AIMS) (AIMS, 2016).

1.1.4 RDM in academic institutions

The need for the adoption of RDM practices in academic institutions has been influenced by, among others: the increased need for academic researchers to collaborate; increases in calls to make research data output findable, accessible, interoperable, and reusable; publishers seeking to be responsive to calls for transparency of research data; organisations seeking to manage valuable public research data; and the public seeking to gain and re-use knowledge for their own purposes (Bryant, Lavoie & Malpas, 2017; Chigwada, Chiparausha & Kasiroori, 2017; Koopman & De Jager, 2016; Steele, 2014; Kahn et al., 2014).

While academic institutions are noticing the changes in scholarly communications which require them to mandate the management of research data, the adoption of good practices in RDM is seemingly in its infancy (Chiware & Becker, 2018). Good RDM practice entails that other researchers are able to access research data with ease and and that data should be transparent (Bryant, Lavoie & Malpas, 2017), and this needs to be an effective practice across all academic disciplines. Therefore, it is evident that the adoption and continuous practice of RDM is indispensable within the academic research process (Digital Curation Centre, 2015).

As has been seen from the introduction in the present study, the adoption of RDM practices by academic researchers is important in the context of RDM.

1.2 Background to the study

For a clear understanding of the background to the study, this section is devoted to describing the country as well as the institution where the study was undertaken. The researcher further discusses the general nature of research activities within the country and the institution, as well as the ongoing discussion on research, data, open access/open data policies and RDM at the institution and across the country.

1.2.1 Namibia

UNAM operates in a country which is classified as a lower middle-income (Republic of Namibia, 2009:6). The country's economy is heavily dependent on the extraction and processing of minerals for export (Namibia Statistics Agency, 2016:13). Located in the south-western part of Africa, Namibia is one of the least populated countries in Africa. The estimated population is 2.3 million (Namibia Statistics Agency, 2016:13) and more Namibian people live in rural areas than urban areas (Namibia Statistics Agency, 2016:13). Trotter et al. (2014:58) believe that post-independence Namibia is stable and peaceful. Moreover, the Namibia Statistics Agency (2016:16) indicates that Namibia is divided into 14 regions and English is the official language.

There are three major universities in Namibia, namely: University of Namibia (UNAM), Namibia University of Science and Technology (NUST), and International University of Management (IUM) and these universities are called upon to engage in research activities. Some of the activities as outlined in UNAM's Scholarly Communications Policy (2013:3), include: the dissemination of research activities using the internet, changing from print to digital formats, compliance with the changing patterns of research funding, and new initiatives to engage in global data infrastructure and coordination.

Research is an important ingredient for Namibia's socio-economic development and this idea has prompted the establishment of the National Commission on Research and Technology (NCRST), a state-owned enterprise established by the Research, Science and Technology (RST) department (Act No. 23 of 2004). NCRST is responsible for the coordination, monitoring and supervision of research in science and technology in Namibia (UNAM, 2015:7).

Some of the on-going debate around research, data, and new technologies in Namibia point out that Namibia is aligning itself with the global trend of managing research data. For example, the Namibian government implemented the e-governance strategic plan (2014-2018) to offer online government services to the public (Open data portal ..., 2016).

Furthermore, in April 2016, Namibia hosted a forum on open data and open science in agriculture to support access to agriculture, science and technical information in sub-Saharan Africa (AIMS, 2016). Some of the resolutions of the forum were that: Namibia was to develop a national steering committee on open data and open science, while NCRST was assigned to coordinate the committee. It was further suggested that the committee must involve academic institutions such as UNAM. The other resolution of the forum was for NCSRT to formulate a science, technology and innovation policy, hence the forum advised NCRST to include issues relating to open access and sharing of research data (AIMS, 2016).

In addition, a young Namibian entrepreneur by the name of Amugongo Mbangula Lameck established the first Namibian open data portal to enable the publication of quality data and to store all public data (Open data portal ..., 2016).

However, besides the plans and formulation of some policies around research, open access and open data, there are no clear directives regarding RDM in Namibia as there is at present no policy that addresses and emphasises RDM practices in Namibia.

1.2.2 The University of Namibia

UNAM is Namibias' oldest state-owned university which was established under the Parliament Act 18 of 1992 and began operating in 1992 (UNAM, 2015:03). UNAM is an urban based university with 12 sites/campuses country wide and seven regional centres. Academic programmes at the university are held by eight faculties, eight schools, and three centres, as follows (UNAM, 2015:03):

1. Faculty of Agriculture and Natural Resources

- School of Veterinary

2. Faculty of Economic and Management Sciences

3. Faculty of Education

4. Faculty of Engineering and Information Technology

5. Faculty of Health Sciences:

- School of Medicine
- School of Nursing
- School of Public Health
- School of Pharmacy
- School of Dentistry

6. Faculty of Humanities and Social Sciences

7. Faculty of Law

8. Faculty of Science

- School of Computing
- School of Military Science

Centres

- Multi-disciplinary Research Centre (MRC)
- Centre for Open, Distance and e-Learning (CODeL)
- Centre for Quality Assurance and Management (CEQUAM)

UNAM registered 24, 759 students in 2017 from 43 countries across the world (UNAM, 2017). There are 1,754 staff members of which 948 are academic staff and 804 are administrative and supporting staff (UNAM, 2016:5).

The responsibility of research at UNAM comes from the University of Namibia Act (No.18. of 1992), which insists that the university must "undertake, advance and disseminate knowledge for the socio-economic development of the nation and beyond". For that reason, faculty lecturers and academic researchers spend a significant amount of time doing research within their disciplines in addition to teaching (UNAM, 2015:9). Most of the research done by academic researchers is used to advise government and influence public policy (UNAM, 2015:6). Additionally, research done at UNAM is often adopted in industry practice (UNAM, 2015:9). For instance, the Kalimbeza rice project in the Zambezi region is a collaborative research done by UNAM and Namibia's Ministry of Agriculture Water and Forestry.

At UNAM, scholarly communication is aligned with the university's vision, mission and mandate, hence, it recognises that publishing is a means of dissemination of knowledge. UNAM positions itself in the growing international open access movement whereby most academic institutions in Africa are making their research outputs available through the use of the internet (UNAM Scholarly Communications Policy, 2013: 4). Thus, UNAM's position on participating in open access initiatives is found in its scholarly communications policy.

In addition to the scholarly communications policy, a research policy and a research ethics policy have been developed (UNAM Scholarly Communications Policy, 2013: 6). The research policy addresses the expectations of the Namibian government for UNAM to publish all research outputs in a publicly available format such as a repository so that the public can have access to it (UNAM Scholarly Communications Policy, 2013: 6). However, according Trotter et al. (2014), much of the research done at UNAM is not easily accessible due to technological constraints such as: bandwidth, log in constraints and fragile research infrastructure (UNAM Scholarly Communications Policy, 2013:6). These technological constraints are distinguished by Trotter et al. (2014:97) who further assert that the above constraints hinder UNAM from disseminating its research more widely.

To align the scholarly communications practices with the rapidly developing world-wide standard for the production of scientific research, UNAM established the Centre for Research and Publications (CRP), which has influenced UNAM to commit to quality research out-puts

(UNAM, 2015:6). UNAM's CRP office help researchers to apply and attain funding from NCRST and international funders. Thus far, the university has managed to secure funding from NCRST for some research projects (UNAM, 2015:6). It is evident that research activities are taking place at UNAM in view of activities such as the university joining the Global Open Access Portal (GOAP), an organisation developed to help policy makers with the necessary information about Open Access (OA) and to help policy makers in understanding the importance of OA and how it can be made a success (United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2017.), and the opening of an open access repository administered by UNAM's library, and which hosts most of the institution's scholarly communications such as thesis, monographs, and conference papers (Trotter et al., 2014:4).

Although Trotter et al. (2014:4) maintain that research at UNAM is in a developmental context because the university's focus is on teaching and that the research carried out at the university is basically for the personal desire to create new knowledge and enhance teaching, there have been proposals to develop research policies which will address the university's position regarding the sharing of research data (UNAM Scholarly Communication Policy, 2013:4). It is believed that the proposed policy will include good RDM practices to enable effective data sharing.

1.3 Research problem

One thing that researchers do is to gather data for the purpose of answering a research question. In today's world, the gathered data needs to be managed during and after the study has been concluded, and this is becoming a requirement within academic and research institutions. Dora & Kumar (2015) note that RDM practices have already been adopted in some academic institutions. However, the extent to which RDM practices have been adopted at UNAM is not known.

Tenopir et al. (2011:1) maintain that, if academic researchers do not adopt RDM practices, not only is there a substantial risk of losing valuable data, but also the institution runs the risk of not conforming to global standards which will help them to remain viable within the global research environment. Additionally, for the adoption to continue, it is believed that there must be standards such as principles, guidelines and rules that researchers must follow. These cannot be

produced at UNAM if the university's research stakeholders are not aware of how well researchers understand the concept of RDM or what practices they already have in place.

Since little is known about the current position and behaviours of UNAM researchers regarding the adoption of RDM, there is a possibility of delays in the development of the RDM policy. Tenopir et al. (2011:3) emphasise the fact that the extent to which researchers adopt and practice a new trend such as RDM is not mainly dependent on them. They point out that, if policies have been developed, researchers are most likely to adhere to them (Tenopir et al., 2011:3), and as such, they believe that policies have a major influence on encouraging individuals to adopt and conform to practices.

This study may therefore increase the understanding of the adoption of RDM at UNAM by mapping the current knowledge and behaviours of academic researchers towards RDM and recommending workable solutions to the challenges encountered by researchers as they attempt to adopt RDM in their daily research process.

It is hoped that the evidence gathered from the academic researchers will provide guidance in the formulation of an RDM policy and in planning strategies for services and support for RDM at UNAM.

1.4 Objectives of the study

To address the topic, the study is guided by a set of objectives as indicated below:

1. To investigate the extent to which RDM has been adopted as part of the research process at UNAM;
2. To identify challenges encountered by researchers attempting to practice RDM at UNAM; and
3. To provide possible solutions to some of the challenges identified.

1.5 Research questions

The following questions were generated to address the objectives:

1. To what extent have researchers adopted RDM practices at UNAM?
2. What are the current developments regarding RDM at UNAM?
3. What are the challenges that academic researchers encounter in adopting RDM practices?
4. What are practical solutions to RDM adoption challenges that can be implemented at UNAM?

1.6 The importance of this study

It is anticipated that this study will make at least three contributions to the area of research data management. First and foremost, it will expand the knowledge base of research data management as an emerging trend within scholarly communications, through a contribution to the on-going debate. Secondly, many studies have been conducted globally on RDM practices. However, none of these studies have focused on the Namibian perspective, let alone UNAM. Moreover, because there is no literature on RDM in the Namibian context, the value of establishing the understanding and knowledge of RDM practices at UNAM make this study significant. In addition, this study will lay a foundation for future literature in the Namibian context. Thirdly, the study is an opportunity to identify the challenges faced by researchers as they attempt to adopt RDM and consider how the adoption and good management and curation of research data will improve the potential value of research within UNAM.

1.7 Overview of the research methodology

For this study, a survey design in the form of a questionnaire was selected to investigate the knowledge and behaviour of researchers about data management practices across all faculties at UNAM. The questionnaire was administered through an online instrument known as

SurveyMonkey, that enabled an approach to be made to many academic researchers across all UNAM sites country-wide.

The online questionnaire consisted of 26 questions with a mixture of multiple-choice responses and free text fields focusing on: awareness, habits, practices, adoption and challenges faced by UNAM academic researchers with respect to RDM practices. The questions were designed in such a way that they described issues reflecting the objectives of the study. A stratified sample was drawn from a list of all 948 faculty members (the number of academics taken from the UNAM annual report of 2016). The Raosoft sample size calculator (Raosoft, 2004) states that 274 is the minimum recommended sample size necessary for a 5% margin of error and a 95% confidence level from a population of 948, and that was the intended sample size. The paid version of SurveyMonkey was used for data collection and analysis, while tables and charts were created using Microsoft Excel.

1.8 Definitions of terminologies

The definition of terminology has been provided to assist in understanding frequently used terms and concepts when going through this research.

Data

Data may be defined differently based on the subject discipline. For this study, data is defined as information in a raw or unorganised form. For instance, facts, figures or instructions presented in a form that can be comprehended, interpreted and communicated by a human being, or processed by a computer (Reitz, 2002:201). Data can be statistics, spreadsheets, experimental results, databases, work of art, images, and sketch books (Burnham, 2012:2).

Data Management Plan (DMP)

Dobreva (2018:142) defines a DMP as the documentation of the process and procedures taken by a researcher in planning, describing and communicating the activities carried out during the research lifecycle.

Open Data

Open data is the data that can be freely used, reused and redistributed by anyone without much restriction (Berghmas et al., 2017:3). Open data practices facilitate collaboration, drive data analysis and promote data transparency

Research Data

Research data is defined as a collection of structured information from any discipline or sources which can be used by a researcher to undertake their research or provide an evidential record of their research (Burnham, 2012:5). There are many ways of creating research data and for different purposes and through different processes such as observation and experiments; with the evolving technology, most of research data are perceived to be in digital formats (Nhendodzashe & Pasipamire, 2017).

Research Data Management

There are many definitions of RDM. However, this study used Cox, Pinfield & Smith's (2014:300), definition who defined RDM as "the organisation and description of data from its entry to the research cycle through to the dissemination and archiving of valuable results." Dobreva (2018:142) adds that RDM describes all aspects of planning, organising, documenting, storing, and sharing of data.

Scholarly Communication

Scholarly communication is defined 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 (Trotter et al., 2014:63).

1.9 Research report plan

This study is covered in five different chapters as outlined below:

First chapter: Introduction and background to the study. The main topics of this chapter are the introduction and background to the study, research problem, objectives and research questions,

significance of the study, an overview of the research methodology and definitions of terminologies used in the study.

Second chapter: Theoretical framework and review of previous studies. The main topics covered in this chapter are the theoretical framework adopted for the study as well as the review of literature that relates to the topic under investigation.

Third chapter: Research design and methodology. This is the chapter where the research approach, design and methods are covered. It further gives the data gathering process including the population, sampling procedures and techniques, ethics and study limitations.

Fourth chapter: Data analysis. This chapter provides an analysis of the gathered research data.

Fifth chapter: Findings, conclusions, recommendations and suggestions. This is the concluding chapter where the researcher reports the findings, gives conclusions and recommendations as well as suggestions for areas which need to be researched further.

1.10 Chapter summary

The chapter introduced the study, described the background to the study, identified the research problem, outlined the objectives and research questions, explained the significance of the study, and briefly described the research methodology. The chapter further provided the definition of terminologies associated with the study topic, and the research outline.

CHAPTER 2: Theoretical framework and literature review

2.1 Introduction

This chapter begins by discussing the theoretical framework that guided the study. Rogers' Diffusion of Innovations (DOI) Theory is used to frame the study. The chapter presents studies that used Rogers' DOI theory and further clarifies why this theory was selected for the study. The reviewed literature is on the important themes and concepts arising from the research questions and as they relate to the aims and objectives of the study are also discussed. The last part of the chapter summarises what was covered in the entire chapter.

2.2 Theoretical framework

Creswell (2014:53) defines theories as "believed facts that attempt to give a reasonable or rational explanation of cause and effect relationships among a group of observed phenomena". A researcher may use a theory to present an argument or discussion (Creswell, 2014:54). For this study, a theory is used to discuss the phenomena under study. Thus, theory here is used to guide the research study to find relevant facts (Creswell, 2014:54).

For this study, the theory is deductively used and placed at the beginning of the second chapter with the objective of verifying the theory rather than developing one. The researcher collected data to explain the theory and the results are used to approve the theory (Creswell, 2014:59). Hence, the theory is the framework for the entire study.

In research studies, a theoretical framework is used to hold and support a theory. Bell and Waters (2014:104) define the theoretical framework as a descriptive device which is used to explain the themes and concepts of the study. The theoretical framework can be narrated or explained using graphics to give a detailed description of the main key features and to build variables to be studied.

Furthermore, theoretical frameworks are believed both to form the basis for predictions about relationships among variables of the research study and to guide the context for investigating a

problem and serving as a guide to thoroughly identify logical explanations and predictions (Punch, 2006:49).

This study is based on an existing theoretical framework. Hereunder the chapter begins with the identification of the framework that provides both the structure and guidance for the study by establishing the concepts and their relationship to each other (Punch, 2006:49).

2.2.1 Diffusion of Innovation Theory

Rogers founded the Diffusion of Innovation (DOI) theory in 1964. DOI theory has its origin in communications, and it essentially seeks to explain in what ways, how and why as well as the rate at which new ideas, concepts and technology spread (Robinson, 2009:1).

Rogers (2003:5) defines 'diffusion' as the process by which an innovation is communicated through certain channels over time among the members of a social system. From Rogers' definition of diffusion, four basic key elements are distinguished namely: innovation, communication channels, time, and social system. For a clear understanding, the four elements need to be briefly explained.

Rogers (2003:12) defines innovation as an idea, behaviour or object perceived to be a new actor coming into play and that is seen as such by its audience. For this study, the innovation is RDM, a concept that promotes the management of research data sets. DOI theory was chosen for this study as it helps in measuring the rate of adoption of RDM at UNAM.

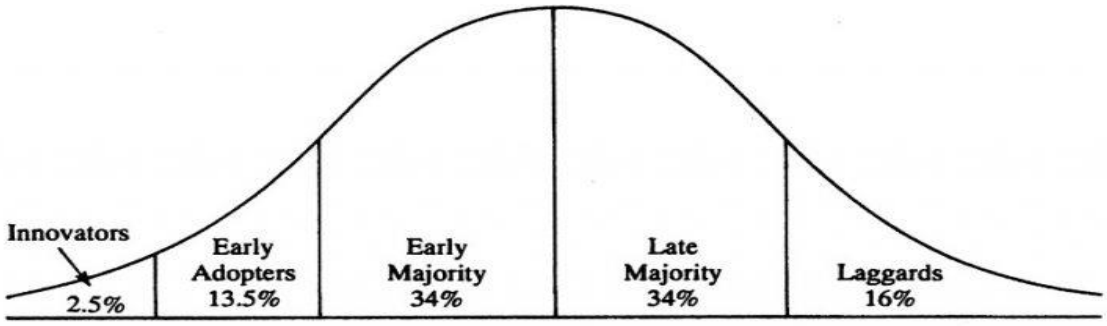
Communication channels are the means through which a message or information is transmitted to its intended audience (Rogers, 2003:18). In diffusion, communication concentrates on the innovation (Rogers, 2003:18). One example of a communication channel is mass media channels such as the use of the internet to enlighten the targeted audience regarding an innovation (Rogers, 2003:18).

The time element suggests that new ideas require an amount of time from the time they emerge to the time when they are broadly accepted and practiced (Rogers, 2003:20). The innovation-decision process (discussed later) makes up part of the time dimension and it is used in this study.

Finally, a social system is made up of individuals, groups and institutions involved in a mutual relationship to solve a problem and mainly to achieve a common goal (Rogers, 2003).

Rogers' DOI theory proffers that a population cannot adopt a new idea all at the same time, rather, they tend to adopt a new idea in a sequential manner. Thus, Rogers (2003: 281) breaks down a population into five sections, and these sections are distinguished by their attitudes and behaviour regarding a new idea (Rogers, 2003) and this can be seen as presented in Figure 1.

Figure 1. Rogers' five sections of the population based on their adoption of a new idea



Source: Rogers (2003:281)

The innovators: they are a group of people who devote time to develop new ideas (Rogers, 2003:282).

Early adopters: the first group of people to adopt an innovation if they see the benefits of it; their interest is more on satisfying their own personal needs (Rogers, 2003:283).

Early majority: are mainly influenced by the success of a new idea, for instance, if the idea is endorsed by policies; solid proof of benefit is vital for this group (Rogers, 2003:283)

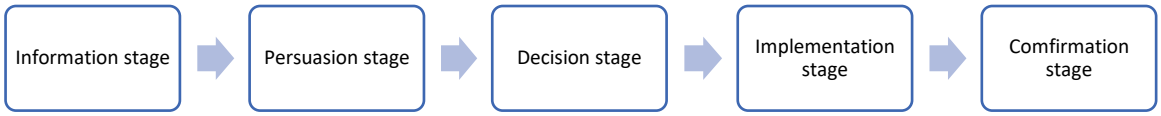
Late majority: this group does not take risks and new ideas make them very uncomfortable. They are afraid of not fitting into the new trends and are often influenced by the fears and opinions of laggards (Rogers, 2003:284).

Laggards: this group will go to any length to find faults and risks in a new idea. They are people who see a high risk in adopting a behaviour, an idea or attitude (Rogers, 2003:284).

2.2.2 Innovation-decision process

The innovation-decision process involves the procedure through which an individual, organisation or other decision-making unit goes from knowing about the existence of an innovation to continue the use of it (Rogers, 2003:168. To measure the adoption of a new idea, Rogers' element of time describes how the successful adoption of a new idea is attained through an innovation-decision process which is explained in stages. This study was guided by these stages and these stages were used in this study to find out at what stage UNAM researchers are currently towards adopting RDM in their practices, and to determine what is most likely to influence the adoption of RDM practices. Rogers (2003:169) describes the innovation-decision process in five stages as shown in Figure 2 below.

Figure 2. The flow of a model of stages in the innovation-decision process (Rogers, 2003:170)



Source: Rogers (2003:170)

Information stage: where an individual learns about the existence of an innovation and looks for information about the innovation, making means to understand what the innovation is, how it works, and why it works (Rogers, 2003:20). For example, managing data is a multifaceted process which includes technology, knowledge organisation, and policy and knowledge of the research process (De Roure, 2014: 235). Therefore, the researcher may learn about the existence of RDM through any of the above.

Persuasion stage: after learning about the innovation and its advantages and disadvantages, individuals form their own attitude and behaviour towards an innovation (Rogers, 2003:20).

