The adoption of research data management practices by emerging researchers: A case study of emerging researchers at a higher education institution in the Western Cape, South Africa

by

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DEDICATION

I dedicate this to my son Luvolwethu Xesi, who has been supportive in this journey and for constantly asking, “Dad, when are you finishing?”.

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ABSTRACT

Research Data Management serves a crucial role in navigating the intricate landscape of contemporary research. This study, comprising five chapters, adopts a qualitative approach and leverages Activity Theory to explore the factors that influence researchers' Research Data Management practices and comprehend how practices relate to the Research Data Management environment at the institution.

The research design uses semi-structured interviews to collect data from Masters and Doctoral students (referred to as 'emerging researchers' in the study) and librarians as representatives of Research Data Management stakeholders within the institution. Document analysis was employed as a complementary tool to acquire insight into the current situation of Research Data Management in the institution under investigation. The collected data was analysed using thematic analysis.

The study findings provide insight into a wide range of Research Data Management practices, including various storage options, issues with metadata documentation, complex opinions on data preservation and sharing, and a solid dedication to ethical considerations. These practices were influenced by factors such as Research Data Management practices and continual education and communication initiatives to teach a better awareness of the benefits throughout the research lifecycle.

The study offers several recommendations, including prioritising research training programs, establishing transparent communication channels for institutional Research Data Management policies, fostering collaborative platforms, and providing ongoing support and education. Finally, this study provides foundational insights into the complex interaction of factors that influence Research Data Management practices, laying the groundwork for creating effective methods to build a culture of responsible data management within academic institutions.

Keywords: Activity theory, research data management adoption, research data management policy, research data management practices, research data management services, research data management

ACRONYMS AND ABBREVIATIONS

AT	Activity theory
CHAT	Cultural-historical activity theory
DMP	Data management plan
HCI	Human-computer interaction
HEI	Higher education institution
IL	Information literacy
IR	Institutional repository
OA	Open access
UCT	University of Cape Town
RDM	Research data management
RDMS	Research data management service

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CHAPTER 1:
INTRODUCTION TO THE STUDY

1.1 Introduction

Research Data management (RDM) has become a topic of interest in higher education, prompting significant investment in services, resources, and infrastructure to meet researchers' data management demands (Bryant, Lavoie & Malpas, 2017: 4). RDM is a critical component in advancing research (Redkina, 2019: 53). RDM practices can speed up the research process, enhance cooperation, and prevent data loss (Cox et al., 2017: 54). Appropriate RDM practice ensures that the scientific community has access to and can use the underlying research data required for validating and supporting research findings (Abduldayan et al., 2021: 328). As research grows more reliant on digital data as computers and networks proliferate, universities worldwide increasingly emphasise the need for efficient data management and stewardship to underpin the changing research environment (Henty et al., 2008: 1). RDM is still in the development stage in Africa because many African countries have not yet adopted RDM practices on a national level (Chiware & Becker, 2018: 1). This study investigated the RDM practices used by Masters and Doctoral students at a Higher Education Institution (HEI) in the Western Cape, South Africa. The Masters and Doctoral students in this study will be referred to as emerging researchers. Additional input to the study was provided by librarians, who are members of the RDM stakeholder community. The institution at which this research was conducted requested to remain anonymous.

1.2 Background to the study

According to Tenopir et al., (2011: 1), data is the foundation of scientific endeavours, playing a crucial role in making informed scientific decisions, managing resources wisely, and facilitating sound decision-making processes. High-quality data is particularly essential for these purposes. The term 'data' is most commonly used to refer to records or recordings encoded for use in computers and also refers to statistical observations and other recordings or collections of evidence (Zins, 2007: 480). Data is "a collection of symbols that signify real-world system states and are brought together because they are considered relevant to some purposeful activity" (Shanks & Corbitt, 1999: 787). According to Borgman (2012: 1061), "data are facts, numbers, letters, and symbols that describe an object, idea, condition, situation, or other factors".

There are numerous methods for generating research data for various goals and through multiple processes such as observation and experimentation. Still, technological advancement allows most research data to be accessed in digital formats (Borgman, 2012). Data can be found in different forms, such as spreadsheets, experimental results, databases, works of art, pictures, and sketchbooks (Wootton, 2007). Some data types have immediate and long-term value; others gain value over time, while others are more difficult to recreate than curate (Borgman, 2012: 1062). Data becomes information when processed into a meaningful form for the recipient (Zins, 2007: 486). There is compelling evidence that data-driven decision-making can significantly improve business performance (Provost & Fawcett, 2013: 58).

The view that data should be open arose from a critique of how governments handled data and a bold vision of a future in which everyone has equal access and the ability to profit from data (Perini et al.,2019: 4). The commonly accepted definition of open data is that it is data which is "freely available, machine-readable, and free of licensing restrictions on reuse" (Perini et al., 2019: 8). In conclusion, this section highlights the foundational role of data in scientific endeavours, highlighting its diverse forms and the importance of high-quality data for informed decision-making. The integration of robust RDM practices is imperative for maintaining the credibility of research outcomes and fostering a culture of data-driven decision-making in the scientific community (Marlina, Nizar & Purwandari, 2022).

1.2.1 Research data management

RDM is defined as ''the organisation of data, from its entry to the research cycle through to the dissemination and archiving of valuable results'' (Cox et al., 2017: 2). RDM "consists of a number of different activities and processes associated with the data lifecycle, involving the design and creation of data, storage, security, preservation, retrieval, sharing, and reuse, all taking into account technical capabilities, ethical considerations, legal issues and governance frameworks" (Cox & Pinfield, 2014). According to Nwabugwu and Godwin (2020: 4), RDM is consuming, storing, organising, and preserving data generated and gathered by an organisation. They further elaborate that the care and preservation of data generated throughout a study cycle are referred to as RDM (Nwabugwu & Godwin, 2020: 5).

1.2.2 Importance of RDM

RDM is becoming increasingly important for global companies, institutions, funders, governments, and legislation (Nwabugwu & Godwin, 2020). In addition, Nwabugwu and Godwin (2020: 2) suggest that RDM activities ensure that research data has long-term value

and utility for new analyses and replication of study findings. According to Tenopir et al. (2011), RDM makes communication easier and keeps researchers' activities aligned and coordinated in contexts where collaboration between project members is crucial. Good RDM allows for verifying findings and new research based on current data (Nwabugwu & Godwin, 2020: 2). Nwabugwu and Godwin (2020) highlight the multifaceted role of RDM in research, emphasising its pivotal contribution to elevating the overall quality and efficiency of the research process

Data management is critical in research because data is a valuable resource that takes time and money to produce (Corti et al.,2014). Researchers' utilisation of RDM practices is integral for ensuring compliance with grant application requirements (Flores et al.,2014: 84). Nwabugwu and Godwin (2020: 5) highlight that data sharing improves the assessment of research findings, validates research techniques, avoids duplication of data gathering, increases research visibility, and fosters cooperation. When researchers practice RDM, they make their data accessible to others, enabling verification of their findings and providing a foundation for further exploration and expanding published results (Nwabugwu & Godwin, 2020). This approach promotes transparency, reproducibility, and collaboration in the scientific process, as others can scrutinise, build upon, and potentially validate the outcomes of the original research.

1.2.3 RDM stakeholders and services

Governments and funding agencies, university leadership, research support units, and researchers are the four primary RDM stakeholders (Tenopir et al., 2013; Pinfield, Cox & Smith, 2014). These stakeholders' collaborative and coordinated work is essential for effective RDM (Nwabugwu & Godwin, 2020: 7).

Funding organisations are increasingly requesting that researchers make their data available and requiring them to develop and implement a Data Management Plan (DMP), which is a formal document that explains how data will be managed during and after a research project (Nwabugwu & Godwin, 2020: 5). In many developed countries, funding agencies have enforced mandates and advocated for national data retention legislative instruments and frameworks for responsible research conduct for around two decades (Bunkar & Bhatt, 2020: 2). In response to funder mandates, university leadership have had to adopt policies and research tools to ensure researchers adhere to specific RDM requirements (Nwabugwu & Godwin, 2020).

The involvement in RDM of research support units sometimes requires support staff to take on a new or adjusted job (Ohaji, Chawner & Yoong, 2019). According to Ohaji et al. (2019), there are three main aspects to this support role: helping create data, connecting different groups, and taking care of data over time. Lewis (2010) highlighted the RDM functions that could be carried out by university librarians. In 2019, Ohaji et al. (2019) proposed that the RDM pyramid (Figure 1.1) includes a foundational layer indicating the connection between RDM functions and five stakeholders who can play a role in providing support to the researchers during the data collection and access management.