Decision stage: this is considered an important and main stage where a decision must be made by an individual; it is at this stage where an individual decides to adopt or reject the innovation (Rogers, 2003:20).

Implementation stage: at this stage, an innovation is fully used by individuals, be it through compliance with policies or integration into practices by an individual out of own free will (Rogers, 2003:20).

Confirmation stage: this is the final stage where an individual who has fully integrated the innovation confirms if it is beneficial or not (Rogers, 2003:20). It is important to note that individuals at this stage may as well decide not to adopt the innovation. Rogers (2003) maintains that the rate at which an innovation is adopted is mainly characterised by: (1) its relative advantages – a belief that a new idea is better than the old one; (2) its compatibility – an innovation's compatibility with the values, beliefs, past experiences and practices of individuals; (3) its complexity – whether an innovation is easy to use; (4) trialability – can the user test an innovation on a limited basis to see if it works; and (5) its observability – the clarity to . others of the results of an innovation (Rogers, 2003).

Robinson (2009) points out that the DOI theory is pertinent for studying the adoption of any innovation. The idea is that the product/innovation responds to the needs of users rather than users having to change to adopt the product (Robinson, 2009).

For this study, it is useful to consider the innovation-decision process of DOI theory as a framework to examine the extent of adoption of RDM at UNAM and to articulate the stages at which individual researchers are with regards with the adoption of RDM.

2.2.3 Studies that have applied Rogers DOI theory

DOI theory has been used in several different fields of study; however, each field of study focused on a different element of the theory. In recent years, DOI theory has been applied in several studies to measure the rate of adoption of a new idea.

Among studies that recently used DOI theory is the one by Dube and Gumbo (2017) who applied DOI theory to find out about Zimbabwe's current extent of adoption of online transaction platforms. Their study took a mixed approach where both qualitative and quantitative strategies were used, the result indicating that, although the retail industry had made great progress to

adopt online technology platforms, the adoption by customers was relatively low (Dube & Gumbo, 2017).

DOI theory seems to gain more momentum in Information Communication Technologies (ICTs), as DOI theory is often used to study an individual's adoption of ICTs services, practices and uses. Some of the studies that used DOI theory in ICT include: a study by Forman & Goldfarb (2005) who applied DOI theory to study the adoption of ICTs in businesses. The study adopted a quantitative approach where a survey was used. The result indicated a variance in internet use, suggesting the presence of a digital divide. Another example is that of Muriithi, Horner & Pemberton (2016) who applied DOI to study factors contributing to the adoption and use of ICTs within research collaborations in Kenya. A mixed approach was used and the results indicated a little diversity in the adoption and use of ICTs.

Some related studies that used DOI theory within the LIS discipline include those of: Leonard (2014), who investigated the adoption and views about and use of e-books at the University of Namibia, using a mixed method. The study found that there was a high level of awareness about e-books by students. Majanja-Minishi (2005) conducted a study to determine the relevance of DOI theory as a theoretical framework in library and information science research using a survey research method and structured interview with key informants. The study concluded that because of its broad framework, the theory provided a platform for investigating LIS innovation. Jantz (2012) used DOI theory as a framework to conduct a study that examined librarians' perceptions at six universities on innovation in academic libraries using a structured interview method. In the findings, leadership was alluded to by many librarians as the basis for the organisation to innovate. Lastly, there was a study by Nazari, Khosravi & Babalhavaeji (2013) who applied Rogers' DOI theory to find out the factors that affect the adoption and use of online databases at the University Zone of Iran using a survey method. The findings of the study indicated that almost half of the faculty members were early majority adopters.

The above studies demonstrate that DOI theory is useful for conceptualisation mostly in technological adoption; however, the theory can also be used for the adoption of new ideas such as RDM.

2.2.4 DOI theory application to this study

From the first objective of the study, there is a clear indication that the framework used for the study should include components of new ideas or practices, and some mode of communication to create awareness about an innovation and change attitudes to embrace or reject the new practices/innovation. Therefore, the researcher considered the innovation-decision process of DOI theory as a framework to investigate the extent of adoption of RDM practices

DOI theory, particularly the innovation-decision process, is adopted for this study because it focuses on the stages of adoption of a new idea. The innovation-decision-process helped to ascertain the stage at which UNAM researchers are in accepting RDM as part of their research practices.

Focusing on stages in the innovation-decision process helped the researcher to explain the factors that are most likely to influence how and why the researchers may adopt or reject RDM practices at UNAM.

2.3 Review of the literature

For this study, a review of previous studies was used to trace what has already been done and to find out how much is already known on the topic including what is being debated about, to assess the sources, to point out the relevant research studies, and also finding out what methodologies have been used before in the studies already conducted on the topic (Bell & Waters, 2014:105).

2.3.1 Studies in Africa

Studies addressing RDM practices and adoption have been carried out in Africa. Chiware & Becker (2018) conducted a study to assess the RDM readiness of universities and research libraries in Africa. The result of their study revealed that RDM services were still developing in most academic and research institutions in Africa. Chigwada, Chiparausha & Kasiroori (2017) conducted a survey study on twenty-five institutions in Zimbabwe. The study evaluated how research data is being managed at these institutions and revealed that though RDM is being

practiced at these academic institutions, proper RDM is not being done and there was also a lack of guidelines on good RDM practices. Nhendodzashe & Pasipamire (2017) conducted a study using questionnaires and interviews to assess the RDM readiness of the University of Zimbabwe; the study concentrated mainly on the library aspect. The result revealed that the university library was prepared as it had the necessary technological infrastructure and economic resources. The result further indicated that the university lacked the enabling framework and skills to provide RDM services throughout the data lifecycle.

A study by Koopman & De Jager (2016) in 2014 among the biological sciences researchers at the University of Cape Town (UCT) South Africa, was carried out to investigate the state of RDM and archiving, and the readiness of researchers to engage the sharing of their digital data. It was discovered that some researchers were already engaged in the digital archiving of research data in repositories even though there were no RDM policies in place to guide the academic institutions and the researchers themselves. To explore the current state of affairs regarding RDM in Africa, van Deventer & Pienaar (2015) undertook a personal learning journey for discovering the emergence of RDM and that of some researchers that were engaged in initiating small RDM projects to aid the participation in global research networks. They discovered that the University of Pretoria began the development of RDM initiatives way back in 2007, Tenopir et al. (2011) carried out a survey to study the data practices of researchers in South Africa. The study revealed that the researchers' culture of RDM practices was the barrier for effective research data sharing practices. Lastly, a study by Kahn et al. (2014), was undertaken to assess librarians' views on the changing RDM landscape. The analysis revealed a clear need for combined efforts from both researchers and research stakeholders concerning RDM, particularly South Africa.

2.3.2 Studies done outside of Africa

Furthermore, the review of literature revealed that there are many studies that address RDM practices internationally and some of these are discussed below.

Buys & Shaw (2015) designed a survey to investigate how researchers at Northwestern University in the United States of America (USA) are managing data to determine their future

needs concerning data management. The result of the study revealed that "researchers at the university need both short and long-term storage and preservation solutions". van Tuyl & Michalek (2015) conducted a survey study at Mellon University in the USA to assess RDM practices of a specific faculty. The results of the survey suggested moderate levels of RDM awareness and that to some extent RDM was regulated. Moreover, Kennan & Markauskaite (2015) conducted a study at ten universities in New South Wales in the United Kingdom and Australia to gain an insight into the RDM and sharing practices of academic researchers. The study revealed that most researchers at the universities were finding challenges in managing their research data, and some of the challenges being finding safe and secure storage mainly after the research project has been concluded. Hickson et al. (2016) undertook a project at Griffith University in Australia to understand the aspects of researchers' behaviours towards research data. The results indicated that attitude towards RDM as an innovation is the key element which will need to be addressed if RDM practices are to be attained and fully adopted at the university.

In addition, various studies have been carried out on the academic libraries' roles, relationships and responsibilities towards RDM (Bryant, Lavoie & Malpas, 2017; Searle et al., 2015; Pinfield et al., 2014; Lewis, 2010). As examples.

The findings of these studies, both those done in Africa and outside of Africa, reveal that while it is evident that RDM has been adopted either on an individual or on an institutional level in academic institutions, issues such as lack of long-term storage, lack of knowledge in developing DMPs, and lack of skills in data organisation and management, and in many instances researchers learning on the job, were some of the issues picked to be among the obstacles to good practices (van Tuyl & Michalek, 2015; Hickson et al., 2016).

Additionally, in view of the reviewed literature, there is an indication that many research and academic institutions require library-based data management expertise to serve as sources of authority on newly endorsed policies and requirements. These studies strongly suggested the need for training and outreach programmes as well as safe and secure storage if they are to obtain significant levels of adoption and a good practice in RDM (Dora & Kumar, 2015).

Cox et al. (2017) maintain that many universities have begun to address the RDM strategic objective and a range of institutional stakeholders including academic libraries have engaged in developing policies, services and infrastructure as this ensures the facilitation and adoption of ongoing RDM practices.

2.4 Current developments regarding RDM in academic institutions

Academic institutions are multifaceted organisations and research is a prominent part of academic institution activities, and academic researchers adopting and practicing RDM have become a prominent part of the research landscape. (Halbert, 2013:11). Most universities are expected to adopt and practice RDM (Halbert, 2013:11).

Noteworthy is that many international, and some of the universities in Africa have begun to address RDM and a range of institutional stakeholders including academic libraries, academic researchers, research funders and IT personnel have become involved in many activities regarding RDM (Halbert, 2013:10).

Moreover, there are different developments that are taking place in academic institutions to enhance RDM. Some of the prominent developments picked from different studies include:

2.4.1 Development of RDM services

Many academic and research institutions are developing RDM services to respond to the demand of preserving data gathered from several scientic fields and to provide tools and methods on how these data can become shareable (Dobreva, 2018:141).

2.4.1 Requirement compliance

Corti & Fielding (2016:1) and Koopman & De Jager (2016) point out that in many academic institutions, researchers are requested to submit DMPs addressing issues of management and sharing of research data and their research data to support journal articles. As such, academic institutions are developing guidelines and policies to support RDM practices, hence academic researchers must comply with these guidelines and policies (Halbert, 2013:11).

2.4.2 Sharing of research data

Perrier et al. (2017:1) proffer that researchers are expected to share their research data rather than withholding their research. This practice should be done both on national and international levels. One example is the involvement of various research institutions in open data efforts to share research data and to be more transparent about their research activities (Corti & Fielding 2016:2).

Moreover, researchers put their research data in open repositories like Figshare for the puposes of preserving it for future use and sharing with other researcher (Dora & Kumar, 2015:485). "The sharing practice supports a global trend of funding agencies who are requesting researchers to follow trends for open access and open data which includes activities such as creating standard metadata which will aid in the discoverability of research data" (Perrier et al., 2017:5).

2.4.3 RDM skills and knowledge acquisition

Bryant, Lavoie & Malpas (2017) assert that most academic researchers have no formal skills and knowledge in RDM and as such they are mostly learning on the job. Perrier et al. (2017:5) note that some academic researchers in certain universities are making efforts in obtaining RDM skills through online learning tools, reading books and taking up short courses on digital curation. This serves as the basis for skills development among academic researchers.

2.4.4 Development of infrastructure

As of late, many future investments in academic institutions involve e-infrastructure (Corti & Fielding 2016:3) and both research and academic institutions are slowly setting up their own data curation and publication infrastructure. It is therefore, believed that e-infrastructure will be used as an enabler for research and research data (Corti & Fielding 2016:3).

In the USA, many research and academic institutions provide data archiving services to accommodate research activities and to embrace the current trend within scholarly communication of managing research data (Whyte & Tedds, 2011:4).

2.4.5 Digitally facilitated research activities

In today's research environment, part of the research cycle, if not all, is most likely to be carried out digitally from data collection through to publishing (Corti & Fielding 2016:1). One example is that of a researcher collecting survey and fieldwork data and uploading them to a computer where the data are most likely to be stored on a hard drive or on a web-based cloud.

It is also apparent that the use of digital technologies to collect and analyse research data is being used by a variety of disciplines. Nhendodzashe & Pasipamire (2017) indicate that most researchers at the University of Zimbabwe generate their research data in text and spread sheets using computers.

2.4.6 Writing of a DMP

As mentioned earlier, many research funding agencies are now demanding researchers to include DMPs in research proposals, addressing how researchers will gather, organise, store, preserve and share their research data with other researchers. As such, many academic institutions are adopting similar policies (Halbert, 2013:3).

In view of the above developments and activities, most researchers are left with no choice but to adopt and practice good RDM and change the direction and plans for practices if they are to keep up with the global trends within RDM, which will require them to manage their generated research data during a research project and after the research has been concluded (Halbert, 2013:9).

2.5 Drivers for adopting and practicing RDM in academic institutions

Like in any other research institution, academic researchers and universities experience some driving forces to adopt and carry out good RDM practices (Whyte & Tedds, 2011). Below is an outline of some drivers experienced by academic researchers as well as their institutions.

2.5.1 Research funders' directives and policies

To encourage the adoption of good RDM practices, many research funders across the world have given directives on the principles and practices in the form of policies giving directions on how data sets of the research that they fund should be managed (Whyte & Tedds, 2011). One prominent example is a mandate for DMPs as a condition for funding which has become a huge drive for researchers to carry out good RDM practices (Chiware & Mathe, 2016:1).

2.5.2 Conforming to global trends

It is important for academic researchers to adopt emerging norms for RDM and open access if they are to appear accountable for their research activities including research data (Whyte & Tedds, 2011). As mentioned before, many academic institutions including academic libraries have become engaged in developing RDM policies and services, and these policies are aligned with RDM global trends and the policies addressing the management of research data (White & Tedds, 2011).

2.5.3 Academic researchers seeking to collaborate

One of UNAM's research strategies is to promote collaboration within the university and strengthen international relationships through collaboration (Trotter et al., 2014:84). Whyte & Tedds (2011:5) point out that good RDM practices in academic institutions promote collaboration across departments, disciplines, and institutions, national and international, because RDM allows more collaboration because research data is shareable.

2.5.4 Proof of research results

One important aspect of the publication of results is that it allows other researchers to be able to replicate and build upon the author's published findings. A good practice of RDM is that it allows both the confirmation of the reliability and verification of results and, as mentioned earlier, permits innovative research that is built on existing information (Eynden & Brett, 2010:1).

2.5.5 Emphasis on open access to research data

There are several remarkable Open Access (OA) initiatives around the world, such as OpenAIRE, and the African Open Access platform which seeks to build openness in African science (Trotter et al., 2014:85). Although the OA movement is perceived to be moving at a slow pace in Africa, that United Nations Educational Scientific and Cultural Organization (UNESCO) (2017) records more than 500 journals in the Directory of Open Access Journal (DOAJ) of which UNAM is part of.

Various countries around the world and academic institutions have adopted a declaration on OA, particularly for research data coming from public funding, and they have developed a set of principles and guidelines to facilitate open data (Leonelli, Bezuidenhout, & Rappert, 2018).

Therefore, the drivers discussed above may apply even in institutions such as UNAM where RDM has not been actively discussed. It is most likely to find it becoming more of a priority as academic researchers see a need and the benefits to conform to the global trend of adopting and continuing RDM practices.

2.6 Benefits of adopting and practicing RDM

Adopting and managing research data is perceived to be an obligation and the responsibility of every researcher. It has become an important aspect of responsible conduct. Burnham (2013:1) maintains that every researcher has the individual responsibility to adopt RDM practices and to carry out the effective management of the research data that they create.

The Society of College National and University Libraries (SCONUL) (2015:3) asserts that adopting and managing research data provides many benefits, not only for the researcher but the institution and the wider community. It is important that the adoption of RDM practices will enable researchers and stakeholders to see the benefits associated with it. There are many benefits of managing research data. Eynden & Brett (2010) outline the benefits as follows:

- RDM allows for research data to be cited (Eynden & Brett, 2010).
- RDM helps researchers in managing risks such as data loss and data deterioration (Donelly, 2015). Buys & Shaw (2015) also believe that good RDM practices can help to prevent and manage the loss and deterioration of reseach data.
- Managing research data helps researchers to meet obligations to funders and compliance with open access agendas (Buys & Shaw, 2015). When researchers manage research data, they are most likely to comply with the codes of conduct such as ethics, data protection laws and journal requirements, and this can be attained if RDM is adopted and practiced by researchers.
- RDM practices save money and time. For instance, the researcher can undertake new research without collecting data but rather use an existing data set. In addition, data collection can be funded once and a data set used many times for a variety of purposes (Bryant, Lavoie & Malpas 2017:4). For that, funders are encouraging the re-use of data sets for the benefit of the community and the researcher (Burnham, 2013:5) and this cannot be attained if researchers do not adopt RDM.

Besides the benefits that researchers get from adopting and effectively managing their research data, it is important to note that a good practice in RDM is increasingly recognised as the basis to quality in research and integrity, and it forms part of on-going research (Buys & Shaw, 2015).

2.7 Factors that may influence the adoption of RDM practices in academic institutions

It is perceived that not all new ideas or trends become successfully integrated into communities. In this case, adopting RDM practices must be encouraged and supported by research

stakeholders. The successful adoption of RDM practices may be influenced by many factors including:

2.7.1 Communication

Communication serves as a means for information or knowledge exchange between individuals or organisations (Rogers, 2003:173). In DOI theory, the process involves (1) an innovation (RDM) to be communicated, (2) individuals or a unit who have the knowledge about the innovation, such as data managers, (3) an individual or a group of people who do not yet know about an innovation or have not yet experienced it, such as researchers, and (4) a communication channel connecting the two units, such as an organisation's e-mailing facility or its webpage (Rogers, 2003).

While it is believed that mass media such as internet, radio and television are the best way of reaching and informing an audience about the existence of innovation to create awareness, a face to face communication between individuals is also a very effective way of influencing an individual to adopt and practice a new idea (Rogers, 2003).

Generally, the adoption of any innovation has been linked to effective communication (Ridsdale, 2016:205). Just as technology changes, so does the need for keeping up with it and this can be attained through communication (Ridsdale, 2016). RDM as an innovation and a global trend that basically requires quick and effective communication about developments in the field within research institutions if they are to attain a positive adoption of good RDM practices (Ridsdale, 2016).

2.7.2 Education

Education through awareness is one of the prominent factors that is believed to influence the successful adoption of RDM practices in academic institutions. According to Buys and Shaw (2015:17), education provides researchers with a better understanding regarding the reasons for funders' requirements of RDM practices. Bryant, Lavoie & Malpas (2017:9) maintain that

education is the key aspect to raise awareness in ensuring that research data is properly managed for future use.

Furthermore, Van Deventer & Pienaar (2015:34) believe that raising awareness regarding RDM has provided the research community with an understanding of RDM practices. Additionally, Kahn et al. (2014:304) give examples of formats in which researcher education would take place, one example being the development of focused educational resources.

In addition, Bryant, Lavoie & Malpas (2017:10) found the importance of educating researchers in particularly providing access to research data in support of their findings. They distinguish one important aspect of researchers' education as a focus on metadata creation to promote the discovery of archived data sets. Awareness education can be done through workshops and training sessions aimed at building RDM skills (Bryant, Lavoie & Malpas, 2017:11; Buys & Shaw, 2015).

As it is, there is also a need for education regarding other RDM practices including data handling, organisation, management and sharing (Buys & Shaw, 2015; Tenopir et al., 2011). In addition to educating researchers, Lewis (2010) saw the need to provide training to postgraduate research students as well as undergraduate students as this is an opportunity to start developing good practices among those who wish to progress to research careers.

2.7.3 Infrastructure for data sharing

Placing data in a data repository is a sharing practice which is an important aspect of RDM (Buys & Shaw, 2015:15). However, many studies indicate the lack of proper infrastructure as the main challenge in attaining this good RDM practice (Chigwada, Chiparausha & Kasiroori, 2017; Chiware & Mathe, 2016). The provision of infrastructure, especially for data repositories, is a vital influential factor for the adoption of RDM practices in academic institutions (Buys & Shaw, 2015:15).

2.8 RDM responsibilities in academic institutions

As the adoption of RDM practices increases within academic institutions, it is important to know who is going to carry the responsibility of managing data at different stages in the RDM lifecycle as well as identifying a set of competencies for professionals in this growing field (Bryant, Lavoie & Malpas, 2017; Dora & Kumar, 2015). However, up to now it is not yet clear who is to carry the RDM responsibilities. As such, the roles and responsibilities in managing research data are developing but they are not yet fully established (Dora & Kumar, 2015).

Halbert (2013:6) explains that, thus far, no one entity in academic institutions is willing to take up responsibility for managing research data. Similarly, a paper written by an organisation known as Mercury Project Solution (2013:2) asserts that there is no single person or even a unit within research institutions that has taken over the responsibility of RDM.

Halbert (2013:11) believes that the actual responsibility for the long-term curation of research data is upon academic institutions, but particularly academic researchers who are tasked with different activities supporting the various parts of research and research data endeavours. Halbert (2013:11) believes that in practice academic researchers need to select, curate, return and store data for long-term preservations. In other words, Halbert (2013:11) maintains that RDM is almost entirely the researcher's responsibility. However, the dominant discussion on the topic from the reviewed studies conducted on RDM is that RDM is linked to libraries.

While libraries have begun to play a significant role in RDM, Lewis (2010:19) does not consider librarians' knowledge in metadata and cataloging to be enough for them to be suitable to curate research data, nor does he consider the liaison librarian's knowledge of the bibliographic landscape an ability to advise scientists on data collection formats. However, the nature and extent of the library's role in RDM is to some extent still unclear (Lewis, 2010).