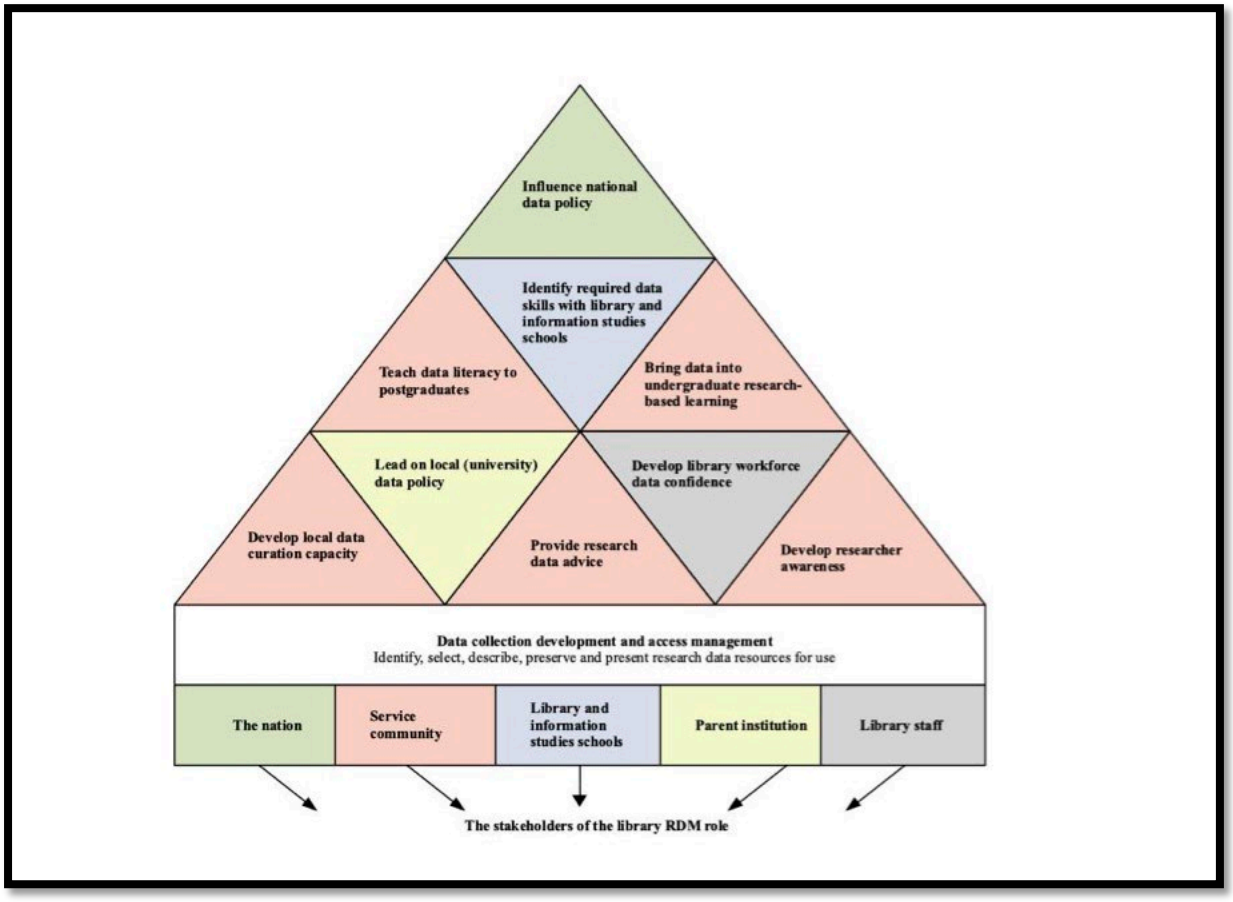

Figure 1.1: Research data management for libraries (Ohaji et al., 2019)

According to Ohaji et al. (2019), library staff and specific academic libraries are modifying their current research support framework to accommodate RDM.

RDM encompasses the entire data lifecycle, from data planning and collection to analysis, preservation, and eventual dissemination (Ashiq, Usmani & Naeem, 2022). As RDM stakeholders, adopting robust RDM practices to their research practices is critical for researchers to harness the full potential of data-driven discoveries while addressing issues

related to data security, privacy, and accessibility (Briney, Coates & Goben, 2020). Furthermore, Briney et al. (2020) underscore that effective data management can simplify researchers' data analysis, visualisation, and reporting, making publication less stressful and time-consuming.

1.2.4 The current state of RDM at the research site

Chiware and Becker (2018) emphasise the necessity of RDM policies to help librarians assist researchers. According to Mthembu and Ocholla (2022), there are a number South African universities, including the one at which this research was conducted, which have adopted RDM policies while some others have instead established procedural guidelines rather than formal RDM policies.

The institution at which this research was conducted showed commitment to RDM, as evidenced by its developed RDM policy framework as well as its creation of specialised support services (HEI, 2021b). The RDM policy recognises the value of research data and pledges to a global standard that ensures open access (OA) and it emphasises that good data management strives to maintain integrity, adhere to ethical norms, and enhance accessibility (HEI, 2021b). The host institution has established an institutional repository (IR) where researchers can publish and share their datasets (HEI, 2024). The IR gives free, open access for others to examine and download their research, as well as the ability to share any form of data and preview various file types in a browser.

1.3 Problem statement

The host institution has developed an RDM policy and built RDM infrastructure and services, but there is no formal evidence that researchers apply good RDM practices. It is unknown how far RDM practices have advanced at the host institution. If academic researchers do not practice good RDM, the negative impact will lead to data loss, and the institution will also risk not adhering to worldwide norms and funder requirements concerning data management (Tenopir et al., 2011). Adopting appropriate RDM practices is becoming more vital for research teams. Despite the research community's efforts to identify optimum data management standards, many research teams struggle to implement them (Tenopir et al., 2011). Understanding existing practices enables institutions to identify gaps, difficulties, and possibilities for RDM (Llebot & Rempel, 2021: 3). Llebot and Rempel (2021) also suggest that understanding the elements that influence research group behaviour and desire to adopt new behaviours might help librarians (part of the RDM stakeholder group) more effectively encourage RDM adoption. The host institution has already developed the RDM infrastructure

and policies. Tenopir (2011: 3) mentions that if policies are already in place, the researchers might comply.

Overall, a systematic inquiry into the current RDM practices and influencing factors can serve as a foundational step toward fostering a culture of responsible and effective data stewardship within the academic community.

1.4 Aim and objectives of the study

This study aimed to investigate emerging researchers' RDM practices and related influencing factors at a HEI in the Western Cape, South Africa. The research assumes that before an institution can influence RDM practices positively, current practices, available resources, and needs must be understood. The investigation will consider various factors that influence the practice of good RDM among emerging researchers, including the roles of RDM stakeholders. In this study, Masters and Doctoral students are referred to as "emerging researchers" because they have not yet established themselves as researchers (Newlin, Munienge & Jabulani, 2019).

1.5 Research questions

The following research questions were posed to achieve the research objective:

1) What RDM practices are employed by emerging researchers in the HEI in the Western Cape, South Africa?
2) What are the factors that influence these researchers' RDM practices, and how do they relate to the RDM environment at the institution?
3) What challenges do emerging researchers face in adopting good RDM practices?

1.6 Significance of the study

This study holds significance for academia, particularly in southern Africa, by advancing our understanding of RDM practices among emerging researchers. It contributes to the academic knowledge base by addressing some of southern Africa's unique challenges and considerations. The findings could contribute towards informing the development of contextually relevant policies and practices and contribute to capacity building for regional researchers. Therefore, this study will contribute to the broader scholarly discourse on RDM, enabling universities to benchmark their practices against industry standards and emerging trends.

1.7 Overview of the theoretical framework

Theories provide academics with 'lenses' through which to view complex problems and societal challenges. They draw attention to distinct parts of the data in a study and give a framework for examination (Scott & Davis, 2015). To achieve the study's goal of investigating the RDM practices of emerging researchers and understanding influencing factors, Activity theory (AT) was chosen as the underlying theoretical framework for the research. AT was chosen because it aids in understanding how users engage with objects in different settings (Engeström, 1999).

AT provides a holistic perspective on activities, considering the social, cultural, and technological aspects that shape individuals' engagement in activities (Engeström, 2001). According to Hasan and Kazlauskas (2014: 9), "Activity Theory is all about who is doing what, why and how." When applied to RDM practices, the theory can be used to explore how various elements, including institutional policies, collaborative practices, and technological tools, influence researchers' activities related to RDM adoption. There are six components to AT (Figure 1.2): subject/subjects, object, tools, rules, community, and division of labour. These will be explored in detail in the literature review.

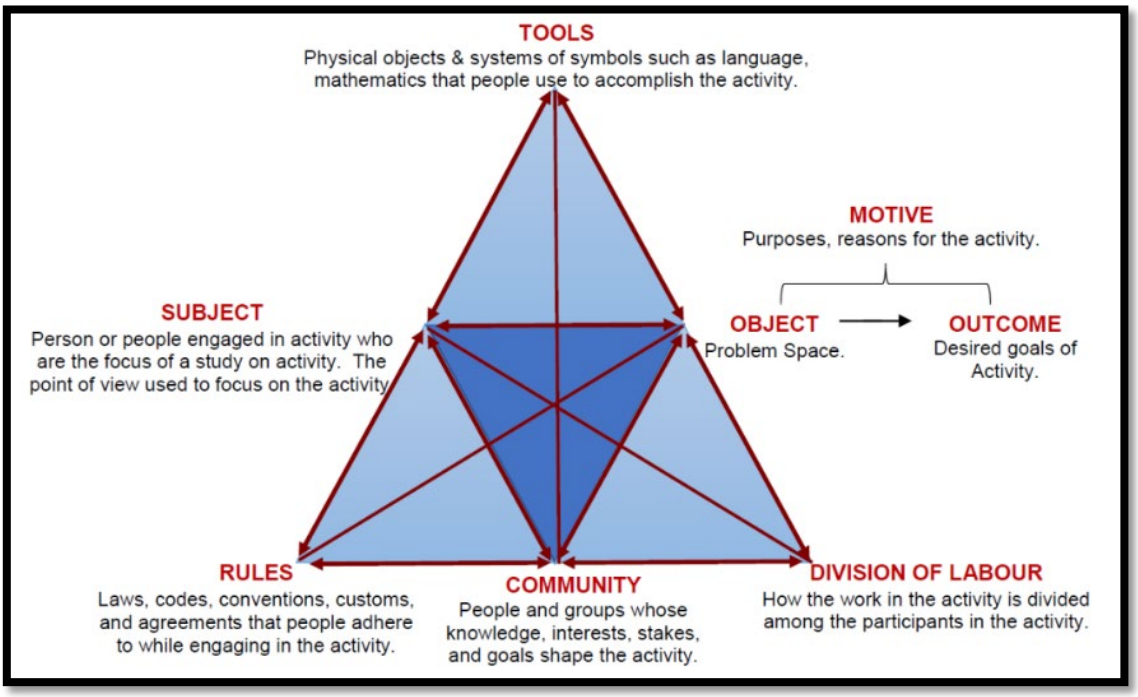

Figure 1.2: Activity theory model (Engeström, 2015: 63)

By examining these interconnected elements, the study aims to understand the factors shaping RDM practices within the academic setting.