Kim, Warga and Moen (2013:68) see a need for academic libraries to increase their roles to include organising and managing data and data sets. Kim, Warga and Moen (2013:68) see librarians' metadata skills as a way for librarians to be research data managers. Moreover, Chiware & Becker (2018) record that the main role that academic libraries are playing in RDM is

that of helping researchers with DMPs. As such, "librarians should be given motivations to obtain additional skills through education and training to enable their effective participation in the digital dimension" (Kim, Warga & Moen, 2013:68). From that point of view, it is most likely that RDM responsibilities will fall on libraries especially in the academic set-up.

2.9 Barriers to effective adoption of RDM practices in academic institutions

It is inevitable that there will be barriers that may hinder the effectiveness of any new idea. RDM practices also do have barriers that include:

- Lack of effective communication such as a face to face communication which is believed to play a vital role in the success of an adoption of a new idea (Rogers, 2003).
- Not having reliable storage for research data as this is an essential part of a good practice. From the reviewed literature, many studies raised storage as part of the concern for good practices (Koopman & De Jager, 2016:4; Buys & Shaw, 2015:4; Kennan & Markauskaite, 2015:71). It is apparent that storage is one crucial barrier to the effective adoption of data management by researchers.
- Lack of data management technical infrastructure such as data repositories that support data management during the research and thereafter is an issue that has been pointed as a concern for researchers and a barrier to adopt and carry out good RDM practices (Bryant, Lavoie & Malpas, 2017:9; Buys & Shaw, 2015:4). In previous studies, it has been established that some data may not be deposited into a data repository because there is a lack of repositories for certain types of data to be stored, and this can make it difficult for researchers to apply good practices to sharing data openly (Bryant, Lavoie & Malpas, 2017:9).
- Van Deventer & Pienaar (2015:36) record a concern for limited commitment from the very senior decision makers regarding the policies and infrastructure to make RDM a reality. This idea is supported by Kahn et al. (2014:304), who suggest that the government should play a key role in the effort to support RDM discussions and to develop policies at national level. Hence, for any form of innovation to be successfully

adopted, including RDM, there must be some form of commitment from the law or policy makers.

- Lastly, there is a lot of uncertainty about the extent to which the researcher can keep pace with evolving technologies and whether this will affect the researcher's ability to practice RDM based on the required standards (Lewis, 2010:11). This is a particular concern for the late majority in the adoption of innovative ideas as technologies evolve at a very fast pace. It is noted that most researchers lack confidence in their ability to engage in good RDM practices and keeping up with the pace of ICT. This is a barrier to the success of RDM practices because researchers are the key players in making RDM a success.

It is apparent that some barriers may be clear from the beginning while some are not. For example, Rogers (2003) saw some barriers to innovation diffusion as a result of individuals' attitudes and perceptions towards an innovation. Therefore, as RDM emerges, seemingly there will be barriers to the good practice and some of the barriers may be clear and some not. Rogers (2003) believes that some barriers are hard to avoid as a new idea emerges, but it is important to create measures that will address the barriers early.

2.10 RDM as an innovation in academic institutions

The state of innovation in academic institutions is marked by substantial changes in research activities (Sanjeeva, 2015:1). The academic research environment is faced with the pressures of global trends that are fast emerging, changing, shaping and extending the research processes, such as the introduction of data management (Strasser et al., 2012).

In response to the innovation, Dora & Kumar (2015:485) note the following: individual researchers are now making an effort to manage research data for future use; journal publishers have begun maintaining their own data repositories to enable authors to host and manage data for the verification of research findings; and academic institutions are initiating RDM policies and procedures so that research data is preserved and managed for future use (Bryant, Lavoie & Malpas, 2017:5). Thus, RDM has become a key aspect of the research process.

In addition, Halbert (2013:6) and also Pinfield & Cox (2014:300) maintain that across the world, RDM is perceived to be emerging. Lewis (2010:7) argues that the management of research data did not recently emerge: it is just the recent developments in technologies that are used to aid research activities that have motivated research stakeholders to manage research data. RDM is now progressively becoming a globally accepted norm among researchers that are taking an interest in managing their research data.

2.11 Chapter summary

This chapter provided an explanation of DOI theory and its relation to the study. It further provided an overview of studies that have used DOI theory. The chapter further provided reasons supporting the use of DOI theory to frame this study.

The chapter further reviewed related literature, which showed that much has been written about RDM. The findings from the reviewed literature gave a clear indication that there is a need for academic institutions to begin to align themselves with RDM as a global trend. It was also seen in the literature that academic institutions must begin to respond to RDM by providing data infrastructure to support the good practices and further develop researchers' skills to perform RDM tasks.

The literature review also confirmed that there is currently no study done on RDM in Namibia.

CHAPTER 3: Research design and methodology

3.1 Introduction

This chapter provides a description of the research methodology. The chapter begins by explaining the research approach, giving a brief overview of qualitative and quantitative approaches, and their advantages and disadvantages. The chapter further gives an explanation of the research methods and design that were followed to collect data. The chapter also explains the population under study, and the sampling strategy and technique. The research instrument used for data collection is also explained. The chapter further provides a detailed explanation on how data was analysed, ethical considerations and the study limitations.

3.2 Research approach

Kothari & Garg (2014:1) define research as the art of systematic enquiry which involves original work in answering a question. “The research process includes defining and redefining problems articulating hypothesis or suggested solutions, collecting, organising, and evaluating data, making deductions and reaching conclusions” (Kothari & Garg, 2014:1). Additionally, Bouma & Carland (2016:7) add that scientific research takes the form of gathering evidence in such a way that others can see why certain data was gathered, how data was gathered and what the findings were and thereby allowing individuals to draw their own conclusions based on the findings.

Research can take different approaches. Creswell & Creswell (2018:3) define research approaches as the “plans and procedures taken by researchers for the purpose of spanning the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation”. Creswell & Creswell (2018:3) further identifies three approaches to research, namely: qualitative, quantitative and mixed methods.

Punch (2006:3) defines qualitative research as empirical research where the data are not in the form of words. Punch (2006:3) adds that a qualitative approach tends to answer the what and why questions. Hence, qualitative data is expressed in the language of images, feelings and

impressions. Basically, a qualitative study describes the qualities of the events under the study (Bouma & Carland, 2016:9).

Quantitative research is where the data is in the form of numbers and this includes anything that is measurable in a systematic way (Punch, 2006:3). Bouma & Carland (2016:9) add that "quantitative data tends to answer questions such as: how much? how many? and how often". Quantitative data are usually expressed in numbers, percentages and or rates.

The last approach is a mixed methods approach, that is believed to reside in the middle of qualitative and quantitative because it integrates elements of both (Punch, 2006:3).

For this study, the way the problem is presented guided the approach. Therefore, to satisfy the objectives of the study, a quantitative approach was selected, which is mainly characterised by its inquiry into statistical patterns (Punch, 2006:3).

There are many advantages to conducting a study using a quantitative approach and some include: the support that quantitative studies offer in generalising about the phenomenon under study; they also allow the study to be undertaken on a larger sample; and because quantitative study are based on statistics, they are perceived to be reliable (Punch, 2008:5). However, Punch (2008:5) specifies the disadvantages of a quantitative approach as: it does not give a clear picture on the complete complexity of human experiences or perceptions; it can reveal 'what' and 'to what extent' but cannot explore 'why' and 'how'.

3.3 Research design

According to Punch (2006:48), research design is the basic plan of empirical research, and sits in between the research questions and the research data. It shows how research questions will be linked to the research data and what tools and procedures are used by the researcher in answering the research questions.

This study is a descriptive study which Perumal (2014:88) defines as the type of research which seeks to identify the characteristics of an observed phenomenon. Perumal (2014:88) outlines three forms of descriptive research such as: observational, correlational and survey research. The survey method was adopted for this study.

Survey research can be carried out on large or small populations; the researcher can select samples to determine relations, incidence, distribution and interrelations (Leedy & Ormrod, 2016). In this method, the researcher questions individuals on a topic and then describes their responses. According to Creswell & Creswell (2018:147), quantitative surveys can be used to assess how people feel about the realisation of policy outcomes before, during and after a given policy intervention. Leedy & Ormrod (2016) describe two important characteristics and purposes of the survey method: (1) it aims at describing certain aspects or characteristics of a population, and, (2) it tests hypotheses about the nature of a population.

Surveys are commonly known for the advantages of collecting a great deal of information from a larger population, and they can be used to obtain personal and social facts, beliefs and attitudes of individuals (Creswell & Creswell, 2018:147). It is important to note two types of a survey which are: cross sectional surveys, where the researcher collects information from a sample drawn from a population; and, longitudinal surveys, where a researcher collects data at different points of time for observing the changes (Perumal, 2014:96). Because the researcher is looking for data on the adoption of RDM practices at a certain time, a cross sectional type of survey was chosen for the study.

A survey was chosen for this study for different reasons among others including: the anticipation that it could help the researcher to investigate the adoption and describe the underlying researcher's behaviour towards adopting RDM practices. Additionally it was chosen in the hope that it would enable the researcher to generalise the results and predict the adoption of RDM practices at UNAM and it was believed that it would enable the researcher to collect data from a larger number of respondents.

A survey was further considered most suitable for this study because several studies from the reviewed literature were carried out using survey research. Examples are: Buys and Shaw (2015); Tenopir et al. (2011); van Tuyl & Michalek (2015); and Chigwada, Chiparausha & Kasiroori (2017).

3.4 Research method

Research methods refer to the methods that the researcher uses in performing research operations (Kothari & Garg, 2014). Therefore, this study used the methods below to perform its operations.

3.4.1 Data collection

According to Bell & Waters (2014:9), different styles, traditions or approaches use different methods of collecting data. However, they maintain that no approach prescribes or automatically rejects any method (Bell & Waters, 2014:9).

In research, an instrument is a general term used to refer to a tool or device used for measurement, for example, a test or a questionnaire (Soanes, Hawker & Elliot, 2006:472).

A questionnaire was chosen for this study because it is the most useful data gathering instrument in survey studies. Scarpa (2012) defines questionnaires as a series of questions that are asked to individuals to obtain statistically useful information on a given topic. Scarpa (2012) further explains that questionnaires are perceived to be reliable, such that when they are properly constructed and correctly administered, they become vital instruments by which statements can be made about a specific group of people or an entire community. Kothari & Garg (2014) distinguish the basic purposes of questionnaires as: (1) they collect suitable data which can be used to describe a phenomenon under study; (2) they minimise bias in formulating and asking questions, for example, questions are normally kept brief and single focused; and (3) they make questions engaging and varied, for example, the questions asked are mostly linked to the respondents' prior experiences.

Given that there are no established instruments available that could address the study goal, the researcher developed a questionnaire by drawing on information from previous studies. The questionnaire has two components: the first was designed to collect information on group demographics. The second was designed to collect data to be used for description. The open-ended questions provided details and respondents' voice to find out what has been overlooked. The open-ended questions were assigned with numerical values that were converted into graphs.

The researcher designed the online questionnaire to be administered by SurveyMonkey. Bell & Waters (2014:157) describe SurveyMonkey as an online cloud-based software that helps researchers create and run online surveys. According to Bell & Waters (2014:157), SurveyMonkey is perceived to be a popular and versatile online questionnaire and survey tool. It is considered reliable and used a lot in today's digital world.

The online questionnaire consisted of 26 questions with a mixture of multiple-choice responses and free text for comments focusing on the current position of researchers regarding the adoption of RDM practices.The focus of the questions was mainly on the innovation-decision process stages such as: the knowledge, beliefs and behaviours of researchers towards adopting RDM practices. The questions were designed in such a way that they would describe issues reflecting the objectives of the study. (Appendix B) contains the full questionnaire used for the data gathering purposes.

3.5 Sample

A sample is a small part or quantity intended to show what the whole is like (Soanes, Hawker & Elliot, 2006:802). In research, the process of sampling involves the use of specific principles to select members of a population to be included in the study (Bouma & Carland, 2016:109). Sampling has an advantage of making any research type and size manageable which is believed to provide more accurate research findings (Bouma & Carland, 2016:109).

A stratified sample was to be drawn from a list of all 948 faculty members (the number of academics taken from the UNAM annual report of 2016). The Raosoft sample size calculator (Raosoft, 2004) states that 274 is the minimum recommended sample size necessary for a 5% margin of error and a 95% confidence level from a population of 948, and that was the intended sample size.

Table 1. Summary of population and sample size

Summary of population and sample size	Total
UNAM academic researchers population size	948
Minimum reccomended sample	274

However, the mailing list which was provided to the researcher by the relevant office from UNAM only contained 481 staff email addresses. Staff roles and faculties were not distinguished. It was therefore decided to invite all 481 people to participate in the survey. The sampling was out of the researcher's hands and was not informed of how this group was constituted.

3.6 Data collection

Upon receiving ethical clearance from UNAM, the researcher was provided with a mailing list comprising of academics and researchers across all campuses. The questionnaire was made available online using the subscription version of SurveyMonkey. An email with a link to the questionnaire was distributed from 10 October to 9 November 2018. Two reminders were sent to both respondents who received the survey but did not respond and to those who answered the survey partially. The first reminder was sent a week after the intial invitation to all the participants and the second reminder was sent in the first week of November 2018.

3.7 Data analysis

Burney (2008:3) defines analysis as a process of systematically applying statistical and/or logical techniques to describe and illustrate, condense, recap and evaluate data. It is an essential component of ensuring data integrity. Burney (2008:3) distinguishes two main types of analysis in research: inductive and deductive. Burney (2008:3) defines inductive analysis as moving from the specific to the general, while deductive begins with the general to the specific (Burney, 2008:3). This study used the inductive approach which, according to Creswell (2014:4), assumes an explanation of a theory. Although Burney (2008:3) asserts that most quantitative studies are carried out deductively because they test hypotheses, for this study, the inductive approach helped the researcher to measure the rate of RDM adoption and to potentially generalise the findings to the entire UNAM community.

Having said that, collected data was filtered to understand what can be claimed of them. Responses to the survey about the adoption of RDM practices were analysed as aggregation and not in isolation.

The researcher presented the collected data by generating tables and graphs. The researcher interacted with data throughout the analysis period using a computer to complete data analysis process.

3.8 Ethical considerations

Ethical approval was granted from both the University of Cape Town which is the study's affiliation and UNAM which hosts the participants under study. All participants were informed in writing about the study and participation was on a voluntary basis. All respondents agreed to participate in the study.

The consent form clearly stated that participants were free to withdraw from the study at any time or leave a question unanswered. Raw data from the questionnaire was stored securely for the appropriate period of time in accordance with ethics requirements and guided by the researcher's DMP written in accordance with UCT's research data management policy.

On confidentiality and anonymity, all information relating to participants remained the property of the researcher during the research project and the affiliated institution after the study is published. The researcher did not collect identifying information of participants such as names, as well as email and IP addresses. The researcher only collected information that was necessary to achieve the study's objectives.

Having established the above, it was believed that all data would be treated in a way that protected the confidentiality and anonymity of the respondents.

3.9 Research limitations

In research, limitations are influences that the researcher cannot control; they are the shortcomings, conditions or influences that cannot be controlled by the researcher (Soanes, Hawker & Elliots, 2006:588). It is important to mention any influences that may limit the study. For this study, the researcher identified the following possible limitations that were obvious prior to the study:

Firstly: the researcher had no experience in primary data collection and there was a huge chance that the nature of implementation of data collection methods might have been flawed due to the researcher's inexperience.

Secondly: RDM is a recent phenomenon and various literatures indicate that RDM is still emerging. Therefore, there was lack of previous studies in the areas of RDM specifically in the Namibian context. Local literature would have been useful as a foundation to build on the topic to effectively achieve the objectives of the study.

Related to the above was the possibility that due to the newness of the phenomenon at UNAM, survey participants would not be willing or able to answer all the questions on RDM.

The researcher did her best to minimise these limitations.

3.10 Reliability and validity

Reliability and validity are considered to play a vital role in enhancing the accuracy of the assessment and evaluation of research work (Creswell & Creswell, 2018:199).

"Reliability is concerned with the extent to which the measurement of a phenomenon is consistent in providing the same result even if it is carried out a number of times" (Kothari & Garg, 2014:71). For example, a test is considered reliable if it gives the same result every time it is carried out and under different conditions (Creswell, 2014: 199). For this study, reliability was mitigated through a sampling procedure where a sample drawn from the population was a true representation of the entire population without any bias. This enabled the researcher to produce reliable results.

"Validity entails the extent to which a data gathering instrument such as a questionnaire measures what it is supposed to measure" (Creswell & Creswell, 2018:199). For this study, the researcher was to test the validity of the questionnaire by running a pilot study to five people in the department of Engineering at the University of Cape Town prior to sending out the questionnaire. This was not done due to limited time. However, care was taken with the construction of the questions to make them as clear as possible to those answering the research questions.

3.11 Chapter summary

The chapter gave a summary of what research is, and the research approach was used by the study. It discussed qualitative and quantitative approaches and explained why a quantitative approach was suitable for carrying out this study on the adoption of RDM practices by UNAM academic researchers. The research design was explained, and why cross sectional survey design was chosen for the study. The chapter further explained the data collection method used to gather data. The sampling process with its advantages were also explained as were data collection and analysis, research ethics, research limitations and reliability and validity.

CHAPTER 4: Data analysis

4.1 Introduction

The 2006 *Oxford dictionary of current English* defines analysis as the examination of something in detail to explain or describe it (Soanes, Hawker & Elliots, 2006:28). In this chapter, the data from the quantitative survey is presented, analysed, described and interpreted in a systematic manner. Data is analysed to identify and describe the knowledge and behaviour of UNAM academic researchers with respect to the adoption of RDM practices.

For the purpose of reporting data analysis and findings, the researcher made use of descriptive statistics such as percentages and means. The descriptive statistics are used to describe the basic features of the data in the study. The analysis for this study involves counting attributes, describing them and reporting the findings. Written answers to open-ended questions where respondents gave their own views or elaborated further were analysed thematically and then quantified. The researcher used tables and figures to present the analysis in a clear manner.

All data presented in this research study are derived from the online questionnaire (see Appendix B).

4.2 Survey response overview

Data for this study were obtained from a self-administered online questionnaire. The survey was sent to 481 academics as well as administrative and support staff consisting of different professionals. The mailing list which comprised of 481 was provided to the researcher by the relevant office from UNAM's annual report (2016). Because the mailing list did not distinguish the staff members' roles, administrative and support staff were included on it as well as those academics who conduct research and those who do not conduct research.

Of the 481 invitations sent via SurveyMonkey, 480 were received by the participants and one email bounced back. Ninety participants responded to the survey by clicking on the link in the invintation email. Of the ninety, 87 (97%) respondents agreed to participate in the study by clicking on the agree button on the consent form and three (4%) disagreed. Of the 87 responses

received from those who agreed to participate in the study, three skipped the benchmark question. Therefore, a total of 75 (88%) responses were deemed usable for this study as they responded to the benchmark question which asked them to indicate if they conduct research or not. Ten (12%) were disqualified from the survey because they responded that they do not conduct research studies. In total therefore, the completion rate was 27% of 274(100%) participants. The above data is presented in Table 2 below.

Given the small completion rate that the study received, the researcher was unable to make a fair generalisation of the findings. However, the researcher hoped to paint a picture of the adoption of RDM practices for this group of researchers.

Table 2. Survey response overview

Survey Overview	**No.**
Total no. of questionnaires sent	481
Total no. of respondents who received the survey	480
Total no. of respondents who responded to the survey	90
Total no. of respondents who agreed to participant in the survey	87
Total no. of respondents who indicated they do not conduct research projects (disqualified)	10
Total no. of respondents who skipped the benchmark question	3
Total no. of responses usable for the study	75

Although the researcher could not firmly establish reasons for such a low response rate, she anticipated that the low response was because:

- The targeted group were academic lecturers who, at the end of the year, take on tasks of invigilating and marking examination scripts and are away from their offices carrying out these duties.
- Some UNAM staff members were on an industrial strike at the time that the researcher was sending out the survey.

All respondents who participated in the survey answered the benchmark question (Question 2) of the survey indicating whether they conduct research projects or not. Respondents who indicated that they do not conduct research were automatically disqualified from the survey. This question was important for this study for the purposes of gathering data only from those who carry out research. It was placed at the beginning to filter respondents and save time for those that do not conduct research as they did not have to complete the survey. Table 3 below shows responses to the benchmark question.

Table 3. Question 2: *Do you conduct research projects*? (n=85)

Answer Choices	Frequency	Percentage
Yes	75	88%
No	10	12%
Total	**85**	**100%**

Table 3 indicates that the majority of respondents to the survey conduct research, and only ten do not. This is not surprising because as a state-owned university, UNAM is mandated to carry out research to influence the socio-economic development of the country.

4.3 Preparation and data checking

The researcher inspected the collected data for completeness and consistency. As such the researcher found out that:

- Some respondents completed the survey partially. However, the partially incomplete responses were found to hold valuable data, thus these were included in the analysis.
- Furthermore, the researcher checked if the respondents left certain questions unanswered. The researcher found out that some questions were skipped following the logic applied to the survey for follow-up questions, while some were skipped because the respondents preferred not to respond to certain questions. All responses were incorporated in the analysis because they contained useful data.

4.4 Analysis and interpretation of collected data

The questionnaire was divided into two sections. The first section of the questionnaire was developed to gather and identify the characteristics of respondents. The second section captured the knowledge and behaviours of academic researchers with respect to the adoption of RDM practices. The last question in the second section invited the respondents to share comments or views regarding RDM at UNAM or in general.

The analysis in this chapter was done by following the questionnaire (Appendix B). Based on the questions asked in the questionnaire, the researcher grouped the analysis into sections as follows:

- Demographic characteristics (4.4.1)
- RDM practices, the way researchers handle data daily (4.4.2.1)
- RDM awareness (4.4.2.2)
- Habits towards RDM, what researchers are doing after learning about RDM (4.4.2.3)
- Influences on RDM adoption (4.4.2.4)
- Challenges faced by researchers as they manage research data (4.4.2.5)
- General views and comments regarding RDM at UNAM and in general (4.4.2.6)

Below is the analysis of collected data supplemented with charts and tables.

4.4.1 Section A: Demographic characteristics

For an understanding of respondents' characteristics, the researcher gathered information on individuals. According to Salkind (2018:3), the researcher gathers this information in a particular study for the purpose of knowing if the sample is the true representation of the target group.

The researcher gathered demographic information from the participants. The researcher identified demographic information that was vital in the description of the participants as well as in the data analysis to enhance the interpretation of the results.

Table 4. Question 3: *What is your occupation*? (n=75)

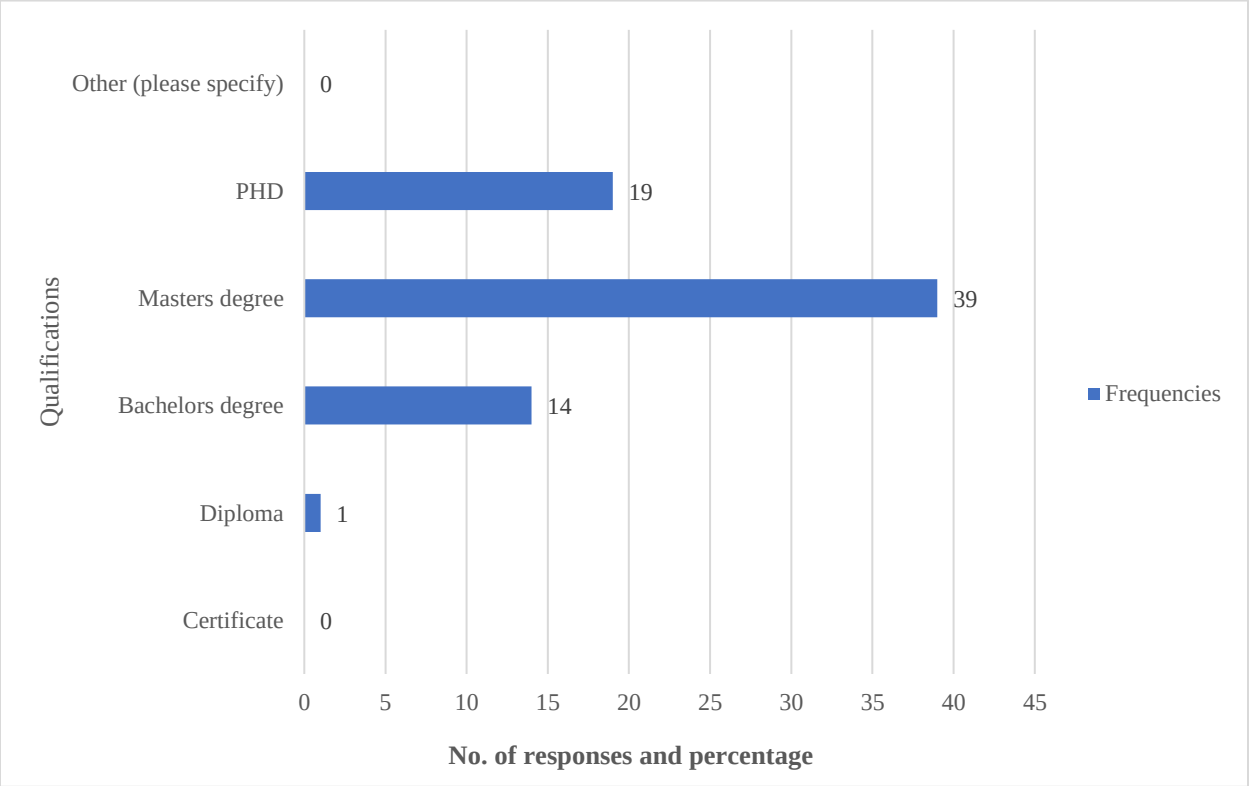
Occupation	Frequency	
Administrative and support staff	3	4%
Tutor	4	6%
Assistant lecturer	4	6%
Lecturer	32	45%
Senior lecturer	11	15%
Associate professor	4	6%
Professor	1	1%
Academic Researcher	3	4%
Assistant researcher	0	0%
Librarian	9	13%
Director	1	1%
Deputy Director	0	0%
Coordinator	0	0%
Other (please specify)	3	4%
Total	**75**	**100%**

In order to know the respondents' occupation, the researcher asked respondents to select from an aggregated list what their occupation was.

Table 4 reveals that almost half (45%) of the respondents were lecturers, followed by senior lecturers (15%) and then librarians (13%). These were followed by tutors, assistant lecturers and associate professors each at 6%. Administrative, academic researchers and those which listed 'other' and were asked to specify any other occupation that the researcher might have left out received the lowest responses (4% each), with deputy dean, associate professor and head of department mentioned as 'other' occupations. Other professions recorded a single percentage each and no responses were received from assistant researchers, deputy directors and coordinators.

It was not surprising to receive a large number of participants from faculty lecturers as these are called to carry out research and they spend a substantial amount of time doing research apart from their teaching duties.

Figure 3. Question 4: *What is your highest qualification*? (n=73)



The researcher asked respondents to select their highest qualification.

Figure 3 shows that many respondents were master's degree holders (39; 53%), followed by PhD holders (19; 26%), then the bachelor's degree (14; 19%).

This question also requested respondents to specify any other qualification the researcher might have left out but none was listed.

In most academic institutions, the requirements to become an academic is a master's degree hence it is not a surprise that the majority of respondents were master's degree holders.

Table 5. Question 5: *In which faculty are you?* (n=69)

Faculty	**Frequency**	
Agriculture and Natural Resources	12	17%
Economics and Management Sciences	2	3%
Education	12	17%
Engineering and Information Technology	2	3%
Health Sciences	13	19%
Humanities and Social Sciences	17	25%
Law	1	1%
Science	10	15%
Total	**69**	**100%**

This question was asked for the researcher to establish from which faculty the responses were. Table 5 presents the frequency distributions to characterise the quantity within the categories and it shows that most of the responses were received from the Faculty of Humanities (25%), followed by Health Science (19%), and then Agriculture and Education (17% each). Economics and Engineering recorded the same percentage of 3% and the lowest number of responses (1) was received from the Law Faculty.

The data can therefore be seen to be weighted more towards the Humanities, Health Sciences, Agriculture and Education disciplines.

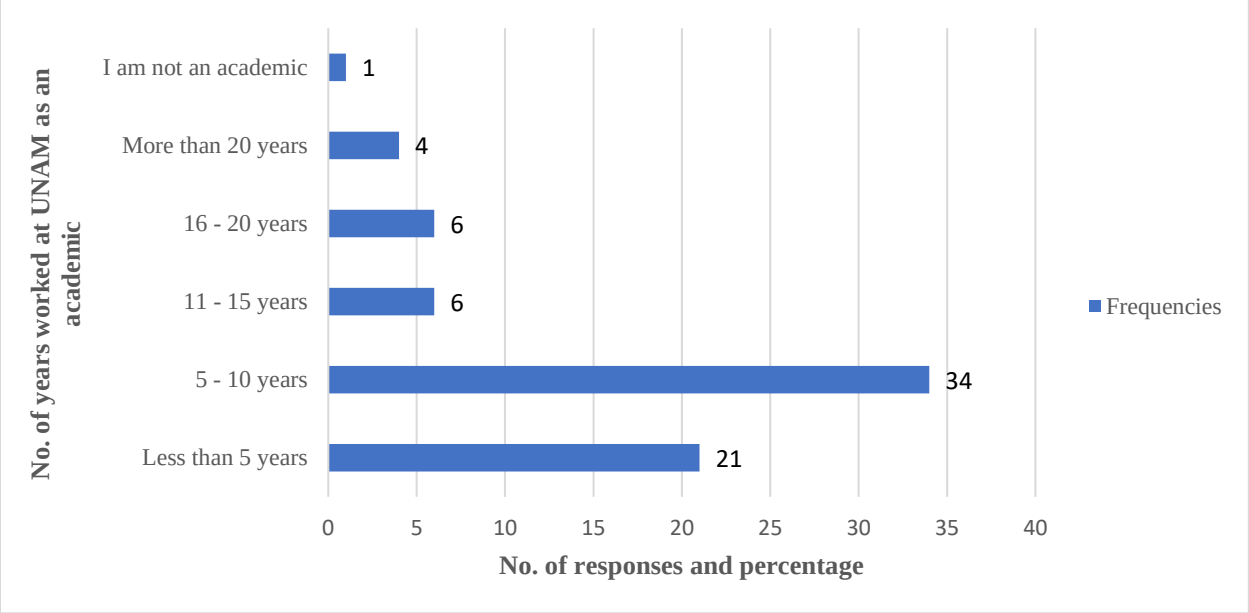
Table 6. Question 6: *Which campus are you?* (n=71)

Campus	**Frequencies**	
Windhoek main campus	40	56%
Eng. Jose Eduardo Dos Santos	1	1%
Hage Geingob	0	0%
Hifikepunye Pohamba	2	3%
Katima Mulilo	6	9%
Khomasdal	2	3%
Neudamm	5	7%
Ogongo	5	7%
Oshakati	3	4%
Rundu	5	7%
Sam Nujoma	2	3%
Southern	0	0%
Total	**71**	**100%**

Table 6 above reveals that many responses were received from UNAM's main campus in Windhoek: slightly above half (56%). A small number of responses were received from the rest of the campuses, Katima Mulilo (9%), Neudamm, Ogongo and Rundu (7% each), less than five percent of responses were received from Oshakati, Hifikepunye Pohamba, Khomasdal and Sam Nujoma and Eng. Jose Eduardo Dos Santos and no response was received from Southern campus.

It should be noted that a substantially bigger number of academic researchers are based at the main campus compared to other campuses. This explains the reasons for a very low to no response received from other campuses.

Figure 4. Question 7: ***If you are an academic at UNAM, how long have you worked for UNAM in an academic environment? (for example, as a lecturer, researcher or librarian,*** **etc.). (n=72)**



The researcher asked this question to know whether those who have worked for UNAM for a long period would be in a better position when it comes to knowing about RDM practices, services and developments.

Those who have worked for UNAM for 5-10 years responded to the survey in many numbers (34; 47%) as shown in Figure 4, trailed by responses from those who have worked for UNAM for less than five years (21; 29%). A relatively low response was received from those who have worked for UNAM for 11-15 years (6; 8%), while those who have worked for UNAM for more than 20 years also received a low response (4; 6%). There was only a single response from respondents who indicated that they were not an academic.

Data reveals that those who indicated in Question 3 that they were lecturers and senior lecturers were the main respondents to the study and they have been working for UNAM only for up to 10 years as has been seen in responses to Question 7, while the Professors who responded have been at UNAM for over 20 years.

Table 7. Question 8: *What is your current employment status at UNAM*? (n=73)

Employment status	Frequencies	Percentage
Permanently employed (Full-time)	57	79%
Permanently employed (Part-time)	1	1%
On contract	15	20%
Casual work	0	0%
Total	73	100%

To find out who bears responsibilities for conducting research projects at UNAM, the researcher asked respondents about their employment status at UNAM.

It is noted from Table 7 that those permanently employed by UNAM responded to the survey the most (79%), followed by those on contract (20%). One person employed permanently part-time responded and there was no response from those doing casual work.

Based on the demographic information gathered from the survey as presented in Tables 4, 5, 6, 7 and 8 and in Figures 3 and 4, it is noted that the demographic data yielded the following: although responses were received from all the eight UNAM faculties, the majority were from the faculty of Humanities (25%). Furthermore, most of the respondents were from UNAM's main campus in Windhoek (56%). Additionally, many responses to the survey were dominated by faculty lecturers (45%), and from those who are permanently employed staff members (79%) as well as from those who have worked for UNAM for five to ten years (34%)

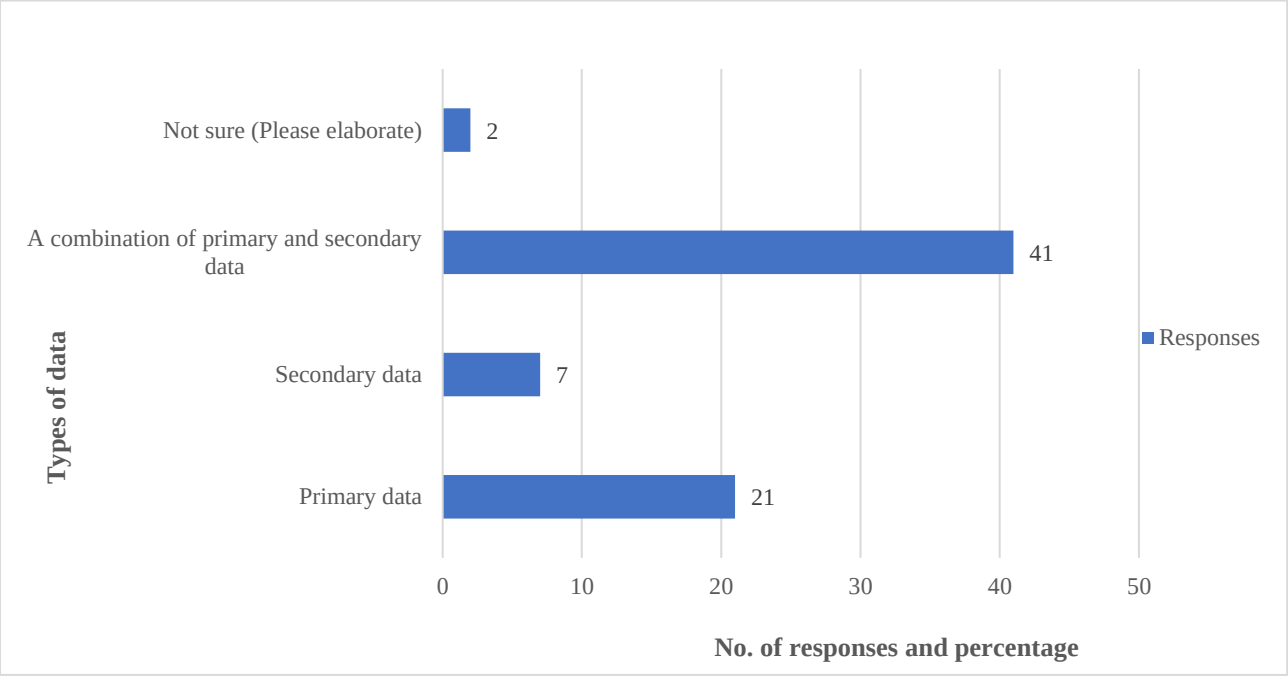
4.4.2 Section B. Knowledge and RDM activities within UNAM

In section B of the questionnaire, respondents were asked to answer a series of questions to help the researcher to achieve the objectives of the study. The reporting that follows is according to themes and not according to the order in which questions were asked.

4.4.2.1 RDM practices

In order to find out where research data used to conduct research comes from as well as establish UNAM researchers' practices when it comes to data, Question 9 of the survey asked respondents to select the type of data they use/collect/create to carry out their research projects.

Figure 5. Question 9: *As a researcher, what type of data do you generate/create/use*? (n=71).



Both primary and secondary data are used, although most research at UNAM seems to be carried out with the use of a combination of both as Figure 5 shows.

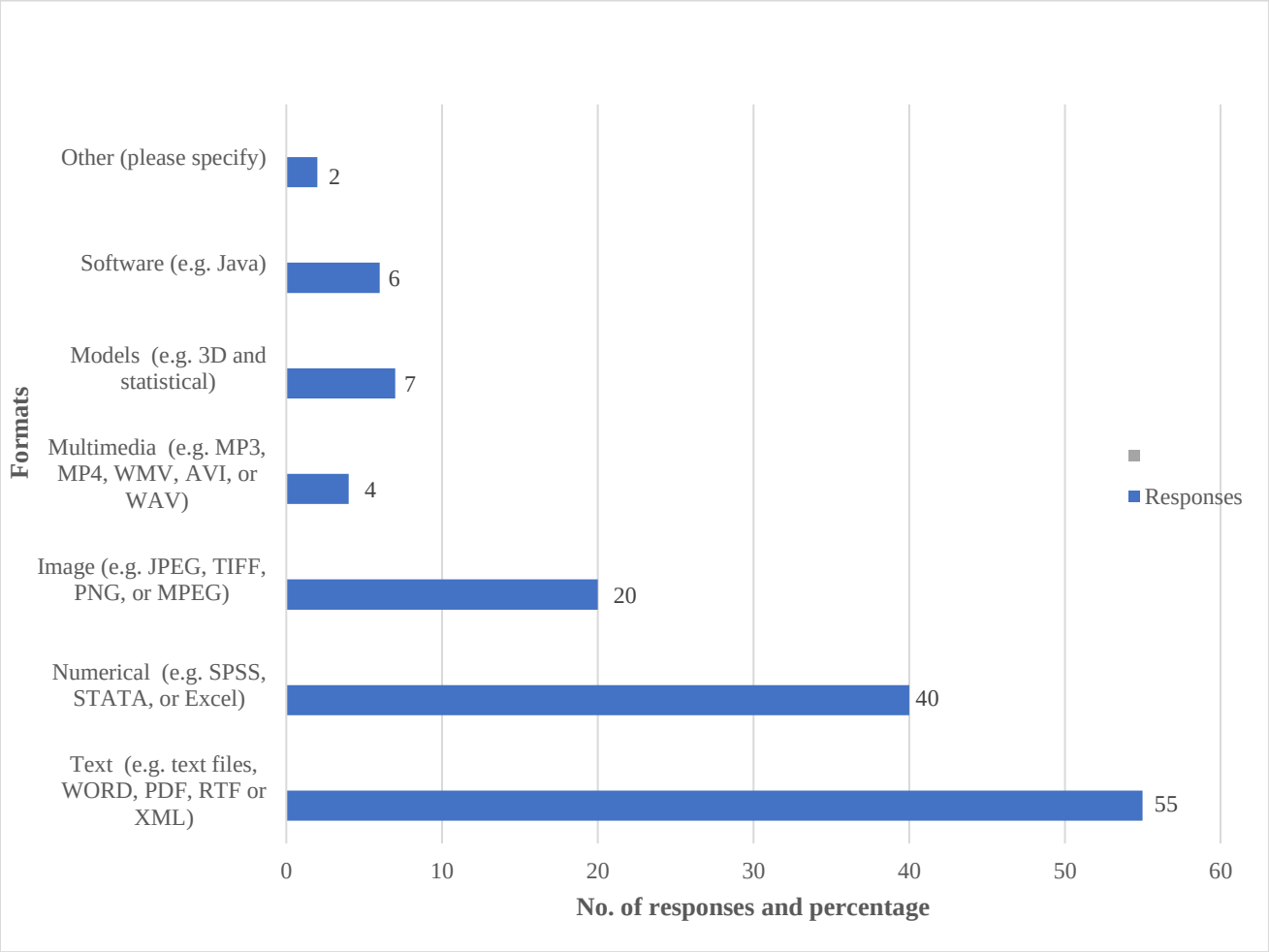
Respondents were also given the chance to elaborate further if they responded that they were not sure. One respondent said:

Theoretical research not requiring data collection

The second respondent indicated *None*

It is a common practice to use different types of data to carry out research based on the discipline and the question the researcher is answering.

Figure 6. Question 10: *In what format/s are your research?* (n=70)



Question 10 asked respondents to select and specify the formats their data are in. As such, Figure 6 shows that most researchers at UNAM (55; 79%) have their research data in text files, followed by more than half (40; 59%) of respondents who indicated that they have their data in numeric formats.

Respondents were given a chance to specify any other format the researcher might have left out. There were two responses to this effect: one respondent specified *Shape file* and the other indicated *None.*

This question required multiple responses, as such the percentage distribution was more than 100.

Figure 6 is evidence that digitally facilitated research data activities are performed at UNAM by this group of researchers.

Table 8. Question 18: *Which particular data-related practices are you involved in?* (n=65)

RDM practices	Total no. of responses
Collecting research data	58
Selecting data for use	33
Saving data into retrievable formats	28
Sharing research data	28
Selecting data for storage	24
Keep data securely	23
Protecting data with passwords	19
Describing selected data/ naming data files	18
Ensure data privacy and anonymity	18
Creating safe and secure data storage	16
Preservation of research data for long term use	14
Data re-use	9
Writing of data management plans (DMPs)	8
Other (please specify)	2

It was important for this study to establish the current RDM practices of researchers at UNAM, hence Question 18 of the survey asked respondents to indicate their practices by selecting multiple responses about the data management practices they are involved in.

Table 8 indicates that, in general, respondents are involved in almost all RDM practices the researcher listed, with data collection being selected by most academics. In further analysis of Table 8, it shows that 'Selecting data for use' was selected by slightly more than half (33; 51%) and the rest of the data management practices were selected fewer times, as listed in Table 8. Writing data management plan received the lowest selection (8; 12%) .

This question asked respondents to select multiple responses, thus the percentage exceeds 100. Respondents were asked to specify any other RDM practices they are involved in. One respondent said:

> *In the process of acquiring data processing software*

Another respondent indicated. *None*

4.4.2.2 RDM awareness

To determine the level of RDM awareness among researchers, respondents were asked if they knew about RDM. Table 9 shows that a few academic researchers at UNAM have heard of RDM.