Within AT, the central aspect of an activity as seen in Figure 1.2 above, is the connection between the subject (the human participant) and the object (the task or activity being undertaken) (Hasan & Kazlauskas, 2014). The "subject" is the person or group doing the activity and includes their reasons or motivations for doing it and the object is the goal or focus (Hasan & Kazlauskas, 2014: 9). According to Kain and Wardle (2014: 4), "The Subject(s) use Tools to accomplish their Object(ives) and achieve their intended Outcomes".

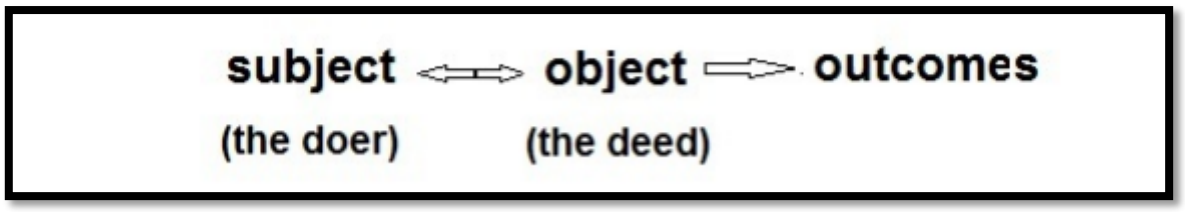

Figure 1.3: The core of an activity (Hasan & Kazlauskas, 2014: 9)

Engström defines the social base of the activity system as rules, community, and division of labour, which sets the activity in a broader context and allows us to account for the variables that it comprises (Kain & Wardle, 2014). As shown in Figure 1.3, the activity starts from the doer and mover towards an object where an outcome can be seen.

1.8 Overview of the research methodology

The study is grounded in the interpretive paradigm to delve into RDM practices and influences among emerging researchers. The use of an inductive qualitative research method in this study followed a case study design focusing on emerging researchers, with input from librarians as RDM stakeholders. Convenience and purposive sampling were employed to select participants, ensuring relevance and insight. Data were collected through semi-structured interviews; document analysis was used for complementary data collection. Thematic analysis was applied to interpret the gathered data systematically. See Appendix E for document analysis checklist.

1.9 Delimitations of the study

This study is delimited in several ways to provide a focused and manageable investigation into RDM practices within HEI. Firstly, the research confines its scope exclusively to one HEI, thereby limiting the generalisability of findings to other academic institutions. Additionally, the study intentionally narrowed its focus to Masters and Doctoral students (emerging researchers), excluding undergraduate students, and established researchers and potentially overlooking differences in RDM practices across various academic levels. The

choice of librarians as the primary example of RDM stakeholders further delimits the study. Geographically, the study is delimited to the Western Cape, South Africa, restricting conclusions' applicability to institutions in different regions or countries. The qualitative research approach adopted, relying on semi-structured interviews and document analysis, contributes to the depth of insights but limits the study's generalisability compared to quantitative methodologies. Lastly, the study employs a relatively small sample size of 14 Master's and Doctoral students and three RDM stakeholders, which constrains the extent to which findings can be extrapolated to a broader population. These delimitations are strategic decisions made to refine the study's focus and enhance the precision of its outcomes within the specified contextual boundaries.

1.10 Ethical considerations

The study secured ethics clearance from the University of Cape Town (UCT) (where the study is registered) and obtained permission from the study site to collect data from emerging researchers and librarians. All participants were fully informed about the study and signed consent forms before participating. In Chapter 3, further details about ethical considerations are discussed.

1.11 Outline of the report

This study is organized into five distinct chapters, each detailed as follows:

Chapter One: Introduction and Background. This section delves into the study's introductory aspects, encompassing the research problem, objectives, research questions, significance, an overview of research methodology, and the delimitation of the study.

Chapter Two: Theoretical Framework and Literature Review. This chapter explores the theoretical framework guiding research question two of the study and reviews previous literature relevant to the investigated topic.

Chapter Three: Research Design and Methodology. This chapter details the research approach, design, and methods used for data collection, including details on the data gathering process, population, sampling procedures, techniques, ethical considerations, and study limitations.

Chapter Four: Data Analysis and Results. This section involves the presentation and analysis of the collected research data.

Chapter Five: Discussion and Findings. This section presents the findings, recommendations, future studies and summary and conclusions.

1.12 Chapter summary

This chapter introduced the importance of RDM in higher education, emphasising its role in advancing research. The background discussed the foundational role of data in scientific endeavours, introduced open data and defined RDM. The problem statement highlighted the gap between existing RDM infrastructure and evidence of its application. The aim was to understand current RDM practices and influencing factors among emerging researchers, guided by specific research questions. The significance lies in contributing to academia in southern Africa, informing policies, methodologies, and capacity building. The theoretical framework of AT was introduced, and the research design, methodology, delimitations, and ethical considerations were outlined.

CHAPTER 2:
LITERATURE REVIEW

2.1 Introduction

This literature review aims to comprehensively examine previous studies related to the current research, as outlined by Creswell and Creswell (2018: 32). The review focuses on the key themes and concepts relevant to the research questions. Specifically, the literature review pertains to RDM that is adopted by researchers and the different factors that affect the adoption of RDM practices. The literature will also show the developments made in RDM and its adoption by researchers. Additionally, the literature has described the stages of the research life cycle, which speaks to practices, and identified the factors that motivate and discourage researchers from implementing good RDM practices. It is important to note that the rate of RDM adoption varies globally and even at the university level. The review aims to identify key factors influencing RDM adoption and challenges faced by emerging researchers in adopting RDM practices. The chapter begins with an outline of the theoretical framework employed in the current study.

2.2 Theoretical framework: Activity theory

A theoretical framework is a set of concepts and theories that provide a foundation for understanding a research problem and guiding a study (Creswell & Creswell, 2018). Theories provide researchers with lenses to see complex problems and societal concerns, concentrating their attention on various parts of the data and offering a framework for their investigation (Reeves et al., 2008: 631). The fundamental goal of theory is to answer how, when, and why researchers or society behave (Bell & Waters, 2014). The theoretical framework helps to organise the research by providing a structure for the study, and it also helps to identify the key variables and relationships that will be explored (Grant & Osanloo, 2014). Choosing a theory provides a shared perspective to analyse evidence and think about the problem at hand (Grant & Osanloo, 2014: 15). The theoretical framework in this study is to assist the researcher in identifying the factors that influence researchers' RDM practices and understand how they relate to RDM environment at the institution.

AT, often known as cultural-historical activity theory (CHAT), is a framework founded on the work of Russian psychologist Lev Vygotsky and associates (Nickerson, 2023). AT offers a comprehensive and dynamic approach to studying human behaviour and cognition in a sociocultural setting (Bedny & Harris, 2005). AT has evolved and is now used in a variety of

domains, including psychology, education, human-computer interaction, and organizational studies (Hasan & Kazlauskas, 2014).

AT is a psychological and sociological theory that focuses on human activity as a holistic and dynamic system (Engeström, 2001). It is used to understand and analyse how people engage in activities and relate to their social and cultural contexts. According to Engeström (1999), AT is a holistic approach to human activity, considering the activity system and the historical and cultural context in which it is situated.

Bedny and Harris (2005: 130) define activity as "a goal-directed system, where cognition, behaviour, and motivation are integrated and organised by a self-regulation mechanism toward achieving a conscious goal". Therefore, AT is built on the premise that an activity needs to occur, external factors shape the activity's direction, and the outcome depends on the interaction of the entire activity system. The core subsets that make the activity system are subject, tool, object, rules, community and division of labour (Hashim & Jones, 2007: 7).

2.2.1 Subject

Bedny and Harris (2005) describe a subject as a person who participates in an activity, either alone or in a group and has different roles in transforming and applying materials and information. According to Tiko (2022: 56), a subject includes the technical and non-technical entities involved in the operation of an activity. The subject is understood as a product and a producer of the action (Engeström, 2001). It is also seen as having a dialectical connection with the activity system's instruments, regulations, and division of labour (Engeström, 1999). These elements shape and are shaped by the subject.

For this study the emerging researchers are the 'subjects' within the activity system. The emerging researchers are motivated by the desire to achieve good RDM practices (object) and the implementation of good RDM practices may or may not be influenced by tools (such as RDM infrastructure and services), rules (such as policies), and the research community that shares the same object of good RDM practice but has different roles to play (division of labour).

2.2.2 Object

In AT, 'object' is defined as a tangible material, product or idea that can be shared by individuals taking part in an activity (Tiko, 2022: 56). According to Murphy andRodriguez-Manzanares (2008: 443), object "refers to the raw material or problem space at which the

activity is directed and which is moulded or transformed into *outcomes* with the help of physical and symbolic, external and internal tools". According to Hasan and Kazlauskas (2014), the object of activity includes the activity's focus and purpose. Therefore, an "object" refers to the goal or purpose of an activity. It is the thing that the activity is directed towards and can be either material or mental. An activity's outcomes can be intended, but there may also be unintended consequences. Many researchers have interpreted the term object as synonymous with objectives (Bedny & Harris, 2005: 131). In the context of the research topic, the emerging researchers' objective is to adopt RDM practices, which will translate into applying good RDM practices.

2.2.3 Tools

According to Tiko (2022: 56), tools mediate the object in an activity network, and the subjects use the tools to achieve the desired outcome. O'Leary (2010) believes that the subject generates outcomes by using the tool, and the outcomes are produced within the context of a community with its corresponding rules and division of labour. Depending on the level of detail in the analysis, tools may include decision support systems, analytical models, databases, scanners, and even spreadsheets (O'Leary, 2010: 344). Therefore, the tools an individual uses can significantly impact their engagement in an activity and shape their understanding of the task. In AT, tools mediate between the subject and the object of activity, allowing the subject to interact with and transform the object (Iyamu & Shaanika, 2019).