Table 9. Question 11: ***Have you heard about research data management (RDM)?*** **(n=67)**

Have you heard about RDM?		
	Yes	No
Agriculture	3	9
Economics & Mgt	0	2
Education	2	10
Engineering and IT	1	1
Health Science	4	9
Humanities & SS	7	9
Law	1	0
Science	3	6
Total	**21 (31%)**	**46 (69%)**

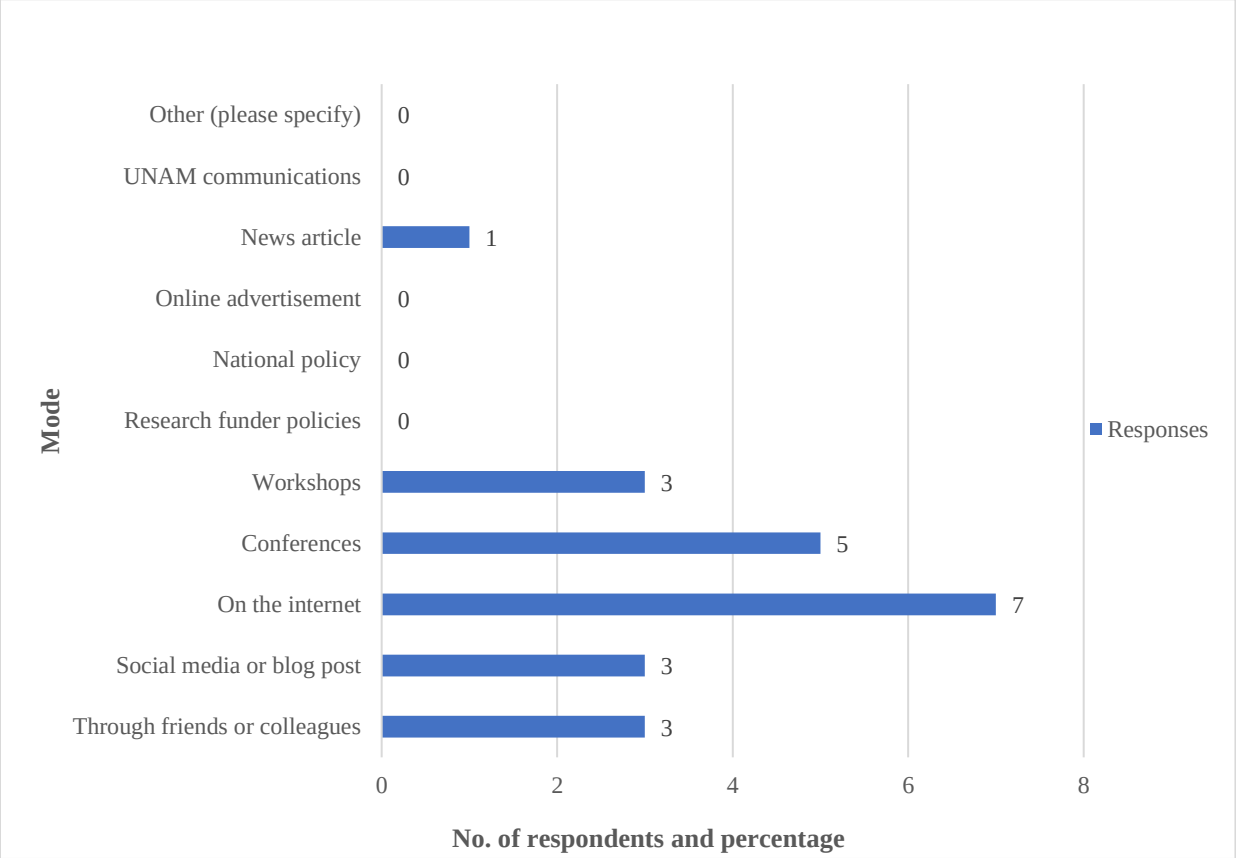
The reason for this high response about not knowing about RDM is likely because RDM is a relatively new concept and as such it has not been endorsed by policies in many African academic institutions (Chiware & Becker, 2018).

Further analysis of Table 9 indicates that more respondents in each faculty recorded having not heard about RDM compared to the fewer number of responses who have heard about RDM

Question 11 of the survey provided respondents with an opportunity to skip the follow-up questions (12 - 17) if they answered that they have not heard about RDM. This is because their answers to (Questions 12-17) depended on a level of RDM knowledge to be able to know what is happening regarding RDM at UNAM.

As can be seen in Figure 7 as well as Tables 10, 11, and 12 the number of responses to those questions were reduced.

Figure 7. Question 12: *How did you first learn about RDM*? (n=22)



In order to know how RDM practices are being taken up at UNAM, respondents were asked to select from an established list of ways in which they found out about RDM.

Figure 7 reveals that most researchers who responded to the survey came to learn about RDM on the internet (7; 31%), followed by those who learned about it through conferences (5; 22%), those who learnt about RDM through friends or colleagues, workshops and social media (3; 14%). The lowest number of respondents (1) indicated that they had learnt about it through news articles. The rest of the options were not selected.

Although it would have been interesting that researchers learnt about RDM through UNAM communications, it is not surprising that a lot of researchers learnt about RDM through the internet as it has become a great way of self-learning for many individuals.

The analysis shows that there was no response specifying any other mode. Thus, it is assumed that the list was comprehensive.

Table 10. Question 13: ***Are you aware of any RDM services already in place at UNAM?*** **Question 14:** ***Are you aware of any RDM services in development at UNAM?*** **(n=22)**

RDM awareness				
Services already in place			**Services in development**	
	Responses	Percentages	Responses	Percentage
Yes	2	9%	3	13%
No	17	77%	17	77%
Not sure	3	14%	2	10%
Total	**22**	**100%**	**22**	**100%**

To establish whether RDM has been implemented at individual or departmental level, the researcher asked respondents whether they were aware of such services.

Table 10 shows that many (77%) respondents do not know of any services already in place at UNAM. Very few (9%) respondents answered that they know of RDM services already in place at UNAM and other (14%) respondents indicated that they were not sure but they did not elaborate further.

In further analysis of Table 10 regarding the services in development, the responses showed that many (77%) respondents were not aware of any services in development addressing RDM, while very few (13%) respondents indicated they were aware, and others (10%) indicated that they were not sure. No further elaboration was were given for that choice of answer.

For those who indicated that there are services already in place, the researcher believes that these services might have been implemented at individual or departmental levels as there are no formal RDM services yet being offered by the library or research office at UNAM.

For those who indicated that there are services already in place the researcher believes that these services might have been implemented on individual or departmental level as there are no formal RDM services yet being offered by the library or research office at UNAM. In view of Table 10 analysed as an aggregation of responses, there is a clear indication that respondents to the survey are not aware of any RDM services already in place or in developmental stage

4.4.2.3 UNAM academic researchers' habits towards RDM

In order to determine the degree to which different academic researchers at UNAM behave towards RDM once they become aware of it, the researcher asked respondents whether they have tried to find out more about RDM.

Table 11 Question 15: ***As an individual have you tried to find out more about RDM*****? (n=22)**

Individuals interested in finding out more about RDM		
	Yes	No
Admin. & support staff	0	0
Tutor	0	1
Assistant lecturer	0	0
Lecturer	1	4
Senior lecturer	3	2
Assistant professor	0	3
Professor	0	0
Academic researcher	0	1
Assistant researcher	0	0
Librarian	5	1
Director	1	0
Deputy director	0	0
Coordinator	0	0
Total	**10 (45%)**	**12 (55%)**

Table 11 shows that more than half (55%) of the respondents indicated that they have not tried to find out more about RDM, while fewer (45%) respondents indicated that they have tried to find out more about RDM.

A further analysis of Table 11 indicates that most of the professionals who responded to the survey had not tried to find out more about the RDM. However, it is interesting to note that almost all librarians who responded to this question indicated that they have tried to find out more about RDM, with only one librarian indicating that they have not.

According to responses to Question 15, seemingly the interest of academic researchers to find out more about RDM is very low. It is possible that there is no motivation for academic researchers at UNAM to find out more about RDM, because most of them are not familiar with the RDM concept.

Table 12. Question 16: *How often if ever, do you discuss RDM in your own department*? And 17: *How often if ever, do you discuss RDM outside your own department*? (for example, in your social settings or with other departments). (n=22)

RDM discussion				
In departments			**In social settings**	
	Frequencies	**Percentage**	**Frequencies**	**Percentage**
Often	1	5%	2	10%
Sometimes	11	50%	8	36%
Never	10	45%	12	54%
Total	**22**	**100%**	**22**	**100%**

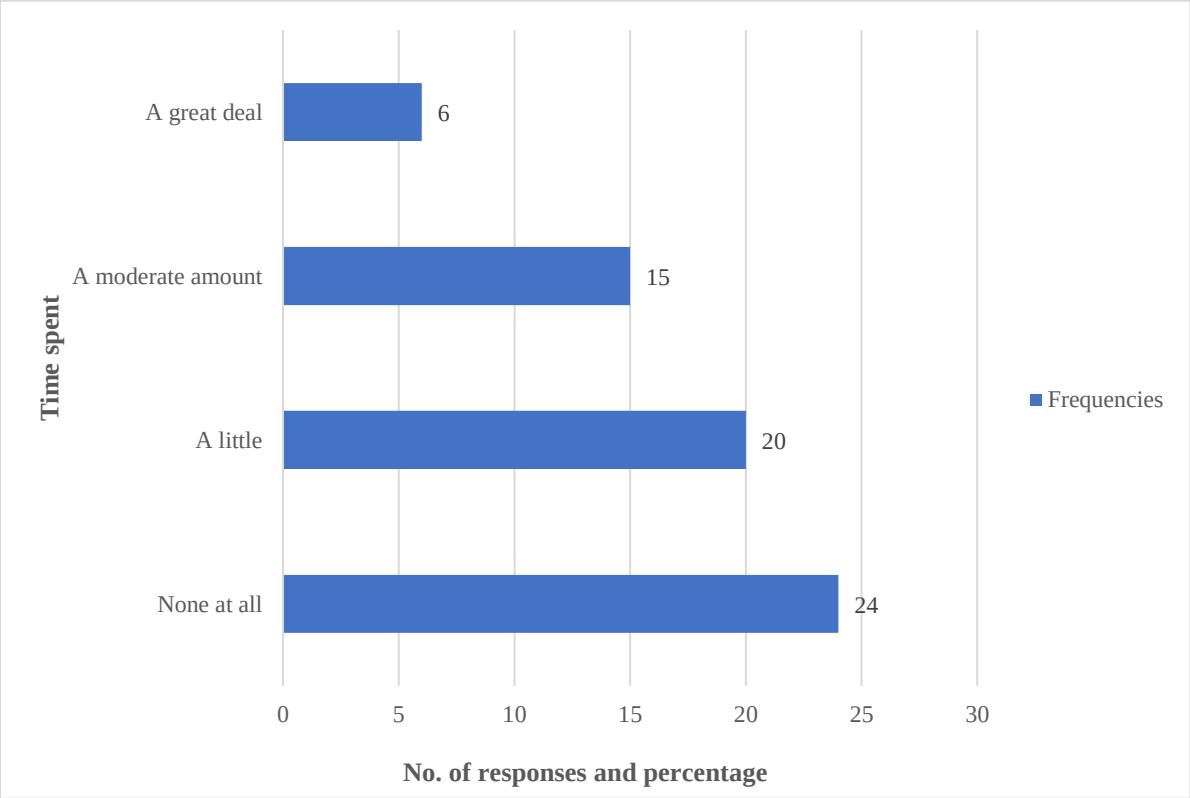
In order to establish whether peer-to-peer conversations at UNAM about RDM were being used to disseminate information about RDM, Questions 16 and 17 of the survey measured respondents' attitudes towards RDM through asking respondents to select the rate at which they discuss RDM within their departments and outside of their department, for example in social settings.

As a result, Table 12 shows that only a few respondents indicated that they often discuss RDM within their department. Half of the respondents (11) indicated that they discuss RDM sometimes and 10 (45%) respondents indicated that they never discuss RDM within their department.

Further analysis of Table 12 shows that very few (2; 10%) respondents discuss RDM outside of their department often, and eight (36%) respondents indicated that they discuss it sometimes, while 12 (54%) respondents said that they never discuss RDM outside their department.

Although RDM is a new concept, discussion is required within departments and in social settings for individuals to understand the advantages derived from RDM practices. It is interesting to note that even though RDM is yet to be adopted at UNAM, there are some discussions around the concept although it is among few individuals.

Figure 8. Question 19: ***As an individual, do you invest effort/time in integrating RDM in your research process?*** **(n=65)**



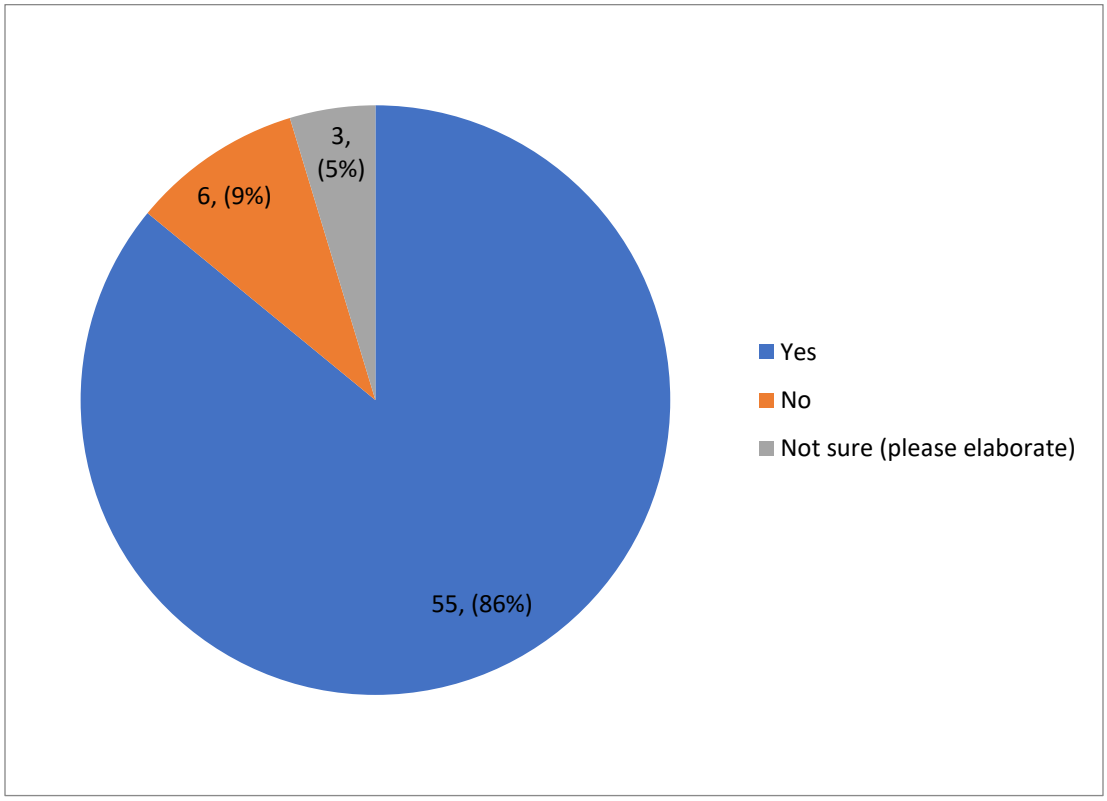
In order to measure the time/efforts invested by respondents in integrating RDM into their work, the researcher asked respondents to select, based on the short aggregated list, the time they spend in integrating RDM into their research process.

Figure 8 shows that many (24; 37%) respondents don't spend much time/effort in integrating RDM practices into their research process, 31% (20) spend little time, while 23% (15) spend a moderate amount of time. Those who spend a great deal of time had the lowest response of 9% (6). The order of ranking from highest to lowest (1) a great deal, (2) a moderate amount, (3) a little (4) none at all.

Figure 8 shows the resistance to RDM by academic researchers that do not make effort to spend time to integrate RDM practices into their research process. The researcher here perceives

awareness of RDM as a way to influence individuals to invest time and efforts in integrating RDM practices into their research process

Figure 9. Question 20: ***In the interests of preserving your research data for future scrutiny and re-use, would you consider changing your data practices to include more of the activities listed in question 18?*** **(n=64)**



Question 20 was asked to determine the behaviours of researchers in adopting RDM practices and it was posed to all survey participants after a definition of RDM was provided for them.

The results in Figure 9 express the interest of academic researchers in adopting RDM, as many (86%) appear to have an interest in integrating RDM practices into their research process. Very few (9%) indicated that they were not interested and 5% indicated that they were not sure.

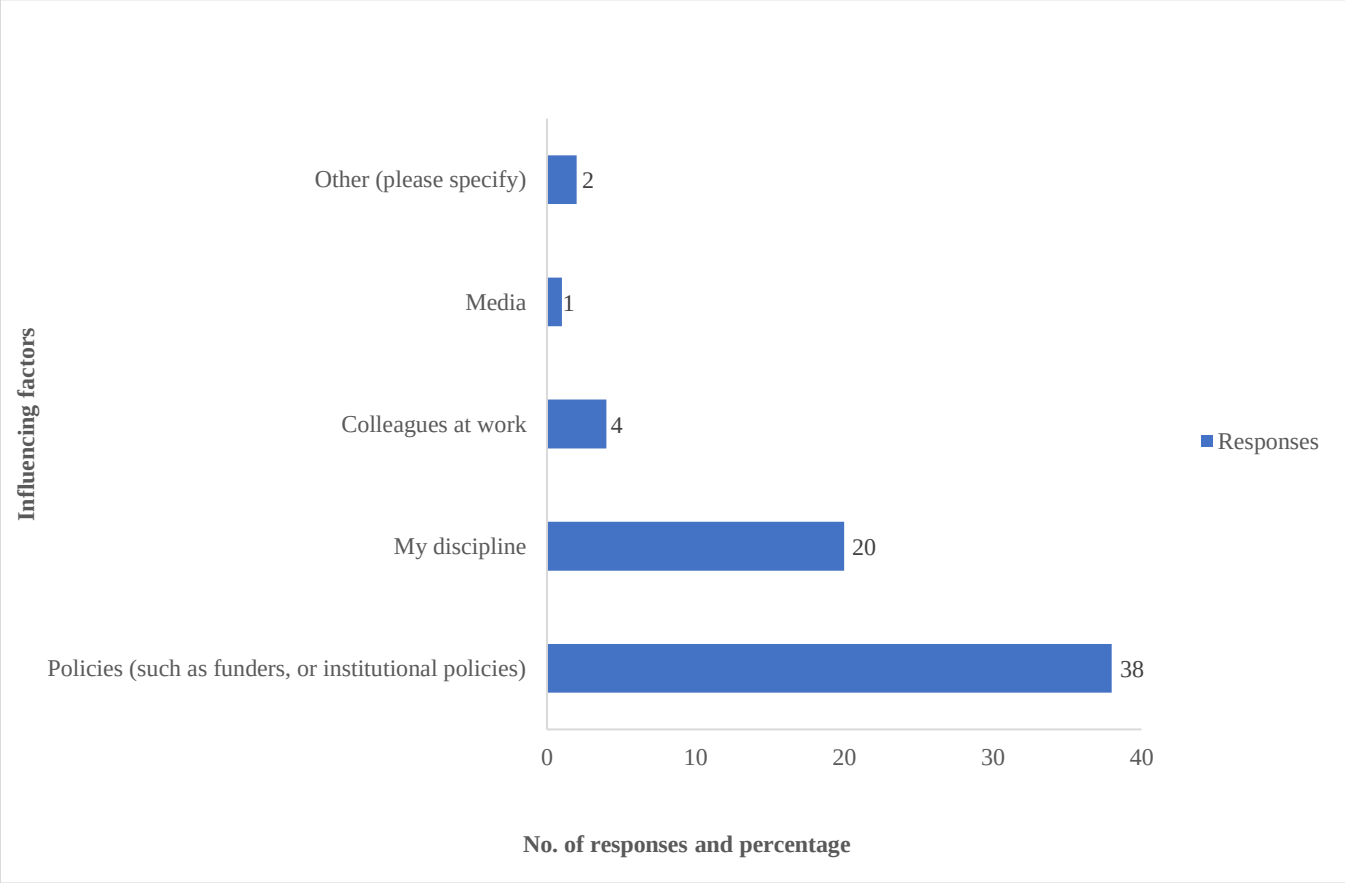
This question asked respondents to elaborate further if they were not sure about changing their data practices. Respondents had different views and comments, for instance, one respondent said

that they need a reason for doing that, another one said that they hardly have time for it and the last one thought this was a wrong question in their research area.

4.4.2.4 Influences on adoption of RDM

As the study was to establish UNAM's position regarding the adoption of RDM, Question 21 of the survey asked the respondents what could encourage their adoption of RDM practices. Figure 10 presents the participants' responses.

Figure 10. Question 21: ***What is most likely to influence your interest to adopt (further) RDM practices in your research process?*** **(n=65)**



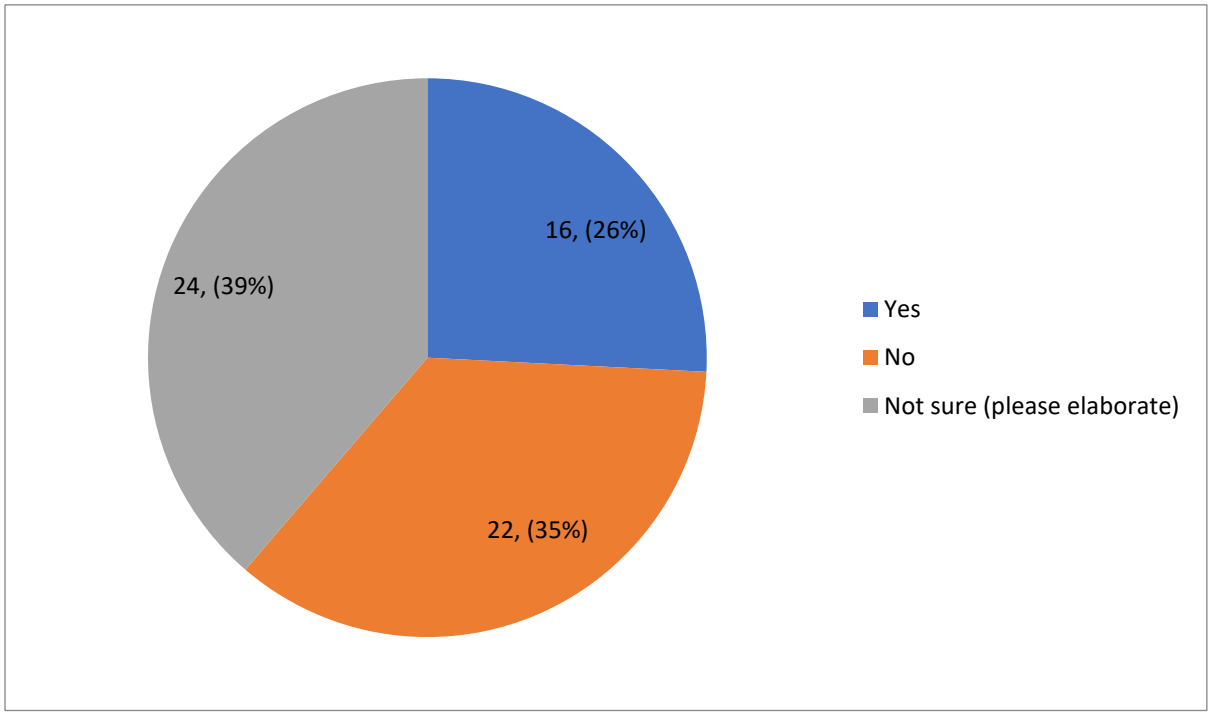
Many respondents, significantly more than half (38; 58%), indicated that policies such as funders and institutional policies would influence their adoption, followed by 31% (20) of respondents

who felt that their discipline would be a great influence, while 6% (4) indicated that they would be influenced by their colleagues at work. Only one respondent indicated that they would be influenced by media.

Respondents were asked to specify any other factor that may influence their adoption of RDM. One of the respondents indicated *Exposure and awareness* as factors that may influence his/her likeliness to adopt RDM, while another respondent specified that *Nothing* would affect their adoption of RDM.

It is interesting to note that so many academic researchers indicated that the funder and institutional policy would influence their adoption of RDM. RDM is driven by many factors, however funders' demand for data management has been at the forefront, as can be seen in the literature.

Figure 11. Question 22: *Currently at UNAM, are there any policies, programs, or incentives that would encourage you to adopt RDM practices?* (n=62)



To discover more factors that would influence researchers to adopt RDM practices, respondents were asked to indicate whether there are policies, programmes and incentives at UNAM which may encourage their RDM adoption.

Very few (26%) respondents knew of such policies, while some of the respondents specified that there are none (35%) and the majority indicated that they were not sure if such programmes, policies and initiatives were there or not (39%).

Those who said that they were not sure were asked to elaborate further and 22 responses were received to this effect. The responses seemed to be reiterating that respondents do not know about any policies, programmes or incentives that would encourage them to adopt RDM practices.

Some respondents felt that communication about certain policies that exist at UNAM is very important as one respondent said that: *Such policies, programs or incentives should be known to all staff members.*

It should be noted that it is easy for individuals to adopt a new trend if it is endorsed by policies. Thus, if researchers do not know that such policies exist, they are most likely to be reluctant to adopt a new idea.

Table 13. Question 23: *If UNAM were to become more proactive in encouraging RDM among its researchers, which of the following services would you like it to offer*? (n=65)

Services	**Responses**	
Provide safe and secure data storage	49	75%
Provide training	53	81%
Provide data repository	31	48%
Provide workshops on RDM	44	68%
Provide training on metadata creation	31	48%
Participate in global open data initiatives	32	49%
Develop policies to enhance RDM	32	49%
Other (please specify)	2	4%

The researcher asked Question 23 in order to understand the needs of different people within UNAM with regards to RDM services.

Table 13 above shows that respondents selected a range of options that were needed. However, it is clear that many academic researchers at UNAM preferred that UNAM provide them with training (81%), safe and secure data storage (75%) and workshops on RDM (68%). Slightly below average (49%) indicated that UNAM should participate in global open data initiatives and policy developments respectively as well as provide a data repository (48%) and training on metadata creation (48%).

It is clear from the responses to Question 23 that researchers would like UNAM to offer all of the RDM services listed by the researcher. However, it should be known that offering all of these services could be a challenge for many academic institutions and UNAM is no exception.

Respondents were given an option to select as many as applied, hence the percentage distribution exceeds 100.

A closer look at data revealed interesting information and it shows that almost all services listed by the researcher were preferred by different occupations on different levels for instance:

- *Administrative and support staff* prefer the provision of safe and secure storage and participation in global open data initiatives more than the other services.
- *Tutors* selected mostly the provision of safe and secure storage.
- *Assistant lecturers'* list was topped by the provision of safe and secure storage, provision of training and the provision of workshops on RDM.
- *Librarians* prefer training, workshops on RDM and interestingly a developmental of policy to enhance RDM.
- *Directors* contrary to the librarians' preference for policy development, preferred all the services with the exception of developing policy to enhance RDM.
- *Lecturers* prefer the provision of training the most
- *Senior lecturers* prefer safe and secure storage and training.
- *Associate professors* prefer training and the participation in global open data. One associate professor who responded to this question does not know about RDM and

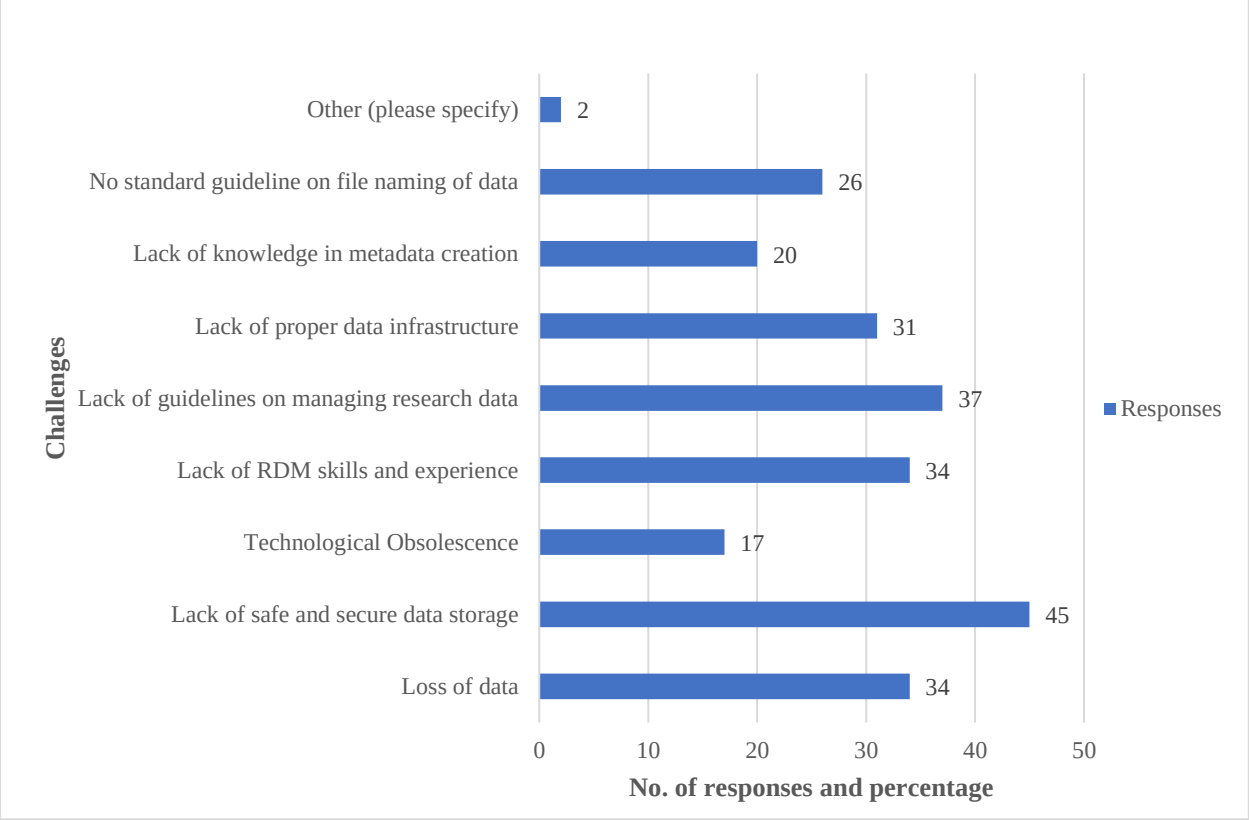
preferred UNAM to provide all the services excluding training on metadata and the participation on global open data initiatives.

- *Academic researchers* prefer UNAM to offer safe and secure storage and training the most.

4.4.2.5 RDM challenges faced by UNAM academic researchers

One of the objectives of the study was to identify the challenges faced by researchers as they work with research data and adopting RDM practices. Thus, Question 24 of the survey asked respondents to select multiple responses from a list of challenges they are faced with. The percentage distribution for this question is above 100 percent.

Figure 12. Question 24: *What challenges do you encounter as you work with research data daily*? (n=65)

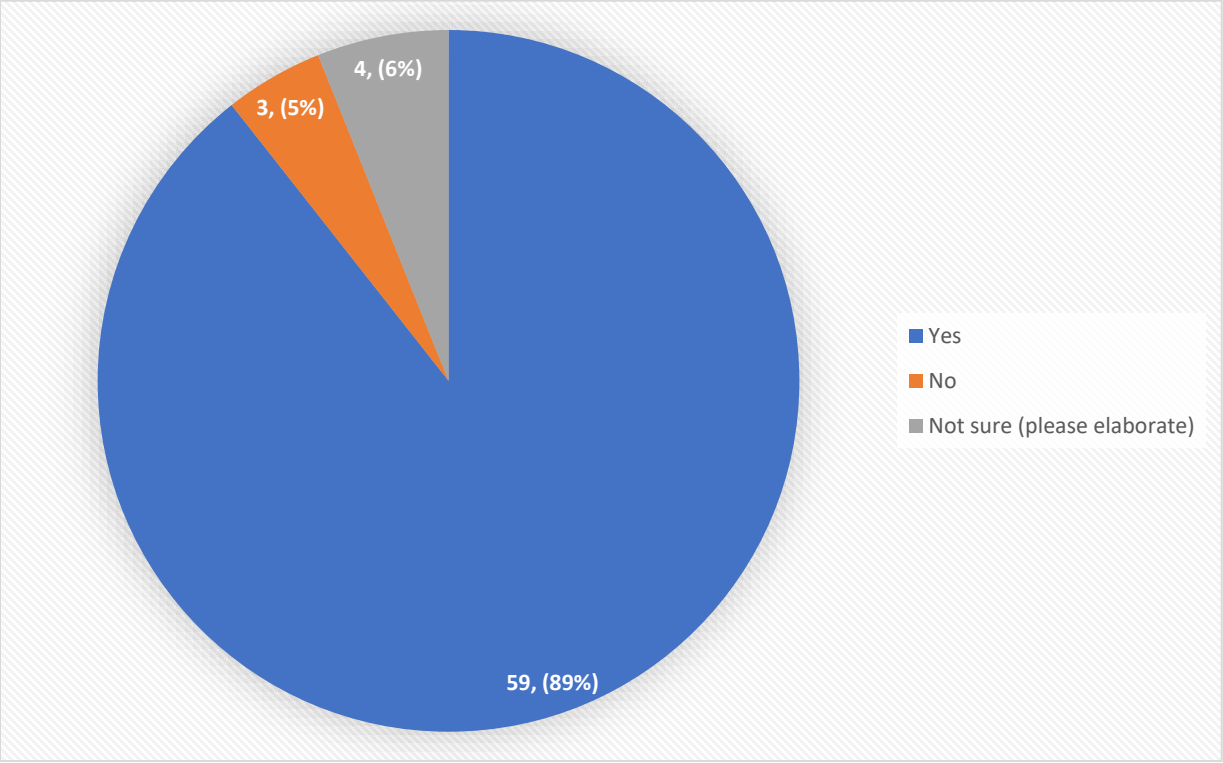


Although all the challenges listed by the researcher were selected by many academic researchers, Figure 12 above shows that lack of data storage was found to be the greatest challenge for many academic researchers at UNAM (45;69%), correlating with the previous question where respondents preferred the provision of safe and secure storage mostly among other services.

The rest of the listed challenges were selected by 26-34 (40%-50%) of respondents, except for 'Lack of knowledge in metadata creation' (20; 31%) and 'Technological obsolescence', which was selected by the lowest percentage (17; 26%).

Like some of the questions in this study, this question asked the respondents to list any "other" challenges they are faced with, and none was specified. This could possibly be because the researchers do not yet know about challenges because they are not practicing in RDM to a great extent.

Figure 13. Question 25: *Would you be interested in learning about RDM?* (n=66)



In order to establish their interest in RDM, respondents were asked if they would be interested in learning about RDM. The analysis in Figure 13 is evidence enough that many academic

researchers who responded to the survey were interested in learning about RDM. Only three indicated that they were not interested, and four were not sure.

This question asked respondents to elaborate further if they had selected that they were not sure. One of the respondents said: *It will depend on time*. Another respondent: *I would if it helps.* A third said: *It has little or no effect in my area of research*. The last one asked, *Who would offer RDM lessons, how and when?*

4.4.2.6 General views and comments regarding RDM at UNAM and in general

Question 26 of the survey provided respondents with an opportunity to give general views, comments and concerns regarding RDM at UNAM or in general. Table 14 below captures the eight respondents' views and opinions as expressed:

Table 14. Question 26: General views and opinions of respondents on RDM

Views and opinions
Training in this field is needed
Who should be responsible to oversee the development of RDM, the library or research office?
UNAM should put emphasis on developing the policies and guidelines on RDM, especially on storage for long term purposes. The security and privacy of data must be prioritised and be implemented by all staff members
UNAM should develop courses for dealing with RDM
A workshop on RDM to create awareness will be appreciated, maybe it will be an opportunity for UNAM to start investing in RDM
It will be interesting to see UNAM investing more in RDM and establish policies to enhance RDM
Network storage of data such as, Google , Cloud, etc
Enrollment of RDM department/faculty for periodic updates and all new development related to RDM

Among the responses, there were five comments about training, two about data storage and one about policy development.

It is apparent that training is essential if the adoption of RDM is to be fully attained. As has been seen in Table 14 and supported by the analysis of Question 23, this has been echoed by many academic researchers who responded to the survey.

In view of the second section of the questionnaire, it is evident that RDM practices are being carried out in UNAM by researchers who responded to the survey. It is also clear that researchers who responded to the survey depicted different behaviours towards RDM, of which unfavourable behaviours were noted. Furthermore, the analysis shows that RDM adoption is non-existent for a group of researchers that participated in the survey. In addition, many researchers who responded to the survey were faced with various challenges as they worked with data. However, it was interesting to note that a large number of respondents were interested in learning about RDM. Lastly, respondents gave different views, comments and concerns about RDM in general and particularly at UNAM.

4.5 Chapter summary

In this chapter collected data was presented. For a clear understanding of collected data, the researcher analysed and presented data in charts and table formats. The study further solicited academic researchers' views and comments regarding RDM at UNAM and in general, as such, these were also analysed thematically and presented in graphical format.

CHAPTER 5. Data interpretation, recommendations and conclusions

5.1 Introduction

In this chapter, the researcher discusses the core findings derived from the collected data in relation to the objectives of the study, the reviewed literature and the theory guiding the study. Based on the insights gained regarding the findings, the researcher gives recommendations as well as suggestions for future and further studies on the topic.

This study investigated the extent to which RDM practices have been adopted as part of the research process at UNAM by researchers.

5.2 Discussion of the findings

The findings of the study are discussed in relation to the research objectives and in relation to the innovation-decision process of the DOI theory, which frames the study, which in turn allowed the researcher to draw a conclusion about where in the process UNAM is.

5.2.1 The extent to which RDM has been adopted as part of the research process at UNAM (Objective 1).

This objective was investigated by looking at awareness, practices, habits and adoption of RDM at UNAM by researchers.

Awareness

The study found that there is a low level of awareness of the concept of RDM among the sample who responded to the survey at UNAM (see Table 10 in chapter 4 where 69% of respondents said they had not heard of RDM). RDM studies done in Africa bear similar results, indicating the low level of RDM awareness in most research and academic institutions in Africa (Chiware & Becker, 2018; van Deventer & Pienaar, 2015; Kahn et al., 2014). The concept is still new to most

researchers, even in South Africa, which seems to be more advanced in terms of RDM, and in Africa as a whole of which UNAM is part.

Developed countries such as the United Kingdom showed moderate levels of awareness regarding RDM practices in van Tuyl & Michalek's (2015) study. The difference in the focus area of the current study and that of van Tuyl & Michalek (2015) would contribute to a difference in awareness levels.

After the knowledge stage of the innovation-decision process where individuals learn about the existence of an innovation, persuasion occurs where individuals form their own behaviour towards an innovation. These habits are formed as researchers repeat the actions of RDM, for instance, if they engage in seeking more information about RDM.

The findings of the study suggest different behaviours of researchers at UNAM towards RDM. For example, it was found that many participants were not taking the initiative to acquire knowledge about RDM as shown in Table 12 in chapter 4, where 45% of respondents never discuss RDM within their department and 54% never discuss RDM outside their department in social settings. Additionally, the study found that many researchers were not investing time in integrating RDM into their research process as shown in Figure 8 in chapter 4. Similarly Cox (2017) and Bryant, Lavoie & Malpas (2018), noted in their studies that researchers' level of engagement in RDM practices was very low.

Contrary to this study's findings is that of Perrier et al. (2017) that was conducted in Toronto, which found that many researchers were taking initiatives by getting involved in any sort of knowledge acquisition about RDM, such as taking online courses (Perrier et al., 2017:5). It is clear from the review of literature that most academic researchers have no formal skills and knowledge in RDM and they are learning on the job (Bryant, Lavoie & Malpas, 2017). In addition, Dora & Kumar (2015:485) note that some researchers are encouraged to make an effort to manage research data for future use in response to the global trend regarding RDM. For example, a general interest in RDM is noted as some researchers have been seen to be engaged in developing their personal skills to improve RDM practices (Bryant, Lavoie & Malpas, 2017).

Those that are practicing RDM on an individual level are also noted by Koopman & De Jager (2016).

Practices

This study found that RDM practices are actively taking place at UNAM within the group that responded to the survey, despite many of them not knowing what RDM is. It was found that this group of researchers is managing its own research data on an individual level as has been shown in their responses to the question of what data-related activities they are involved in (results in Table 8). Although RDM is not formally endorsed by UNAM in the form of a policy, there were positive responses to all the choices.

Although most respondents indicated that they had never heard of RDM, this study showed that the practice of managing research data by individual researchers is not firmly linked to their awareness of the concept of RDM.

Adoption

Even with the small number that responded to the survey, this study found that the extent to which RDM practices have been adopted at UNAM is in the infancy stage as adoption is only at an individual level.

Other studies in the literature review found research data management to have been adopted on an individual level (Hickson et al., 2016; Koopman & De Jager, 2016; Kahn et al., 2014; van Deventer & Pienaar, 2015), while other studies suggested that some research communities have adopted RDM on an institutional level (van Tuyl & Michalek, 2011). On the contrary, many other institutions adopting RDM practices are still in the infancy stage, with some adoptions being non-existent (Chiware & Becker, 2018). This is not neccesarily to say that RDM has not been widely adopted across the world.

The reviewed literature mentions several influences that may lead to the adoption of RDM, among others: policies, conforming to global trends, academic researchers seeking to collaborate, proof of research results, and emphasis on open access to research data (Koopman & De Jager, 2016; Buys & Shaw, 2015; Kahn et al., 2014). This study also identified factors that may

influence the adoption of RDM: policies, discipline, colleagues and media, as shown in Figure 10 in chapter 4. Responses to Question 21 which asked respondents what is most likely to influence their interest to adopt (further) RDM practices in their research process.

5.2.2 Confirming DOI theory innovation-decision theory

Although this study was framed by Rogers' DOI theory, the focus was on the innovation-decision process stage, as it was considered appropriate to use this to establish the extent to which the 'innovation' of RDM has been adopted at UNAM.

In order to attain the adoption, the innovation must be known. This is the first stage of the process. The findings for this study revealed that few respondents (31% of respondents to Question 11) seemed to be aware of RDM.

The stage of persuasion is where the researcher is motivated to know more about RDM. Again, only a few respondents were found to be motivated to know more about RDM (Questions 19). It is interesting to note that a close observation of the analysis revealed that librarians were a bit more advanced compared to other groups as they seemingly have the knowledge of RDM and they were in the second stage where they are engaged in developing personal skills in RDM and becoming the driving force in the institution.

The third stage is the decision stage. This stage has not been reached by this group of respondents as their behaviour shows that they have not yet gone through the persuasion stage. This is evident in their responses to the following questions: Question 15 which asked respondents if they have tried to find out more about RDM (Table 12 in chapter 4); and Question 16 and 17, which asked respondents how often they discuss RDM in and outside their own department (Table 13 in chapter 4). Question 19 asked respondents how much effort/time they invest in integrating RDM into their research process. The results showed that 37% of respondents were not spending any time in integrating RDM and 31% was spending little time on it (Figure 8 in chapter 4), showing that a decision about adopting the innovation has not been made by the majority of respondents.

The fourth stage is implementation, which can only be attained when the decision is made to try an innovation and the last stage is confirmation, which in this case could not be attained as it depended on the success of all the previous stages.

The findings of the study provide evidence supporting the argument that individuals' behaviour determines their final decision of adopting or rejecting an innovation

The study indicated that although RDM has been practiced to some extent by the group which responded to the survey, complete adoption is seemingly non-existent. The study then concludes that the majority of this group of researchers is at the knowledge stage of the innovation-decision process. It is at this stage where researchers are learning about RDM, how it works, and the advantages derived from it. Some are at the persuasion stage and a few at the decision stage, but the implementation and confirmation stages have not been reached, possibly because of the lack of policies, support and guidance from the institution.

5.2.3 Identify challenges encountered by researchers attempting to practice RDM (Objective 2)

The challenges that researchers are faced with as they attempt to adopt RDM practices were identified by asking respondents to select their prefered answers from a list.