Llebot and Rempel (2021: 3) assert that RDM is a skill researchers must have and that many organisations provide Research Data Management Services (RDMS). Perrier and Barnes (2018: 3) opine that "Drivers for developing research data management services vary from institution to institution and in different national contexts." Pinfield et al. (2014) highlighted many motivators for RDMS, including storage, security, preservation, compliance, quality, sharing, and jurisdiction.

The development of RDMS in research institutions has been driven by the need to write data management plans and make data accessible to the public. RDM infrastructure and services influence the researcher's behaviour (Avuglah, 2016). In this study, RDM infrastructure and services such as data analysis tools/software and the institutional data repository can affect the adoption of RDM practices and are the 'tools' in the activity network.

2.2.4 Community

Murphy and Rodriguez-Manzanares (2008: 443) define community as "the participants of an activity system who share the same object". A "community" is a group of people who share a common goal or activity (Engeström, 2001). Individuals within the community engage in activities together and collectively shape the development of the activity. Community is an essential concept in AT as it helps to explain how individuals and groups engage in activities together and how their collective efforts shape the activity and their shared understanding of it (Miettinen, 1999). Furthermore, the community is a location for meaningful negotiation and developing shared understandings and practices (Kaptelinin & Nardi, 2006). According to Llebot and Rempel (2021), social interactions among members of a research team are an important factor in determining whether a research group will successfully adopt best practices in data management. The participants involved in adopting and applying RDM practices, including researchers, library and other support staff, university management and funders, are considered a community in this study. In the study context, the focus was on the emerging researchers and on librarians who often interact with emerging researchers.

2.2.5 Division of labour

Murphy and Rodriguez-Manzanares (2008: 443) define the division of labour as assigning duties and responsibilities to community members and distributing authority and status. O'Leary (2010) opines that division of labour refers to cooperation and specialisation in an activity. He further argues that division of labour can refer to balancing activities and parts of activities among different people and artefacts (O'Leary, 2010).

The hierarchical structure of organisations that support the activities is called the division of labour. In RDM practices, emerging researchers, library and other support staff, university management and funders have different roles.

2.2.6 Rules

Murphy and Rodriguez-Manzanares (2008: 344) state that "rules are explicit and implicit norms that govern system actions and interactions". According to Tiko (2022: 57), "rules govern subjects as they carry out their activities and interactions with other components of the community". He further argues that rules maintain order in communities, and achieving objectives becomes challenging if rules are not in place (Tiko, 2022). Generally, any group in the community can contribute to forming rules (O'Leary, 2010: 344). Rules can include formal rules, such as laws and regulations, and informal rules, such as social customs and

conventions (O'Leary, 2010). These rules shape the way people interact with one another, the way they approach tasks and goals, and the way they understand and make sense of the world around them (Miettinen, 1999).

In the RDM context, rules include the policies that research organisations and funders put in place for researchers to ensure compliance regarding how the data is handled. Policies include developing DMPs describing the research project's data life cycle from the research's beginning until dissemination. Disciplinary research practices can also be viewed as rules because they shape the activities of the research community within a specific discipline and provide a framework for conducting research consistently and reliably (Denzin & Lincoln, 2008; Denzin & Lincoln, 2018). These rules are frequently established through consensus building among community members and are intended to ensure that research is rigorous and ethical (Miettinen, 1999). They also help define the discipline's boundaries and the types of questions deemed essential or worthy of investigation. When RDM policies and mandates lag in the country, that impedes the overall process and procedure of providing RDM services and practices in libraries more effectively (Al-Jaradat, 2021: 7).

2.3 AT application in research

2.3.1 Studies where AT was used

According to Hashim and Jones (2007: 10), AT has been applied in psychology, management and information systems studies. One of the primary reasons for the application of AT in information systems research is that it provides a well-developed framework for analysing the complex dynamics of the investigated settings (Crawford & Hasan, 2006: 9). AT has not been widely used in RDM studies.

AT has evolved into a versatile framework for academics from a variety of fields to better comprehend human activity and its complex interactions with social, cultural, and technical environments (Allen, Karanasios & Slavova, 2011). Barhoumi (2015) conducted a study that explored the effectiveness of using mobile technologies, specifically WhatsApp mobile learning activities guided by AT, in supporting a blended learning course on scientific research methods in Information Science. The study used AT as a framework to guide the development of WhatsApp mobile learning activities and assess their impact on students' knowledge management. The study used an experimental research design to assess the impact of blended learning activities that combined in-class and WhatsApp activities vs a typical classroom learning strategy (Barhoumi, 2015). The findings revealed that using WhatsApp in

a blended course plan facilitated online discussions, collaboration, and the sharing of information and knowledge between students (Barhoumi, 2015).

The studies that were done in Information Systems include the paper that investigated and explained techniques for applying AT to Human-Computer Interaction (HCI) design (Mwanza & Bertelsen, 2003). This study described the feasibility and practical implications of employing AT in HCI design, with the objective of shaping future research agendas and establishing AT-based approaches for HCI design (Mwanza & Bertelsen, 2003). AT in this study is used as a conceptual framework used in human-computer interaction and related disciplines to conceptualize user and contextual viewpoints during system design. The study employed a workshop-based approach, with the workshop serving to allow a collective examination of AT approaches based on the perspectives and experiences of participants from various communities. The study indicated that, while AT is a well-known conceptual framework in HCI and related fields, there is a scarcity of operational approaches and techniques that may be readily utilized in HCI design (Mwanza & Bertelsen, 2003).

Also, Lin, Chaboyer, Walllis and Miller (2013) conducted a study investigating factors contributing to the intensive care patient discharge process in healthcare. The study sought to better understand the workload tasks of admissions, discharges, and transfers in the intensive care unit, as well as the factors that influence the patient discharge process. In this study, Lin et al. (2013) used AT to examine how different factors and actors interact to shape the process of discharging patients from intensive care unit. AT in this study offered a theoretical framework for the ethnographic research of intensive care unit patient discharge (Lin et al., 2013). By applying AT, the study was able to analyse the handover process during patient discharge, considering the activities, tools, and social factors involved.

Bligh and Flood (2017) explored the use of AT in empirical research in higher education. AT was used as a framework for understanding human behaviour and social systems that emphasises the role of activity, or the collective human effort to achieve goals, in shaping human experience (Bligh & Flood, 2017). The themes of this study include exploring the ramifications of AT in the development and execution of educational policies and practices within higher education and examining the application of AT to comprehend the influence of technology on teaching and learning practices in higher education; Investigating how AT can be applied to grasp the impact of technology on teaching and learning practices in higher education (Bligh & Flood, 2017). The study explored how AT holds the potential to offer

insights into the intricate processes of learning, teaching, and knowledge production within higher education (Bligh & Flood, 2017). The theory was used to abstract and explain the phenomena under study, providing a framework for understanding the relationships and interactions between different elements. Scanlon and Issroff (2005) used AT as a theoretical framework to better understand the interaction of components involved in the evaluation of learning technologies. The researchers underlined the need for a broader set of evaluation criteria, as well as the interplay between rules, community, and division of work within learning scenarios. The researcher also considered how students' views of efficiency and awareness of divisions of labour affected the introduction and use of learning technology. The study demonstrated that AT can produce more meaningful interpretations of data for summative purposes in the evaluation of learning technology (Scanlon & Issroff, 2005).

Furthermore, Scanlon and Issroff (2005) contended that AT provides a useful perspective for understanding the complicated relationships between technology, learners, and learning settings in higher education. Their research focused on determining the efficacy of various learning tools and the elements that contribute to successful technology-enhanced learning in higher education. The investigation focused on key themes such as collaboration and interconnected relationships among stakeholders (students, instructors, and technology developers) in higher education, the impact of social and cultural contexts on shaping learning technologies, and the processes and mechanisms by which learning technologies support or hinder learning outcomes in higher education.

These studies revealed that effective collaboration is affected by various elements, including team members' shared goals and values, the availability of shared information and communication technologies, and team members' capacity to coordinate their actions and work effectively. In conclusion, these studies showed that AT is adaptable and effective at guiding research in a variety of domains. From education to technology design and healthcare, AT has proven useful in evaluating human behaviours within complex socio-cultural and technological systems, enriching our understanding of these fields and laying the groundwork for future research and practical applications. Collectively, these studies underscore the beneficial role of AT in offering theoretical frameworks for understanding, analysing, and improving various aspects of human activities across diverse disciplines.

2.3.2 AT application in this study

As a theoretical framework, AT is appropriate for this study because the theory can guide the investigation on how subjects (emerging researchers) interact with tools (RDMS) to achieve an outcome and how the rules (e.g. policies) and the community (higher learning institutions, research organisations, etc.) influence the activity system.

Tools and rules mediate researchers' application of RDM practices to achieve good RDM. The subject is the agent who acts on the activity's object, and the object is the product of the activity. The community component considers the people and groups whose knowledge and interests shape the activity's goals. Rules (such as RDM policies) mediate the connection between researcher and community, whereas the division of labour mediates the relationship between object and community (Hashim & Jones, 2007).

2.4 Review of the literature: RDM practices, influences on adoption, services, and challenges

RDM is essential in research since it allows for more efficient research operations and collaboration with others (Frederick, 2019: 4). RDM is concerned with processing and organising data throughout the research lifecycle to store, discover, and reproduce results correctly. It also entails making decisions concerning data preservation and sharing after the project is over (Tenopir et al., 2011). Scholars argue that academic libraries, given their expertise and extensive connections with various stakeholders, are rightly positioned to fulfil a crucial role in RDM (Jackson, 2018). Conversely, the progression of researchers in handling growing data volumes is impeded by limitations in storage infrastructure. Metadata expertise is critical in data management's curation and retrieval elements (Frederick, 2019). Tenopir et al. (2011) allude that effective RDM methods may improve research transparency and reproducibility, enhance data sharing and cooperation, and raise the likelihood of data re-use in the future.