This study found out that the researchers at UNAM who do manage their research data are faced with many challenges as they attempt to work with research data**.**

Safe and secure storage of research data has been noted as a great challenge for many respondents in the survey at UNAM. However, this is not to say other challenges were not considered as a great concern. Other challenges as indicated are: loss of data, technological obsolescence, lack of RDM skills and experience, lack of guidelines on managing research data, lack of proper infrastructure, lack of knowledge in metadata creation and no standard guidelines on file naming of data.

The finding for this study is similar to many other studies which found storage to be a huge challenge. For example, studies by Buys & Shaw (2015), Kennan & Markauskaite (2015), and

Koopman & De Jager (2016) also found that safe and secure storage was a challenge for researchers.

The low level of RDM awareness is also a huge challenge (Table 10, in chapter 4). Lack of RDM services in place and in development (as shown in Table 10, in chapter 4) is another challenge. Some services that are lacking include guidance on writing DMPs, provision of data repositories and the provision of safe and secure storage for research data.

There is also a lack of institutional engagement in developing RDM services and policies (see Figure 11, in chapter 4). Similarly, van Deventer & Pienaar (2015:36) were concerned with limited commitment from senior decision makers regarding the policies to make RDM a reality.

There is also a challenge to the institution as to where in the innovation-decision process researchers are, as many researchers were not even aware of the existence of RDM as seen in Table 9, in chapter 4.

Lack of communication is also a big challenge for UNAM researchers as has been seen in Figure 7, in chapter 4, where there was no indication of researchers learning about RDM through UNAM communications. Communications is a huge driver for the dissemination of information about an innovation.

The reviewed literature also identified many challenges faced by researchers as they manage their research data. Among other challenges is the lack of proper infrastructure as mentioned by Chigwada, Chiparausha & Kasiroori (2017) and Chiware & Mathe (2015).

5.2.4 Possible solutions to some of the identified challenges (Objective 3) and recommendations for change

For some of the challenges, the researcher suggests possible solutions which could be implemented at UNAM. Solutions have been guided by the data analysed, the literature reviewed and from the researcher's own knowledge of UNAM.

- For safe and secure storage, UNAM should develop infrastructures which will help in maintaining good RDM practices. While developments are in progress, researchers could

participate in global initiatives for open data such as Dryad, a data repository developed to support RDM during and after research projects are concluded.

- For communications, UNAM should use the internet as this is believed to be the best way of creating awareness about RDM. Face to face communication between individuals is also a very effective way of influencing an individual to adopt and practice a new idea and it should be encouraged. Librarians in particular, can create awareness about RDM as they have the knowledge and the contact with researchers which would allow for face-to-face communication.
- UNAM should develop policies to enhance RDM. The literature shows that institutional and funder policies are big drivers for the adoption of RDM practices.
- If UNAM were to conform to global standards regarding research activities, particularly RDM practices, the policy maker must consider developing policies to enhance RDM.
- If proper management of research data is to be attained at UNAM, it needs to develop infrastructures to support RDM services.
- UNAM should consider developing courses around RDM to help researchers know how to manage their research data.
- UNAM should encourage writing and attachment of DMP to every research proposal carried at UNAM.
- UNAM should encourage researchers to attach research data to support their research findings.

5.3 Future research studies

This study is the first to be done at UNAM regarding RDM, hence it has provided the first step towards filling the knowledge gap by investigating researchers' RDM practices, knowledge, motivation and behaviours as well as the challenges they and the institution are faced with as they attempt to adopt RDM practices. Therefore, recommended future studies are:

- A comparative study on research data management practices in different disciplines, which will give more insights into what type of data is produced from different subject areas and how researchers deal with data on a daily basis.

- A mixed methods study to gather detailed information on the perceptions of researchers regarding RDM.

5.4 Study limitations

The researcher recognises that there were several limitations to the study which included:

- The study was limited to UNAM academic researchers across all campuses, therefore the generalisation of findings to other academic institutions in Namibia cannot be done.
- The researcher did not capture as much data as initially envisaged, hence the findings cannot be generalised to the institution.
- Faculty responses varied; some faculty had little or no representation.
- As there is a low level of RDM awareness at UNAM, the researcher perceives that researchers would have been more motivated to take part in the study if they were familiar with the topic under study and they believed it would yield better benefits for them.
- As this is a minor dissertation limited to one year of study, the time constraints meant that running a pilot study to test reliability was not possible.
- Time constraints also meant that the survey was sent out towards the end of the year when most of the targeted group were invigilating and marking examination scripts.
- During the time the survey was sent out, some of the UNAM staff members including academics were on an industrial strike thus they were not in office.

Despite the limitations, the study still has strengths and it is a contribution to the field of RDM.

5.5 Summary

The study investigated the extent to which RDM has been adopted as part of research activity at UNAM. The study was carried out quantitatively whereby a survey in the form of a questionnaire was used. Data was gathered and analysed using a self-administered online web-based tool known as SurveyMonkey. Excel was used to analyse the data and to create tables and charts.

The researcher discussed the findings, identified challenges and provided solutions to some of the challenges identified. Most respondents to the survey were placed at the knowledge stage within DOI's innovation-decision process, while fewer were placed at the persuasion where they were forming their behaviours towards RDM and some were placed at the decision stage as the data revealed that they were aware of the RDM concept and were engaged in activities that lead to a choice of the adoption or rejection of an innovation, and one such example is data management practices.

5.6 Conclusions

In conclusion, RDM is becoming a common practice and a positive intervention by academic institutions such as UNAM might produce a rapid adoption and full implementation of RDM practices, which could bring researchers the advantage of conforming to global standards as well as improving the quality and quantity of research coming from UNAM.

References

AIMS, 2016. *Namibia hosts Forum on Open Data Open Science Agriculture in Africa in the context of Sustainable Development Goals*. 18 April 2016. Available: http://aims.fao.org/es/activity/blog/namibia-hosts-forum-open-data-and-open-science-agriculture-africa-context-sustainable. [2018, May 16].

Almas, B., Bicarregui, J., Blatecky, A., Hill, S., Lannom, L., Pennington, R., Stotzka R. & Treloar, A. et al. n.d. *Data management trends, principles and components what needs to be done next?* Available: https://rd-alliance.org/sites/default/files/paris-doc-v6-1_2.pdf.[2018, April 30].

Avuglah, B.K. 2016. Developing an implementation plan for research data management (RDM) at the university of Ghana (UG). Masters Thesis. University of Pretoria, Available: https://repository.up.ac.za/bitstream/handle/2263/62100/Avuglah_Developing_2016.pdf?sequence=1 [2019, January 27].

Bell, J. & Waters, S. 2014. *Doing your research project: a guide for first time researchers*. 6th ed. Glassgow: Bell & Bain LTD.

Bello, O., Akinwande, V., Jolayemi, O. & Ibrahim A.O. 2016. Open data portals in Africa: an analysis of open government data initiatives. *African Journal of Library, Archives and Information Science.* 26(2):97-106 Available: https://www.researchgate.net/profile/Olayiwola_Bello/publication/312057417_Open_Data_Portals_in_Africa_An_Analysis_ofOpen_Government_Data_Initiatives/links/586d634608ae6eb871bced07/Open-Data-Portals-in-Africa-An-Analysis-ofOpen-Government-Data-Initiatives.pdf [2018, August 21].

Berghmas, S., Cousijn, H., Deakin, G., Meijer, I., Mulligan, A., Plume, A., De Rijcke, S. & Rushforth A., et al., 2017. *Open data: the researcher's perspective*. CWTS, Elsevier and University of Leiden. Available: https://www.elsevier.com/__data/assets/pdf_file/0004/281920/Open-data-report.pdf [2018, April 11].

Bezuidenhout, L.M., Leonelli, S., Kelly, A.H. & Rappert, B. 2017. Beyond the digital divide: towards a situated approach to open data. *Science and public policy.* 44(4): 464-475. DOI: 10.1093/scipol/scw036.

Bouma, G. & Carland, S. 2016. *The research process.* 6th ed. Australia: Oxford University Press.

Bryant, R., Brian, L. & Malpas, C. 2017. A tour of the research data management (RDM) service space. *The realities of research data management*, Part 1. Dublin, Ohio: OCLC Research. DOI:10.25333/C3PG8J

Burney, A. 2008. *Inductive and deductive research approach*. Available: www.drburney.net/INDUCTIVE%20&%20DEDUCTIVE%20RESEARCH%20APPRO. [2019, February 04].

Burnham, A. 2012. *Research data definitions*. Available: https://www2.le.ac.uk/services/researchdata/documents/UoL_ReserchDataDefinitions_20120904.pdf [2018, March 12].

Burnham, A. 2013. *An introduction to managing research data: for researchers and students.* Available: https://www2.le.ac.uk/services/research-data/documents/an-introduction-to-managing-research-data [2019, July 02].

Buys, C. & Shaw P. 2015. Data management practices across an institution: a survey and report. *Journal of librarianship and scholarly communication* .3(2):0-24. DOI: 10.7710/2162-3309.1225

Chigwada, J., Chiparausha, B. & Kasiroori, J. 2017. Research data management (RDM) in research institutions in Zimbabwe. *Data science journal*. 16(1-9). DOI: 10.5334/dsj-2017-031

Chiware, E.R.T. & Mathe, Z. 2015. Academic libraries' role in research data services a South African perspective: *South Africa journal of libraries and information science*. 8(2). DOI: 10.7553/81-2-1563

Chiware, E.R.T. & Becker, D.A. 2018. Research data management services in Southern Africa: a readiness survey of academic research libraries: *African journal of library, archives and information science.* 28(1). DOI: 10.7553/81-2-1563.

Cox, A.M., Kennan, A.M., Lyon, L. & Pinfield, S. 2017. Developments in research data management in academic libraries: towards an understanding of research data services maturity. *Journal of association for information science and technology*. 68(9):2183-2199. DOI: 10.1002/asi.23781

Cox, A., & Verbaan, E. 2018. *Exploring research data management.* London: Facet publishing Available: https://www.amazon.com/Exploring-Research-Management-Andrew-Verbaan/dp/178330278X [June 2019, 30].

Cox, A.M.,Pinfield, S., & Smith, J. 2014. Research data management and libraries: current activities and future priorities. *Journal of librarianship and information science.* DOI: 10.1177/0961000613492542

Corti, L. & Fielding, N. 2016. *Opportunities from digital revolution: implications for researching, publishing and consuming qualitative research.* SAGE open. 6(4): 1-13. DOI: 10.1177/2158244016678912

Creswell, J.W. 2014. R*esearch design: qualitative, quantitative and mixed methods approaches* 4th ed. Califonia: Sage publication.

Creswell, J.W. & Creswell, J.D. 2018. *Research design: qualitative, quantitative and mixed methods approaches*. 5th ed. Los Angeles: Sage publication.

Kumar, D.A., 2015. Advocacy for open access. In: Mishra, S. & Satija,M.P. (eds.), *Introduction to Open Access [Open Access for Library Schools,1]*. Paris: UNESCO, 43-54. Available: https://www.academia.edu/11847592/Advocacy_for_Open_Access [2018, March 24].

Dearing, J.W. 2009. Applying diffusion of innovation to the invention development. *Research on social work practice*. 19(5):503-518. DOI: 10.1177/1049731509335569

De Roure, D. 2014. The future of scholarly communications. *UKSG journal*. 27(3):233-238. DOI:10.1629/2048-7754.171

Donelly, M. 2013. Research data management and the H2020 open data pilot. *Facilitate open science training for European research*. (FOSTER). 22 October. Available: https://www.fosteropenscience.eu/sites/default/files/pdf/1914.pdf [2018, April 15].

Digital curation centre, 2014. Funders data plan requirements. Available: http://www.dcc.ac.uk/resources/data-management-plans/funders-requirements. [2018, March 12].

Davidson, J. 2015. Integrating data management planning into the pre-award, in award and post-award stages. ARMA 25th *annual conference*. (Digital Curation Centre, United Kingdom. 03 June. Available: http://www.dcc.ac.uk/resources/publications/2015 [2018, March 13].

DIRISA, 2018. *National data workshop*. 19-21 June 2018. Meraka institute, South Africa. Available: https://www.csir.co.za/dirisa-national-data-workshop-2018 [2019, January 28].

Dobreva, M. 2018. *Digital archives management, use and access*. London: Facet publishing inc.

Dora, M., and Kumar, H.A. 2015. *Managing research data in academic institutions: role of libraries*. Available: http://hdl.handle.net/1944/1889 [2018, May 14].

Dube, C. & Gumbo, V. 2017. Technology acceptance model for Zimbabwe: the case of the retail industry in Zimbabwe. *Applied economics and finance*. 4(3):56-76. DOI: 10.11114/aef.v4i3.2208

Eynden, V., & Brett, B.M. 2010. Data lifecycle and data benefits of managing and sharing your data. Available: https://www.ukdataservice.ac.uk/media/187718/dmplanningdm24apr2013.pdf [2018, April 12].

Forman, C. & Goldfab, A. 2005. Diffusion of information and communication technologies to business. Available:

http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.488.5382&rep=rep1&type=pdf [2018, April 15].

Halbert, M. 2013. The problematic future of research data management: challenges opportunities and emerging patterns identifies by the DataRes project. *International journal of digital curation*. 8(2):111-122. DOI:10.2218/ijdc.v8i2.276

Hickson, S., Poulton, K.A., Connor, M., Richardson, J. & Wolski, M. 2016. Modifying researcher's data management practices: a behavioral framework for library practitioners. *IFLA journal*. 42(4):253-265. DOI: 10.1177/0340035216673856

Higgins, S. 2008. The DCC curation lifecycle model. *International journal of digital curation*. 3(1):134-140. Available: *ijdc.net/index.php/ijdc/article/download/69/48 [2018, March 21]*.

Jantz, R. 2012. Innovation in academic libraries: An analysis of university librarians' perspectives. *Library and Information science research*. 34(1):3-12. DOI: 10.1016/j.lisr.2011.07.008

Kahn, M., Higgs, R., Davidson, J. & Jones S. 2014. Research data management in South Africa: how we shape up. *Australian academic and research libraries*. 45(4):296-308. DOI: 10.1080/00048623.2014.951910

Kennan, M. & Markauskaite, L. 2015. Research data management practices: a snapshot in time. *International journal of digital curation.* 10(2): 69-96. DOI: 10.2218/ijdc.v10i2.329

Kell, C., & Czerniewicz, L. 2016. Visibility of scholarly research and changing research communication practices: a case study from Namibia. In Esposito, A. 2016. *Research 2.0 and impact of digital technologies on scholarly inquiry*. Hershey, Pennsylvania: IGI global. Available: http://hdl.handle.net/11427/23990 [2018, March 15].

Keralis, S.D.C., Stark, S. & Halbert, M. 2014. Research data management in policy and practice: the DataRes project. *Council on library and information resource*. Available: http://www.clir.org.pubs/reports/pub160.pdf [2018, March 07].

Kim, J., Warga, E. & Moen, W. 2012. Data curation in the academic library job market. *Proceedings of the American Society for Information Science and Technology.* 49(1):1-4. DOI: 10.1002/meet.14504901283

Koopman, M. & De Jager, K. 2016. Archiving South African research data: how ready are we? *South African journal of science*. 112(7):1-7. DOI: 10.17159/sajs.2016/20150316

Kothari, C.R. & Garg, G. 2014. *Research methodology, methods and techniques*. 3rd ed. India: New age international limited publishers.

Leedy, P.D. & Ormrod J.E. 2016. *Practical research: planning and design*. 11th ed. Colorado: Pearson. Available: https://www.pearson.com/us/higher-education/product/Leedy-Practical-Research-Planning-and-Design-11th-Edition/9780133741322.html.[2018, March 24].

Leonard, A. 2014. The views, adoption and use of e-books by undergraduate students at the University of Namibia promoter. Masters Thesis. University of South Africa. Available: *uir.unisa.ac.za/handle/10500/23180 [2019, January 31]*.

Leonelli, S., Bezuidenhout, L. & Rappert, B. 2018. Introduction: Open data and Africa. *Data science journal*. 17(5):1-3. DOI: 10.5334/dsj-2018-005.

Lewis, M. 2010. Libraries and the management of research data. *Envisioning future academic library services initiatives ideas and challenges.* Available: http://eprints.whiterose.ac.uk/11171/1/LEWIS_Chapter_v10.pdf [2018, March 20].

LIASA, 2014. *The annual general meeting of the LIASA*. 25 September 2014. Gauteng, South Africa. Available: http://www.liasa-new.org.za/wp-content/uploads/2015/06/LIASA-AGM-minutes-2014.pdf [2019, January 27].

Majanja-Minishi, M.K. 2005. The diffusion of innovation theory as a theoretical framework in library and information science. *South African journal of libraries and information science*. 71(3):211-224. DOI: 10.7553/71-3-586

Mercury project solutions, 2013. *Research data management in practice*. Available: http://www.ands.org.au/datamanagement/data-management-practice-guide.pdf. [2018, April 01].

Muriithi, P., Horner, D. & Pemberton, L. 2016. Factors contributing to adoption and use of information and communication technologies within research collaborations in Kenya, information technologies for development. *Information technology for development*. 22(1):84-100. DOI: https://doi.org/10.1080/02681102.2015.1121856

Namibia statistics agency. 2016. *Namibia inter-censal demographic survey 2016 report*. Available: https://cms.my.na/assets/documents/NIDS_2016.pdf [2018, March 12].

National commission on research science and technology. 2006. *Fostering excellence through knowledge and innovation*. Available: http://www.ncrst.na/files/downloads/97827dfe63318c5_Brochure.pdf [2018, February 23].

Nazari, F., Khosravi, F. & Babalhavaeji, F. 2013. Applying Rogers' Diffusion of Innovation theory to the acceptance of online databases at University Zone Iran. *Malaysian journal of library and information science*. 18(3):25-38. Available: https://ejournal.um.edu.my/index.php/MJLIS/article/view/1873 [2018, March 18].

Nhendodzashe, N. & Pasipamire, N. 2017. Research data management services: are academic libraries in Zimbabwe ready? The case of University of Zimbabwe library. Available: http://library.ifla.org/1728/ [2018, April 12].

Open data portal a technical enabler for innovation and growth. 2016. *New Era*. 24 February. Available: https://www.newera.com.na/2016/02/24/open-data-portal-technical-enabler-innovation-growth/ [2018, April 10].

Perrier, L., Blondal, E., Ayala, A.P., Dearborn, D., Kenny, T., Lightfoot, D., Reka, R. & Thuna, M. 2017. Research data management in institutions: a scoping review [Dataset]. DOI: 10.5281/zenodo.557043.

Perumal, T. 2014. *Research methodology*. *course material*. 8(1993) 87-104. Available: https://www.tankonyvtar.hu/en/tartalom/tamop412A/20110021_22_research_methodology/adatok.html [2018, February 20].

Pinfield, S., Cox, A. & Smith, J. 2014. Research data management and libraries: relationships, activities, drivers and influences. *PloS One*. 9(12). DOI: 10.1371/journal.pone.011473.

Punch, K.F. 2006. *Developing effective research proposals*. 2nd ed. Singapore: Sage publications.

Raosoft, 2004. *Sample size calculator*. Available: http://www.raosoft.com/samplesize.html [2019, January 31].

Republic of Namibia 2009. *Namibia national housing policy 2009*. Available: https://www.ohchr.org/Documents/Issues/Housing/subnationalgovernments/201114_Response_Namibia2.pdf [2019, January 28].

Research science and technology act, 18 of 2004. Government gazette of the Republic of Namibia. 3356. 23 December. Government notice no. 283. Windhoek: Government printers. Available: http://www.ncrst.na/files/downloads/b95_RESEARCH%20SCIENCE%20AND%20TECHNOLOGY%20ACT%202004%20NAMIBIA.pdf [2019, January 28].

Research Data Allliance. 2015. *Research Data Alliance outputs*: Available: https://rd-alliance.org/sites/default/files/attachment/RDA_Outputs_May2015_web.pdf%5Cnhttps://rd-alliance.org/plenary-meetings/rda-fourth-plenary-meeting.html%5Cnhttps://rd-alliance.org/outcomes. [2018, April 17].

Reitz, J.M. 2004. *Dictionary for library and information science*. United States of America: Greenwood publishing inc.

Ridsdale, C., Rothwell, J., & Smit, M. 2016. Strategies and best practices for data literacy education. Available: http://www.idees-ideas.ca/sites/default/files/sites/default/uploads/general/2015/sshrc-ksg-smit.pdf [2018, April 12].

Robinson, L. 2009. A summary of Diffusion of Innovations. Changeology. Available: https://www.enablingchange.com.au/Summary_Diffusion_Theory.pdf. [2018, April 15].

Rogers, E. 2003. *Diffusion of innovations*. 5th ed. New York: Free press.

Salkind, N.J. 2010. *Encyclopedia of research design*. Thousand Oaks: SAGE Publications, Inc. DOI: 10.4135/9781412961288.

Sanjeeva, M. 2015. *Changing roles in changing times: scholarly communications and research support*. 05 March. Available: *eprints.rclis.org/32481/1/IITGN.pdf [2018, April 16]*.

Scarpa, R. 2012. *Guidance for the design of quantitative survey-based evaluation*. Available: http://ec.europa.eu/regional_policy/sources/docgener/evaluation/doc/performance/scarpa.pdf [2018, April 25].

SCOUNUL, 2015. *Research data management, briefing for library directors*. Available: http://www.scounul.ac.uk/page/research-data-management [2018, March 14].

Shearer, K. 2015. *Comprehensive brief on research data management policies*. Available: https://portagenetwork.ca/.../Comprehensive-Brief-on-Research-Data-Management-Policies [2018, April 16].

Soanes, C., Hawker, S. & Elliot, J. 2006. *Oxford dictionary of current English*. New York: Oxford university press inc.