Researchers are crucial in adopting and implementing RDM practices within their research projects. Several studies have underlined the necessity of researcher buy-in for successful RDM deployment. Tenopir et al. (2011) are of the opinion that researcher attitudes and views of RDM strongly predict whether or not researchers engage in RDM activities. They further state that researchers' opinions of the usefulness of RDM techniques are related to the extent of RDM implementation.

This section reviews past studies on RDM, particularly those pertaining to RDM practices and factors that impact adopting RDM practices.

2.4.1 RDM practices

This section will highlight the good RDM practices in line with some of the RDM literature. Good RDM begins with a DMP and includes several activities during and after the research project. The creation and execution of a DMP is an important step for researchers to meet the expectations of research funders and ensure good data management throughout the project (Darlington & Ball, 2012: 5). According to DataONE (Strasser, Cook, Michener, Budden & Koskela, 2011), the DMP should be developed during the proposal stage, and the following practices should be considered when developing a DMP:

- Clearly defining the purpose and scope aligned with project goals.
- Assigning roles and responsibilities for the project team.
- Specifying data management requirements, including collection, storage, organization, documentation, and sharing.
- Developing a strategy for data security, privacy, and ethical considerations.
- Implementing data quality control measures and validation protocols.
- Creating a plan for data preservation and long-term access with considerations for formats, metadata, and archiving.
- Outlining data sharing practices, including licensing, citation, and access policies.
- Providing training and support for project team members to ensure DMP adherence.

This approach ensures data readiness, accessibility, and preservation throughout the research lifecycle (Strasser et al., 2011). Bishop et al. (2023) provide an in-depth insight into DMPs, and recommended strategies for enhancing data management, including engaging librarians and information professionals as embedded data assistants and advocating for funders to offer more comprehensive guidance on DMPs.

Effective data organization and documentation are components of successful RDM practices, and Yung, Colyvas and Hwang (2023) show that utilizing consistent file naming conventions, descriptive metadata, and extensive documentation improves data accessibility and understanding. DataONE's lifecycle outlines best practices for managing data. Researchers are encouraged to define data contents clearly, maintain consistent organization, utilize stable file structures and formats, and assign descriptive file names (Strasser et al., 2011: 130). DataONE also encourages researchers to adopt quality assurance measures, such as statistical

summaries. When managing data during the data life cycle, descriptive data set titles, comprehensive documentation, and metadata generation in a standard format are crucial for future usability (Strasser et al., 2011).

Implementing strong data management techniques becomes critical in limiting risks and guaranteeing the confidentiality of sensitive information in a variety of scenarios, as revealed by their thorough study. According to Darlington and Ball (2012), both loss prevention and secrecy require adequate storage and access provisions. Darlington and Ball (2012: 14) further note that the location and the identities of all storage spaces must be identified in general in the project DMP. Strasser (2015: 5) suggests that researchers should construct a complete data backup plan that includes hardware, software, backup frequency, accountable parties, storage characteristics, and contingency procedures for data loss.

Another guide to best practice in RDM are the FAIR principles for making scientific data findable, accessible, interoperable, and reusable. These principles were established to help ensure that data is accessible for humans and computers to access, comprehend, and use (Jacobsen, de Miranda Azevedo, Juty, Batista, Coles, Cornet, Courtot & Crosas, 2020). Jacobsen et al. (2020) elaborated on the meaning of the FAIR acronym:

- Findable: Data should be easily found through search engines, catalogues, and other discovery tools. It should be adequately described with metadata and have persistent identifiers to ensure it can be easily located.
- Accessible: Data should be available in a format that can be easily accessed, read, and understood by both humans and machines. Accessibility includes providing documentation and other information that helps users understand the data.
- Interoperable: Data should be formatted to integrate easily with other data sources and tools. Interoperability includes using open and widely used standards for data representation and communication.
- Reusable: Data should be made available under an open license and with minimal restrictions to allow for its reuse in various contexts. Reusability includes providing documentation and other information that helps users understand the data and how it can be used (Jacobsen et al., 2020).

Goldman, Muilenburg, Schorr, Ossom-Williamson and Uribe-Lacy (2023) suggest that leveraging the expertise of librarians and data professionals in understanding RDM policies,

tools, and best practices can significantly improve data management practices. RDM benefits all researchers, and graduate students are an essential audience for learning appropriate data management practices. However, these students often have limited access to RDM training despite its value (Xu et al., 2022). Xu et al. (2022) conducted a study to address fundamental data management skills. The study specifically emphasised integrating data information literacy (IL) competencies customised to meet the unique needs of graduate students at various stages of the data life cycle. Notably, the feedback underscored a notable enhancement in participants' knowledge and skills pertaining to data management because of the study's focus on tailored IL competencies.

The library is involved in facilitating the teaching of IL, and they have incorporated RDM topics in the IL curriculum (Carlson & Johnston, 2015). IL is defined as a knowledge and set of skills that enable people to recognize when information is required and to access, assess, and successfully use that information (Saranto & Hovenga, 2004: 504). According to Baro (2011: 202), IL is a crucial skill for undergraduate students due to the increasing value of information, the need for lifelong learning, and recognising its role in effective learning in higher education. Integrating RDM into IL enables researchers to gain the skills required to properly manage and deal with research data, such as data organization, documenting, sharing, and preservation (Carlson & Johnston, 2015). Research suggests a lack of IL is caused by underutilization of ICTs and information resources (Baro, 2011). Baro (2011: 203) further states that in Africa, students at all levels of education lack familiarity with diverse information sources and library services, unlike in affluent countries where IL is widely integrated into the curriculum.

2.4.2 Influences on RDM adoption

The availability of resources and support has been noted as an essential element impacting researcher adoption of RDM procedures. According to a study by Bishop and Grubesic (2016), researchers with access to specific RDM assistance and resources were likelier to engage in RDM practices. Chiware and Mathe (2015) report that researchers who were trained in RDM practices are likely to adopt RDM practices. Therefore, researchers' attitudes, beliefs, and training are essential determinants in accepting RDM practices.

Formal institutional RDM policies contribute to the relationship between funders and funding recipients, potentially influencing the implementation of RDM in the future (Higman & Pinfield, 2015). Haythornwaite, Nair, Weaver, Gacenga, Missingham, Ross, Burton and

Winton (2023) believe that a research data policy is a document that ensures research data is managed by following legal, ethical, publishing, and funding body standards. The policy protects against wrongdoing, such as data fabrication and falsification (Haythornwaite et al., 2023). Haythornwaite et al. (2023: 41) suggest that RDM policy should be integrated into a comprehensive framework that includes various documents such as intellectual property policies, employment agreements, and those implementing legislative requirements. An institution's decision regarding an RDM policy should involve careful consideration of regulatory, legal, funder and publisher requirements to ensure the development of a policy that aligns with the institution's specific needs and requirements (Haythornwaite et al., 2023). Policies in RDM exist at many levels, each addressing a distinct aspect of data management. The following are the critical levels of RDM policies:

1) Government: Level Policies: These are overarching policies mandated by government bodies or regulatory authorities. They often set broader standards for data management practices, addressing data privacy, security, and accessibility (Higman & Pinfield, 2015).
2) Funder Policies: Funding agencies have enforced regulations and pushed for national data retention legislation instruments and frameworks for responsible research conduct in industrialized countries (Bunkar & Bhatt, 2020: 2).
3) Institutional Policies: In response to funder regulations, the university administration has had to implement policies and research tools to guarantee that academics follow specific RDM standards (Nwabugwu & Godwin, 2020). Although institutional policies are not as significant as those of research funders, they serve as defined and accessible expressions of institutions' stances. They will likely remain essential reference points as RDM advancements continue (Higman & Pinfield, 2015).
4) Departmental Policies: At a more granular level, individual departments within an institution may have specific policies tailored to their unique administrative and disciplinary research needs. Data management procedures differ across fields because of the nature of the research and the volume and type of data gathered (Akers & Doty, 2013).

2.4.3 Research data management services

Various models have arisen within institutions to address data management, and initiatives to establish data services are led by university technology services, libraries, research offices, or departments and groups focused on data-intensive activities (Henderson & Knott, 2015).

Many universities or research libraries have redefined or expanded their position in RDM services, making librarians a significant contributor to the research process and an essential collaborator in the broader research data ecosystem (Tang & Hu, 2019: 85). The entities that are involved in the data management process have different roles.

RDMS is the term used to “refer collectively to library activities surrounding data management and archiving” (Gunia et al., 2013: 11). According to Tang and Hu (2019: 84), RDM services are characterized as providing information, consultation, training, or active involvement in data management planning and data management guidance during research. As the importance of organizing and handling research information increases, many libraries are thinking about providing additional services related to data to support the research goals of their organization (Henderson & Knott, 2015). One typical technique in designing services or policies is assessing researchers' requirements using surveys (Reichmann, Klebel, Hasani-Mavriqi & Ross-Hellauer, 2021).

Due to a growing emphasis on open data, the need for data management planning, and the potential for "big data" research endeavours, research institutions are acknowledging a rising demand to offer a broader and more specialized range of data services tailored to various stages in the research process (Gunia et al., 2013). Gunia et al. (2013) conducted a survey that examines the contextual needs associated with planning, developing, staffing, and overseeing the implementation of novel RDM services. As per Gunia et al. (2013), two broad services have surfaced. The first is research data management, integrated into the research process during the grant proposal stage. The second involves data archiving, occurring after a project to preserve data and enable online dissemination, facilitating data sharing and offering new data resources for discovery. The survey results indicate the challenges inherent in the early stages of developing new services, including issues related to initiating and promoting campus-wide coordination to address gaps and overlapping services.