Steele, C. 2014. Scholarly communication, scholarly publishing and university libraries: Plus Ca change. *Australian academic and research libraries*. 45(4):241-261. DOI: 10.1080/00048623.2014.950042

Strasser, C., Cook, R., Michener, W., & Budden, A. 2012. Primer on data management: what you always wanted to know. Available:https://www.dataone.org/sites/all/documents/DataONE_BP_Primer_020212.pdf. [2018, May 02].

Tenopir, C., Allard, S., Kimberly, D., Aydinoglu, A.U., Read, E., Manoff, M., & Frame, M. 2011. Data sharing by scientists: practices and perceptions. 6 (6):1-21. DOI: 10.1371/journal.pone.0021101

Trotter, H., Kell, C., Willmers, E., Gray., E., & King T. 2014. *Seeking impact and visibility: scholarly communication in Southern Africa.* Cape Town: African Minds. Available: www.africanminds.co.za/wp-content/uploads/2014/05/9781920677510-content2.pdf [2018, March 15].

UNESCO, 2017. Global open access portal. Available: http://www.unesco.org/new/en/communication-and-information/portals-and-platforms/goap/access-by-region/africa/namibia/ [2019, February 15].

University of Namibia Act, 18 of 2004. Government gazette of the Republic of Namibia. 56. 21 August. Promulgation no. 105. Windhoek: Government printers. Available: www.lac.org.na/laws/1992/460.pdf [2018, March 21].

University of Namibia, 2016. *Annual report 2016.* Available: http://www.unam.edu.na/sites/default/files/newsletter/unam_annual_report2016_web_0.pdf [2018, March 16].

University of Namibia, 2013. *Scholarly communications policy*. Available: http://www.idea-phd.net/images/UNAM-Scholarly-Communication-Policy.pdf [2018, March 07].

University of Namibia, 2017. *Student population 2017.* Available: http://www.unam.edu.na/sites/default/files/student_population_2017.pdf [2018 August 21].

University of Namibia, 2015. *Research report*. Available: http://www.unam.edu.na/sites/default/files/newsletter/unam_2015_research_report.pdf [2018 March 02].

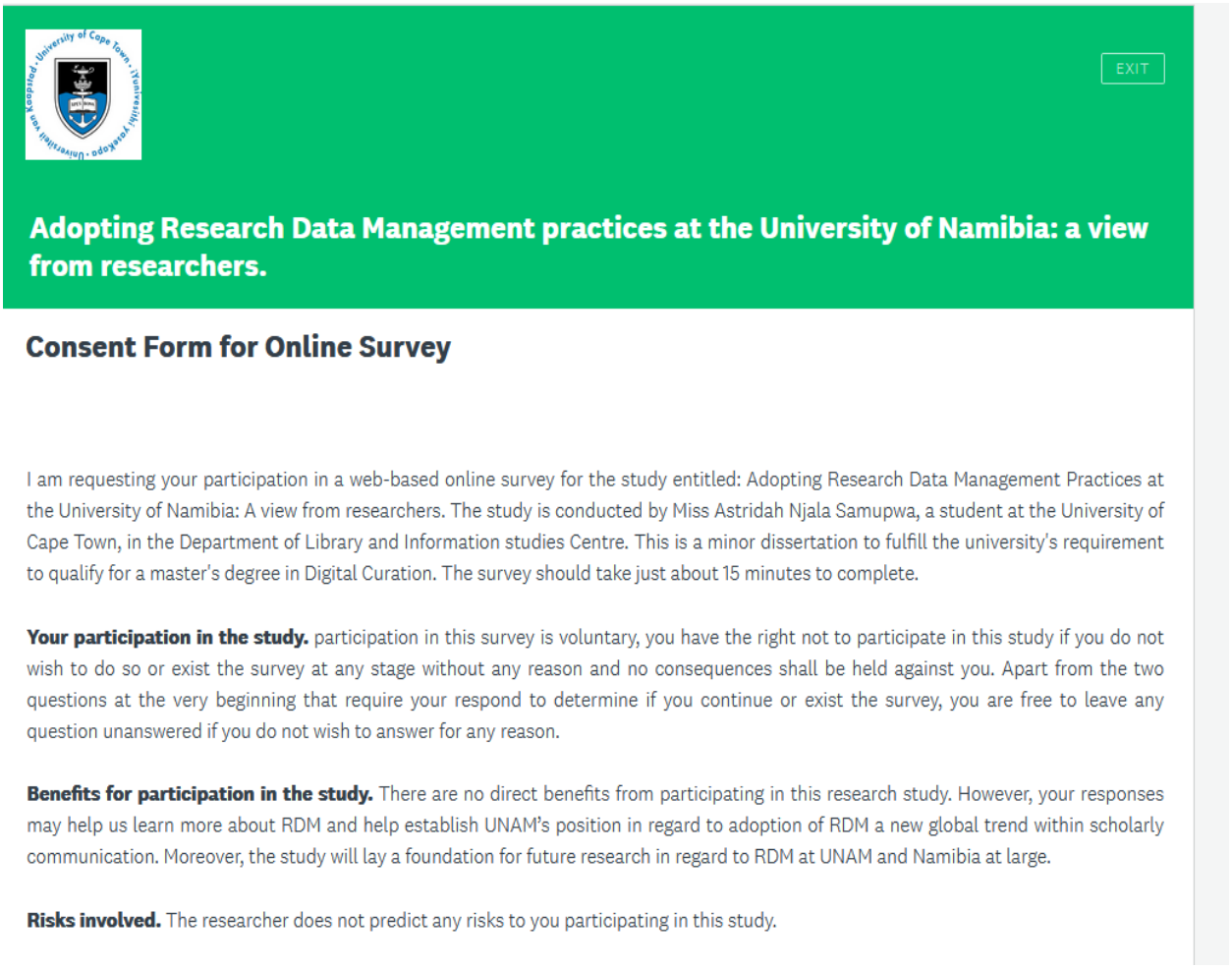
Van Deventer, M., & Pienaar, H. 2015. Research data management in a developing country: a personal journey. *International journal of digital curation*. 10(2):33-47. DOI: 10.2218/ijdc.v10i2.380

Van Tuyl, S. & Michalek, G. 2015. Assessing research data management practices of faculty at Carenergie Mellon University. *Journal of librarianship and scholarly communication*. 3(3): ep1258. DOI: 10.7710/2162-3309.1258

Whyte, A. & Tedds, J. 2011. Making the case for research data management. *A digital curation centre briefing paper*. Edinbugh, September 01, 2011. Available: http://www.dcc.ac.uk/resources/briefing-papers/making-case-rdm [2018, April 12].

Appendices

Appendix A. Informed consent form and Ethical consideration



EXIT

Adopting Research Data Management practices at the University of Namibia: a view from researchers.

Consent Form for Online Survey

I am requesting your participation in a web-based online survey for the study entitled: Adopting Research Data Management Practices at the University of Namibia: A view from researchers. The study is conducted by Miss Astridah Njala Samupwa, a student at the University of Cape Town, in the Department of Library and Information studies Centre. This is a minor dissertation to fulfill the university's requirement to qualify for a master's degree in Digital Curation. The survey should take just about 15 minutes to complete.

Your participation in the study. participation in this survey is voluntary, you have the right not to participate in this study if you do not wish to do so or exist the survey at any stage without any reason and no consequences shall be held against you. Apart from the two questions at the very beginning that require your respond to determine if you continue or exist the survey, you are free to leave any question unanswered if you do not wish to answer for any reason.

Benefits for participation in the study. There are no direct benefits from participating in this research study. However, your responses may help us learn more about RDM and help establish UNAM's position in regard to adoption of RDM a new global trend within scholarly communication. Moreover, the study will lay a foundation for future research in regard to RDM at UNAM and Namibia at large.

Risks involved. The researcher does not predict any risks to you participating in this study.

Confidentiality and anonymity. Your confidentiality is guaranteed as your survey responses are collected and sent to SurveyMonkey where data will be stored and protected securely in electronic format. Only the researcher and her supervisor will have access to the data. Additionally, the researcher does not collect identifying information such as your name, email or IP address. Therefore, your responses will remain anonymous. No one will be able to identify you, and no one will know whether or not you participated in the s EDIT

Inquiries: If you have questions at any time about the study or the procedures taken, you may contact the researcher, Astridah Samupwa on her mobile number +267 837765165/ 264 812784390 or email address on SMPAST001@myuct.ac.za and her research supervisor, Michelle Kahn through her work telephone number at +27 (0) 216501851 or through her work email address at michelle.kahn@uct.ac.za

Consent: Please select one of the following: (agree or disagree) as your choice below. You are allowed to print a copy of this consent form for your keeping. Selecting the "Agree" button indicates that:

- You have read the above information
- And that the above information is clear and understood
- Your participation is voluntarily
- You are above the age of 18 years

" Agree [will take participant to first page of survey]

" Disagree [will exit survey]

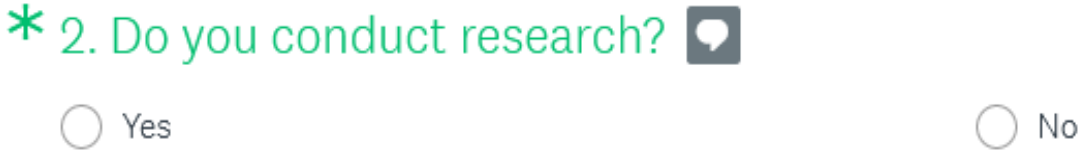
Click or scroll past the "OK" button to reveal the next question.

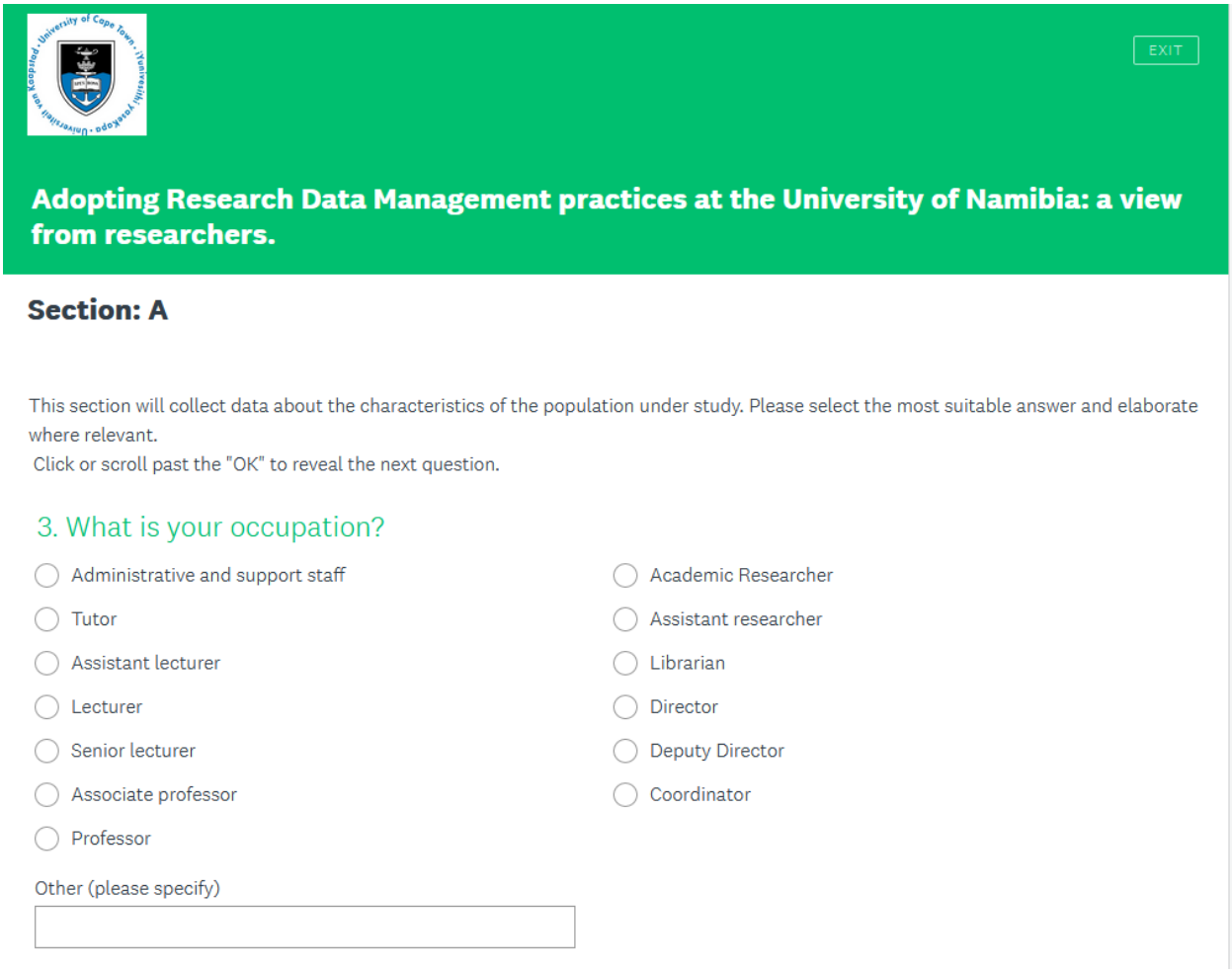
1. Do you consent to participate in the survey?

◯ Agree

◯ Disagree

Appendix B: Data gathering instrument (Questionnaire)





4. What is your highest qualification?

- ◯ Certificate
- ◯ Diploma
- ◯ Bachelors degree
- ◯ Other (please specify)
- ◯ Masters degree
- ◯ PHD

5. In which faculty are you? (Please click the drop-down to select).

6. Which campus are you? (please click the drop-down to select).

7. If you are an academic at UNAM, how long have you worked for UNAM in an academic environment? (for example, as a lecturer, researcher or librarian, etc).

- ◯ Less than 5 years
- ◯ 5 - 10 years
- ◯ 11 - 15 years
- ◯ 16 - 20 years
- ◯ More than 20 years
- ◯ I am not an academic

8. What is your current employment status at UNAM?

- ◯ Permanently employed (Full-time)
- ◯ Permanently employed (Part-time)
- ◯ On contract
- ◯ Casual work

EXIT

Adopting Research Data Management practices at the University of Namibia: a view from researchers.

Section: B

Please answer the following questions about your data management and curation habits. Please select the most suitable answer and elaborate where relevant.
Click or scroll past the "OK" to reveal the next question.

9. As a researcher, what type of data do you generate/create/use?

- ◯ Primary data
- ◯ A combination of primary and secondary data
- ◯ Secondary data
- ◯ Not sure (Please elaborate)

10. In what format/s are your research data? (please tick all the formats you use).

- ☐ Text (e.g. text files, WORD, PDF, RTF or XML)
- ☐ Multimedia (e.g. MP3, MP4, WMV, AVI, or WAV)
- ☐ Numerical (e.g. SPSS, STATA, or Excel)
- ☐ Models (e.g. 3D and statistical)
- ☐ Image (e.g. JPEG, TIFF, PNG, or MPEG)
- ☐ Software (e.g. Java)
- ☐ Other (please specify)

11. Have you heard of Research Data Management (RDM)?

- ◯ Yes
- ◯ No

Not sure (please elaborate)

12. How did you first learn about RDM?

- ◯ Through friends or colleagues
- ◯ Social media or blog post
- ◯ On the internet
- ◯ Conferences
- ◯ Workshops
- ◯ Other (please specify)

- ◯ Research funder policies
- ◯ National policy
- ◯ Online advertisement
- ◯ News article
- ◯ UNAM communications

13. Are you aware of any RDM services already in place at UNAM?

- ◯ Yes
- ◯ No
- ◯ Not sure

14. Are you aware of any RDM services in development at UNAM?

- ◯ Yes
- ◯ No
- ◯ Not sure

15. As an individual have you ever tried to find out more about RDM?

- ◯ Yes
- ◯ No

16. How often if ever, do you discuss RDM in your own department?

- ◯ Often
- ◯ Sometimes
- ◯ Never

17.

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How often if ever, do you discuss RDM outside your own department? (for example, in your social settings or with other departments).

- ◯ Often
- ◯ Sometimes
- ◯ Never

18. Which particular data-related practices are you involved in? (please tick all that are relevant).

- ☐ Writing of data management plans (DMPs)
- ☐ Collecting research data
- ☐ Selecting data for use
- ☐ Saving data into retrievable formats
- ☐ Describing selected data/ naming data files
- ☐ Selecting data for storage
- ☐ Creating safe and secure data storage
- ☐ Other (please specify)
- ☐ Keep data securely
- ☐ Sharing research data
- ☐ Protecting data with passwords
- ☐ Data re-use
- ☐ Ensure data privacy and anonymity
- ☐ Preservation of research data for long term use

19.

As an individual, do you invest effort/time in integrating RDM practices in your research process?

- ◯ A great deal
- ◯ A moderate amount
- ◯ A little
- ◯ None at all

Defining Research Data Management (RDM) is when research data is organised and described from its entry to the research cycle through to the dissemination and archiving of valuable data. RDM practices include: the documentation, curation and preservation of research data, with the purpose of ensuring long-term retention of research data for re-use and replication (Burnham, A. 2012. Research data definitions. Available: https://www2.le.ac.uk/services/research-data/documents/UoL_ReserchDataDefinitions_20120904.pdf. [2018, July 31]).

20. In the interests of preserving your research data for future scrutiny and re-use, would you consider changing your data practices to include more of the activities listed in question 18?

- ◯ Yes
- ◯ No
- ◯ Not sure (please elaborate)

21. What is most likely to influence your interest to adopt (further) RDM practices in your research process?

- ◯ Policies (such as funders, or institutional policies)
- ◯ Colleagues at work
- ◯ My discipline
- ◯ Media
- ◯ Other (please specify)

22.
Currently at UNAM, are there any policies, programs, or incentives that would encourage you to adopt RDM practices?

- ◯ Yes
- ◯ No
- ◯ Not sure (please elaborate)

23. If UNAM were to become more proactive in encouraging RDM among its researchers, which of the following services would you like it to offer? (please tick all that are relevant)

- ☐ Provide safe and secure data storage
- ☐ Provide training on metadata creation
- ☐ Provide training
- ☐ Participate in global open data initiatives
- ☐ Provide data repository
- ☐ Develop policies to enhance RDM
- ☐ Provide workshops on RDM
- ☐ Other (please specify)

24. What challenges do you encounter as you wor… (please tick all that are relevant).

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- ☐ Loss of data
- ☐ Lack of guidelines on managing research data
- ☐ Lack of safe and secure data storage
- ☐ Lack of proper data infrastructure
- ☐ Technological Obsolescence
- ☐ Lack of knowledge in metadata creation
- ☐ Lack of RDM skills and experience
- ☐ No standard guideline on file naming of data
- ☐ Other (please specify)

25. Would you be interested in learning about RDM?

- ◯ Yes
- ◯ No
- ◯ Not sure (please elaborate)

26. Is there anything else you would like to add about RDM at UNAM in particular or generally?

Appendix C: Ethical clearance UCT

Library and Information Studies Centre
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.: UCTLIS201809-13 26 September 2018

Ms Astridah Samupwa,
Library and Information Studies Centre,
University of Cape Town.

Ethics Approval for Master's Research

Dear Ms Samupwa

I am pleased to inform you that on behalf of the Faculty of Humanities ethics clearance has been granted by the Ethics Review Committee of the Library and Information Studies Centre for you to proceed with collecting data for your Master's study entitled '*Adopting research data management at the University of Namibia: A view from researchers*'.

You are reminded to seek further permissions from the proposed data collection site before commencing with your data collection.

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

Mr Patrick Mapulanga
Chair: Department (LISC) Research Ethics Committee

Appendix D: Permission letter from UNAM

CENTRE FOR RESEARCH AND PUBLICATIONS
Office of the Pro-Vice Chancellor: Research Innovation and Development
UNIVERSITY OF NAMIBIA, Private Bag, 13301 Windhoek, Namibia
340 Mandume Ndemufayo Avenue, Pioneers Park, Office D090 ☎ +264-61-2064624 research@unam.na Fax+264-61-206 4624

04 August 2018

Dear Ms Astridah Njala Samupwa

PERMISSION TO CONDUCT RESEARCH ACTIVITIES AT THE UNIVERSITY OF NAMIBIA (UNAM)

Your application to conduct research at UNAM entitled: **"Adopting Research Data Management Practices at the University of Namibia: A view from researchers"** was considered based on ethical evaluation from your institution. Hence, permission is hereby granted with the following conditions:

1. During the course of your research activities at UNAM, you will observe the required procedures, norms and ethical conduct in accordance with the relevant Research Policies and Guidelines. If unsure, please consult *the Centre for Research and Publications* at UNAM for guidance. Any deviations and amendments to the original documents submitted (i.e. research proposal, interview guide, consent forms, etc.) must be submitted again for approval, before the research activities can commence.
2. **The results of the findings will be shared with the PVC: Research, Innovation and Development, and the Centre for Research and Publications, before they are disseminated or published in the public domain.**
3. Upon completion, a copy of the Research Report must be lodged with the UNAM Library for our records.
4. Proper, full acknowledgements of the University of Namibia and all participants /respondents shall be done in the Research Report and any subsequent publications arising from this research.

If you are agreeable to the above conditions, please sign and date a copy of this letter and return it the Centre for Research and Publications (Email: research@unam.na). If you have any queries, do not hesitate to contact the Centre for Research and Publications.

Wishing you all the best with your research.

Yours sincerely

UNIVERSITY OF NAMIBIA
P/BAG 13301, WINDHOEK, NAMIBIA
2018 -10- 05
CENTRE FOR RESEARCH & PUBLICATIONS
TEL: 061 206 4673, FAX: 0886526613
OFFICE OF THE PVC:
RESEARCH, INNOVATION & DEVELOPMENT

Dr. Hileni M. Kapenda

I accept and agree to all the conditions

ASTRIDAH SAMUPWA 04/10/2018

Full Name and Surname **Signature** **Date**