Supporting good practice in RDM is difficult for HEIs, owing to the variety of research procedures and data formats across fields (Savage & Cadwallader, 2019). RDM support communities have sprung up to aid in administrating, preserving, and sharing research data (Frederick, 2019). Individuals or groups who influence or are influenced by the organization's actions and practices, such as funders, institutions, researchers, libraries, and government, are considered RDM stakeholders (Zotoo et al., 2023).

Several studies have demonstrated that RDM stakeholders may provide various services and resources to researchers, such as DMP templates, data storage options, and training on data management best practices (Tenopir, Birch & Allard, 2012; Frederick, 2019; Tang & Hu, 2019). These services are necessary for researchers to efficiently manage their data and comply with funding agency and institutional data management standards. One of the most important contributions of RDM communities is the provision of assistance and guidance to researchers in data management (Patterton, Bothma & Van Deventer, 2018). Tang and Hu (2019: 86) identified the critical stakeholders in data management: Libraries, IT services, academic departments, university managers, and research support services. The introduction of RDMS has been one of the most significant developments in academic library services in the recent decade (Cox et al., 2019).

Singh, Bharti and Madalli (2022) researched the current state of RDM service adoption in Indian academic libraries, including Central Universities and Institutes of National Importance. The paper emphasises that academic libraries in India lag behind industrialized countries in adopting RDM services due to a lack of RDM policy, institutional support, and technological constraints. (Singh et al., 2022). The findings of the study recommend raising awareness among decision-makers, higher authorities of academic institutions, and the government on the importance of developing a solid RDM strategy at both the institutional and national levels. Overall, the paper indicates a lack of awareness and implementation of RDMS in Indian academic libraries, emphasising the need for increased awareness and policy development in this area (Singh et al., 2022).

Hamad, Al-Fadel and Al-Soub (2021) undertook a study with the goal of exploring library staff perceptions of RDM and services in Jordanian academic libraries. The study sought to evaluate the requirements, roles, responsibilities, and challenges associated with RDM services in Jordanian academic libraries. The findings revealed a strong perspective and understanding of libraries' roles and responsibilities in RDM services, as well as the requirements and obstacles that university libraries in Jordan confront in providing these services (Hamad et al., 2021). The characteristics such as employment title, experience, and library type had no effect on the outcomes.

Therefore, the landscape of RDM within academic institutions is defined by the critical role of stakeholders in providing different and specialized services. Libraries, technology services, and research offices play critical roles, as seen by projects like RDMS. These services include

information sharing, consulting, and active participation in data management planning throughout the study process. Challenges uncovered during early service development highlight the importance of strategic planning and cooperation. RDM support communities and stakeholders, as acknowledged regionally by studies such as Singh et al. (2022) and Hamad et al. (2021), emphasise the necessity of specialized methods, policy creation, and greater awareness. These stakeholders' cumulative efforts, which include templates, storage options, and training, make a significant contribution to good research data management, highlighting a key development in academic library services. Looking ahead, the primary emphasis on services will continue critical in addressing changing researcher needs and furthering institutional goals in the dynamic field of data management. Another essential role of RDM stakeholders is the promotion of data sharing and re-use. RDM communities can play a crucial role in promoting data sharing and re-use by providing researchers with access to shared data sets, developing data sharing policies and guidelines, and providing support for data citation and data publishing (Tenopir et al., 2011; Pinfield et al., 2014).

2.4.4 Challenges in achieving good RDM practice

RDM practices are critical for guaranteeing the quality, reproducibility, and accessibility of research results (Briney et al., 2020). However, widespread adoption of these approaches across multiple fields remains difficult (Wilkinson, Dumontier, Aalbersberg, Appleton, Axton, Baak, Blomberg & Boiten, 2016a).

Several factors can affect the application of RDM practices. Contributing factors to the lack of RDM adoption include organisational culture and policies, funding, resources, data complexity and data skills and knowledge (Reichmann et al., 2021). According to Reichmann et al. (2021), most research on RDM practices is in the sciences, and many studies reveal a lack of understanding of RDM topics and institutional rules. A significant variation in data management practices, infrastructures, and approaches within and between disciplines is frequently considered a concern (Reichmann et al., 2021: 1417). One significant disadvantage of empirical research on RDM practices is that it appears to be based on an intuitive comprehension of data (Kurata, Matsubayashi & Mine, 2017). Tenopir et al. (2015: 18) also mentioned that approaches to best practices in data management across fields and organizations are complex and often contradictory and that change may take years. He also suggests questioning the effectiveness and impact of present data management rules, plans, infrastructure, and related activities (Tenopir et al., 2015).

The researcher, based on the literature review, highlighted six significant barriers to the adoption of RDM practices:

- Lack of awareness and understanding: Many researchers are unaware of the benefits of RDM best practices (Tenopir et al., 2015). A lack of awareness can lead to misunderstanding and ambiguity regarding effectively applying RDM (Pinfield et al., 2014).
- Researchers frequently struggle with limited access to proper storage facilities, data management tools, and technical assistance for RDM tasks (Subaveerapandiyan, 2023). Limited storage might make implementing and maintaining excellent data management procedures practices (Borgman, 2012).
- Competing priorities and time constraints: Researchers often face tight deadlines and competing demands on time (Bickman & Rog, 1998). RDM is already viewed as an additional load on researchers' necessary time, and incorporating RDM methods into their operations is difficult without incentives to manage the data (Wilkinson et al., 2016b).
- Insufficient incentives and rewards: The lack of a monetary incentive to share research data contributes to the challenges (Zhu, 2020). As a result, a lack of recognition and incentives may deter researchers from devoting time and effort to RDM.
- Complex ethical and legal considerations: Researchers must navigate complex ethical and legal issues related to data privacy, intellectual property, and data sharing agreements (Carroll, 2015). Understanding how copyright pertains to research data sharing is an extra effort for researchers (Carroll, 2015: 3).
- Data interoperability: Different research disciplines use various data formats and software tools (Huvila, 2022). This lack of standardization and interoperability can make sharing and reusing research data challenging (Martin et al., 2022).

Singh et al. (2022: 2) highlight the existing state of RDM services in Indian academic libraries, revealing a lack of RDM policy and guidelines adoption and implementation. The results indicate a necessity for academic libraries in India to establish robust RDM policies at both institutional and national levels, clearly outlining the responsibilities of libraries in RDM. The challenges highlighted by Singh et al. (2022) in Indian academic libraries include the absence of RDM policies at institutional and national levels, insufficient collaboration

and support, technological barriers, professionals' reluctance, limited expertise, and awareness gaps about RDM concepts.

Overall, the literature suggests that academic libraries contribute significantly to various RDM initiatives within universities, and academic library involvement in the delivery of RDMS may be a remedy for the reinforcement of the relationship between the library and researchers, which has weakened in recent decades (Andrikopoulou, Rowley & Walton, 2021). The lack of proper management impedes the application of good RDM practices (Zotoo et al., 2023) but RDM communities can effect change in this regard.

2.5 Chapter summary

This chapter provided a comprehensive literature review, primarily centred on RDM and its adoption by researchers. The literature review explored AT and its application across different disciplines. The review delved into the barriers to successful RDM practices, such as awareness, resource restrictions, time constraints, and ethical considerations. Literature related to the aspects of AT as they pertain to RDM were explored: the RDM communities and their responsibilities, RDMS, and RDM policies were explored, emphasising their responsibilities in assisting researchers and assuring data management compliance.

CHAPTER 3:
RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter provides an outline of the research methods used. It begins by explaining the chosen research paradigm and briefly comparing qualitative and quantitative methodologies and their strengths and shortcomings. Furthermore, the section describes the specific strategies used for data collection. The population under examination and the sample technique are described in depth. A description of the research instrument used to collect data is provided. Furthermore, the section discusses the data processing procedure, ethical considerations, and the study's limitations.

3.2 Research paradigm/worldview

According to Ugwu, Ekere and Onoh (2021), Thomas Kuln coined the term paradigm in 1962, defined as a philosophical mode of thinking. The theoretical or philosophical foundation for the research endeavour is referred to as the research paradigm (Khatri, 2020: 1435). Saunders et al. (2009) express a preference for employing the term 'philosophy' over 'paradigm' and define it as the researcher's worldview or assumptions guiding their research (Ugwu et al., 2021: 117). Creswell (2014a) reports that worldviews are moulded by one's discipline, the beliefs of advisers and instructors in one's field, and previous research experiences. According to Meissner (2022: 543), paradigms and theories influence how we perceive the world. When addressing paradigms, normative factors such as beliefs, culture, ideas, ideologies, and social values are unavoidable (Meissner, 2022: 544).

A paradigm is made up of four parts: ontology, epistemology, methodology, and methodologies (Scotland, 2012: 9). Ontological assumptions concern what defines reality, whereas epistemology concerns the nature and forms of knowledge (Ugwu et al., 2021). Ugwu et al. (2021) define methodology as the underlying strategy or action plan that guides the selection and implementation of specific methodologies. Methods, in turn, refer to the many approaches and procedures used for data collecting and analysis. Research paradigms are classified, and scholars disagree on the exact number of the paradigms, but the commonly used paradigms are positivism, interpretivism and pragmatism (Ugwu et al., 2021: 119).

Positivism is the scientific viewpoint that has come to dominate practically all modern ideas, including common sense (Eidlin, 2015). Stanford Encyclopedia of Philosophy (2008) induicates that pragmatism is a philosophical movement that views knowing the world as

inextricably linked to activity within it. The interpretive paradigm emphasises understanding individuals and their interpretations of their surroundings (Ugwu et al., 2021: 120). Chowdhury (2014) believes that interpretivists seek meanings and motivations underlying people's activities, such as their behaviour and relationships with others in society and culture. This study has adopted interpretivism because the researcher wants to understand the emerging researcher's RDM practices, which can be investigated by understanding the researcher's perceptions and behaviours.

3.3 Research approaches

There are three types of research methodologies: mixed methods, qualitative methods, and quantitative methods (Creswell & Creswell, 2018: 3). These methods have advantages and disadvantages and selecting a strategy that will suit your study is vital. The main objectives of quantitative research are to measure social reality, objectively test hypotheses, and forecast human behaviour (De Vos et al., 2003: 79). According to Creswell (2014a), quantitative research tests by examining the connections between variables and these variables are often measured with equipment, yielding numerical data that may be examined statistically. The researcher did not use the quantitative method because it does not provide a detailed picture of human experiences or perceptions.

On the contrary, qualitative research does not test hypotheses, and qualitative research design is usually flexible and subjective (Haven, Van Grootel & Leonie, 2019: 229). Henning, van Rensburg and Smit (2004: 3) state that qualitative research does not control the variables. The purpose of qualitative research is to address the "how," "why," and "what" questions regarding a phenomenon (Haven et al., 2019: 232). Qualitative methods guide a study to investigate and, more importantly, understand why a phenomenon is successful or unsuccessful (Tiko, 2022: 31).

In this research project, the researcher used a qualitative approach because of the following reasons:

- This approach allowed the researcher to interact with researchers in conversations regarding RDM .
- A qualitative approach enabled the researcher to comprehend the participants' perceptions, beliefs, concerns, and experiences regarding their RDM practices.
- The approach allowed for a nuanced understanding of the factors influencing researchers' RDM practices.

The researcher opted for a qualitative approach due to the inherent flexibility and adaptability offered by qualitative research methods. Qualitative methods allow researchers to dynamically adjust their approach in response to participant response during the course of the study (Reichmann et al., 2021).

3.4 Research design

Research designs are forms of inquiry that fit within the qualitative, quantitative, and mixed methods approaches and give particular recommendations for research operations (Creswell, 2014b: 12). A design is used to structure the study to attempt to answer the central research questions (Trochim, Donnelly & Arora, 2015). Saunders, Lewis, and Thornhill (2009) believe that it is vital to consider the practicality of the research design, including resource availability, time required for the study, and ethical issues

A case study is a qualitative design in which the researcher delves deeply into a program, event, activity, process, or one or more individuals (Creswell, 2014b: 241). A case study is one of the most widely utilized qualitative social research methodologies (Priya, 2021). Case studies allow the researcher to view the study problem comprehensively. They may aid in articulating, comprehending, and explaining a research problem or circumstance (Baskarada, 2014: 1). Yin (2009: 4) concurs that case study research is especially effective when the researcher wants to comprehend phenomena in a real-world setting. The case study approach enabled the researcher to collect data using a variety of methods which could be used to triangulate data and increase the study's validity and reliability. The case study design was applicable for investigating the RDM practices of researchers and their perceptions of RDM in a higher learning institution setting because it allowed for an in-depth examination of the phenomenon in a specific context.

3.5 Research methods

According to Bell, Bryman and Harley (2019: 39), research methods are a way to acquire data using specialised instruments like a questionnaire, an interview schedule, or observation. Creswell and Creswell (2018) state that research methods are the strategies, techniques, and tools used to collect and assess data to answer research questions. Patten (2017) views research methods as an enabler for constructing systematic knowledge. Saunders, Lewis and Thornhill (2015) suggest that the research method chosen should be determined by the study topic, the type of data needed, and the resources available.

3.5.1 Semi-structured interviews

A semi-structured interview is a research technique that incorporates features of both structured and unstructured interviews (Mueller & Segal, 2014). In qualitative research, interviews are the most generally used data-gathering method, and the semi-structured format is the most commonly used interview methodology (Kallio et al., 2016: 2955). In semi-structured interviews, a guide is utilised with standardised questions and subjects that must be covered. However, the order in which questions are asked is at the interviewer's discretion, and probing may be applied to ensure the researcher addresses the correct material (Harrell & Bradley, 2009). Harrell and Bradley (2009) also highlight that semi-structured interviews are frequently utilized when a researcher wishes to go deeply into a topic and fully comprehend the responses provided.

The researcher chose semi-structured interviews for this study because they allowed the researcher to ask follow-up questions if an intriguing or novel line of inquiry emerged during the interview (Mannan & Afni, 2020: 2). This flexibility in questioning allowed the researcher to go into greater detail on RDM practices.

3.5.2 Document analysis

Document analysis is a systematic process for assessing or evaluating printed and electronic documents (Armstrong, 2020). Like other qualitative research techniques, it entails examining and interpreting data to uncover meaning, gain understanding, and build evidence-based knowledge (Bowen, 2009: 27).

The researcher did not use document analysis as a primary data-collecting method but as a tool to complement the semi-structured interview data. Another motivating factor that made the researcher include document analysis is that qualitative researcher is supposed to draw on several sources of evidence (Armstrong, 2020: 1), particularly in a case study.

3.5.3 Research population

A research population is the group of people or items a researcher wants to investigate. It is the collection of all persons or items that share some quality or feature relevant to the study subject under consideration (Casteel & Bridier, 2021: 343). The study population comprised of Masters and Doctoral students, and the researcher refered to them as emerging researchers for the study. The population size of the emerging researchers at the host institution could not be precisely determined due to the unavailability of verified enrollment figures for 2023 (these will only be published in 2024). As of the most recent data available (for the 2022

academic year), the host institution had 1151 registered master's students and 334 registered doctoral students (HEI, 2023a: 66). The researcher chose the emerging researchers because the RDM policy of the host institution mandates them to adopt RDM practices. The study also included librarians that are actively involved in RDM activities in the host institution. The population of librarians that was recorded was 21 individuals. The librarians were chosen because the library plays a vital role in developing RDM (Avuglah & Underwood, 2019: 5). University libraries have been instrumental in pushing forward the RDM advocacy agenda (Huang, Cox & Sbaffi, 2021). Therefore, the target populations of this study were emerging researchers and librarians (as RDM stakeholders) within the host institution. Institutional documents related to RDM were also investigated.

3.5.4 Sampling

Sampling is the process of selecting units from a population of interest, most commonly people, groups, and organisations, but also texts or images (Trochim et al., 2015). Frederick (2019: 7) opines that the quality of research is not solely determined by the use of appropriate methods, as selecting a suitable sampling method is also crucial. The sampling method chosen is determined by the study objectives, the population of interest, and available resources (Babbie, 2016). Sampling enables any research type and size to be manageable, resulting in credible research findings (Bouma & Carland, 2016). While organising a study, researchers must carefully evaluate the sampling technique and its inherent restrictions (Neuman, 2011). A bigger sample size often yields more accurate findings. Therefore, sample size is an important issue (Creswell, 2014b). Nonetheless, the sample size should be evaluated against the study's viability and available resources (Babbie, 2016). For this study, I intended to interview a sufficient number of emerging researchers to gather a wide spectrum of viewpoints on the study objectives. I concluded the interviews after the fourteenth interview because, after the tenth interview, no new significant insights were emerging from additional interviews.

Non-probability sampling is a sample that uses nonrandomized methods. Instead of random selection, individuals are chosen because they are most suitable or easily accessible (Showkat & Parveen, 2017). The non-probability convenience sampling strategy was used to obtain information from the host institution's emerging researchers. Convenience sampling is a non-probability sampling strategy in which persons who are conveniently accessible to participate in research are chosen (Etikan, Musa & Alkassim, 2016: 2). In other words, rather than using

a random or organised technique of selection, the researcher chose emerging researchers depending on their convenience.

Purposive sampling is also a non-probability sampling technique, and it is used in research to pick a sample of individuals who share certain qualities or attributes. This sampling method can be viewed as judgemental because the researcher selects a sample based on a specified criterion relevant to the research issue (Etikan et al., 2016). Purposive sampling was used to select the librarians actively involved in delivering RDM services. These three librarians were interviewed about their RDM attitudes and duties within the host institution.

Therefore, this study employed both convenience sampling and purposive sampling. Convenience sampling was used to identify research participants registered for master's and Doctorate programs at the host institution, and purposive sampling was used to choose librarians who are directly involved in RDM support. For document analysis, two appropriate documents were purposely chosen: the RDM policy and the OA policy of the host institution.

3.5.5 Ethical considerations

Ethical issues are critical in safeguarding the welfare, dignity, and rights of research participants while maintaining the research process's integrity and validity (Khan & Saigol, 2023: 50). Research ethics is defined as the set of rules and norms that regulate the conduct of scientific investigation involving human subjects, animals and the environment (Khan & Saigol, 2023). The researcher applied for and was granted ethical clearance from the University of Cape Town (see Appendix C) and sought and was granted permission from the host institution to collect data.

All participants were informed about the study in writing. They signed a consent form (Appendix D), ensuring they understood what the study was about and assuring them they participated in this study voluntarily and could excuse themselves if they no longer wanted to be part of the research. The researcher did not gather the participants' personal information. The higher institution that was used for data collection requested to remain anonymous.

3.5.6 Data collection

When all the ethical applications were approved, the researcher approached potential research participants. The host institution has a facility in the library only used by emerging researchers to work on their research. The researcher approached students who were working

in this facility, inviting them to participate in this study. The researcher explained the research to the participants. Once they indicated an interest to participate in the study, the researcher sent an official email explaining the research further, and the researcher scheduled the interview appointment. Before each interview commenced, the participant signed the consent form.

The participants were interviewed in a seminar room provided by the host institution from 05 September to 22 September 2023, and each interview was 25-35 minutes long. The researcher sought permission from the participants to use Microsoft Teams as a means of recording, which made the transcription stage relatively easier. Since interviews generally allow the researchers to observe body language cues (De Villiers, Farooq & Molinari, 2022), the researcher took notes of these occurrences.

The second group of participants was librarians. The researcher's qualifying criteria for selecting these individuals was that the participants must actively participate in RDM services by supporting emerging researchers. Purposively selected librarians were invited by first sending an email to the librarians that explain the aim of the study. Once they agreed to participate, an interview appointment was set up. At the start of each interview, the librarian participant signed the consent form, and the researcher also sought permission from the participants to use Teams as the means of recording. The interviews were done at each participating librarian’s office. This approach allowed a better understanding of the participant's daily work experiences, professional interactions, and organisational challenges. The familiar setting of their offices made the participants feel more comfortable, encouraging them to share their thoughts and experiences openly. Each interview lasted between 25 and 35 minutes.

The researcher maintained a guiding role throughout the interviews, ensuring participants comprehended each question by providing clarifications. When a participant appeared uncertain or lost in the context of a question, the researcher took proactive measures to elucidate and explain the inquiry, fostering a supportive environment for participants to express their thoughts accurately. This approach aimed to minimise misunderstandings and promote a more precise exchange of information. The interview sessions were characterised by a focused and directed approach, emphasising extracting specific information relevant to the research objectives. Consequently, the interviews did not involve extensive open-ended discussions; instead, they were designed to elicit targeted responses, contributing to the

efficiency and effectiveness of the data collection process. This methodological choice was made to ensure the attainment of critical insights without unnecessary elaboration, aligning with the research's scope and objectives. Appendix A contains the interview schedule for interviews with emerging researchers and Appendix B contains the interview schedule for interviews with RDM stakeholders.

3.5.7 Data analysis

Data analysis is “the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data” (Sharma, 2018: 4). Thorne (2000: 68) suggests that analysis "occurs as an explicit step in conceptually interpreting the data set as a whole, using specific analytic strategies to transform the raw data into a new and coherent depiction of the thing being studied". Given the nature of the data obtained for this study, a qualitative data analysis was performed, with the researcher particularly choosing thematic analysis. This study found it fitting to lean towards a thematic analysis because it can benefit learning about felt or lived experiences, perspectives, and opinions (Thorne, 2000). Thematic analysis enabled the researcher to construct a theme structure from the data acquired. Thematic analysis was also performed to evaluate replies from different participants to see whether there is consensus or disagreement on perceptions of RDM practices, RDM support, and factors influencing RDM adoption. The researcher systematically examined RDM policy and OA policy, to extract valuable insights and corroborate the qualitative findings. This multi-faceted approach, combining both qualitative data and insights derived from document analysis, provided a comprehensive perspective on the status of RDM practices in the HEI.

In adherence to the thematic technique proposed by Braun and Clarke (2006), this study followed a systematic process comprising distinct phases. Initially, the researcher familiarised himself with the data, involving a review of audio recordings from the interviews and transcribed each semi-structured interview. Subsequently, the coding phase ensued, wherein the researcher assigned labels to key data features aligned with the study's objectives. The exploration for themes followed, whereby the researcher actively looked for patterns within the data related to the research question. The next step involved a review of identified themes, delving into the nature of each topic and exploring the interconnections between them.

This study adopted a mostly inductive approach. The theory was applied primarily with reference to research question two of the study. The researcher identified emerging themes from the semi-structured interviews and turned the research data into useful information and knowledge that can be utilised to comprehend phenomena during the data analysis step.

Document analysis was utilised as a complementary and supplementary tool to obtain insight into RDM and related policies and understand how RDM services are structured at the host institution. The researcher took a qualitative approach, organising data into themes. In addition, important stakeholders were interviewed to gain feedback and viewpoints on the RDM structure. The combination of document study and stakeholder interviews allowed for a thorough analysis, offering a holistic picture of RDM and its implementation at the host institution.

3.5.8 Study limitations

The word "limitations" refers to probable defects in a research study that are usually beyond the researcher's control and have much to do with the research design (Theofanidis & Fountouki, 2018: 156). Limitations should be acknowledged in the paper before submission since they may impact the study's results, suggestions, and conclusions (Theofanidis & Fountouki, 2018).

The study limitation included participant selection. The emerging researchers were chosen based on their willingness to participate; therefore, this sample may not represent the overall community of emerging researchers. On this limitation, it is essential to recognise that the willingness to participate may introduce a bias in the sample, as those who volunteered may differ in certain characteristics or perspectives from those who did not.

3.5.9 Reliability and validity

Research validity and reliability are critical in proving research quality (Hayashi Jr, Abib & Hoppen, 2019: 98). According to Creswell and Creswell (2018: 199), reliability and validity are essential in improving the accuracy of research assessment and evaluation. In other words, if a study is reliable, it should yield similar results when conducted multiple times or by different researchers using the same methods. Validity is concerned with how well a test measures what it is supposed to measure, whereas reliability is concerned with precision and accuracy (Alamina, Ogbu, Wapaimi & Jacob, 2022: 199). Both reliability and validity are crucial in ensuring the quality and credibility of research findings. Quantitative studies generally exhibit more substantial validity than qualitative research (Hayashi Jr et al., 2019).

The researcher constructed interview schedules based on previous similar studies and collected data through semi-structured interviews supplemented by document analysis, to increase the study's validity. The study recorded and reported on the data as accurately as possible for reliability and trustworthiness.

3.6 Chapter summary

Chapter 3 presented the research design and methodology. It emphasised an interpretive paradigm, using a qualitative approach and case study design to investigate RDM practices. The methods used included semi-structured interviews and document analysis. Ethical considerations were discussed. The participants included emerging researchers and librarians. Sampling entailed both convenience and purposive strategies. Data analysis was conducted using thematic analysis. The chapter acknowledged limitations and attempts at ensuring study reliability and validity.

CHAPTER 4:
DATA ANALYSIS AND RESULTS

4.1 Introduction

Chapter 3 of this dissertation provided an overview of the research methodology employed in this study. This chapter presents the data collected primarily from semi-structured interviews and through document analysis on RDM practices of emerging researchers and factors that influence RDM adoption at a HEI in the Western Cape, South Africa.

4.2 Summary of the participants

A convenience sample (n=14) of Masters and Doctoral students participated in the study. Four of the participants were Doctoral students, and ten of the participants were master's students. The participants registered for master's degrees were enrolled in disciplines such as Design, Education, Industrial Design, Human Resource Management and Hospitality. The four participants enrolled for Doctorate studies were registered for Business Administration in Project Management, Chemistry and Environmental Health.

A purposive sample (n=3) of RDM stakeholders in the institution participated in the study. Librarians were used as representatives of the RDM stakeholders within the host institution. The interviewed librarians have been practising for over 10 years and are actively involved in promoting RDM practices.

4.3 Interviews with emerging researchers

Data from the interviews with emerging researchers is now presented. The data does not differentiate based on level of study so that focus remains on the overall patterns and themes that emerged from the data, regardless of the participants' specific academic standing. Document analysis played a role in enhancing the depth and breadth of the data. Data from the policies analysed is therefore included where relevant.

4.3.1 RDM practices of emerging researchers

This section presents the RDM practices of emerging researchers and also uncovered influences on their adoption of practices when handling and managing their datasets during their research. From the interviews, the areas of emphasis emerged as 1) Data storage and Research data backup, 2) Metadata documentation, 3) Data sharing, and 4) Data preservation.

4.3.1.1 Data storage and research data backup

Participants use multiple storage platforms for their data. The means of storage the participants used include the following platforms: Google Drive (the most used backup platform), hard drives (primary storage platform), flash drives and cloud storage (other than Google Drive). Some researchers had paper-based data that they kept in secured boxes. Participant 4 recounted why they chose to store their data in more than one place:

Participant 4:

> *"I was already working on chapter four of my thesis, and when I was due to submit this section, I could not open the file stored on my laptop. I tried the University IT department to assist, but I was unsuccessful. From this day onwards, I do not use one place for storage".*

Participants mentioned various storage platforms they utilise for their research data. While some preferred the convenience of cloud storage like google drive, others opted for physical storage solutions like hard drives or flash drives.

Regarding research data backup, participants indicated a range of strategies. Data backup included utilising cloud storage and relying on external hard drives. Various backup methods highlighted the diversity in participants' awareness and practices concerning data security. While some participants were proactive in ensuring data redundancy and security through backup methods like cloud storage and external hard drives, others did not fully recognise the importance of safeguarding their research data. As the quotes below demonstrate, in the broader context of diverse research data backup strategies, Participant 7's reliance on their laptop for storage reflects a pragmatic approach suitable for smaller datasets, whereas Participant 11's extensive use of external hard drives and cloud storage demonstrates a commitment to minimizing data loss risks, particularly relevant for larger datasets, as well as convenience in data accessibility.

Participant 7:

> ***"****My laptop stores all my research data because I do not work with huge amounts of data."*

Participant 11:

"All research data, including soil sample information and fungal isolate data, are regularly backed up to external hard drives and cloud storage. This redundancy minimizes the risk of data loss. I do not need to have the hard drive with me constantly."

The University's RDM policy, which was analysed as part of data collection, recommends secure storage and routine research data backup. While it doesn't prescribe storage methods or backup protocols for researchers, it does furnish general guidance to help researchers maintain the integrity and longevity of their research data. For example, it states that principal investigators are primarily responsible for effectively managing research data through a DMP during any project or program. However, all the university's staff and students conducting research are also responsible for effective data management. The policy also encourages researchers to store data in formats conducive to preservation in long-term archival repositories. As for regular backup, the policy suggests that researchers must store research data separately from the primary storage location to mitigate the risk of simultaneous data loss during physical disasters or equipment failures (HEI, 2021b).

4.3.1.2 Metadata and documentation

Investigating the approach participants took when documenting their data and analysing their understanding of the concept of metadata is crucial. It is essential to gain insight into the procedure that researchers followed to ensure that their data contains sufficient metadata, and that the organisation of the data is properly documented for future reuse. The interview contained a question asking participants to explain how they organised their data during the collection phase. The results showed that most researchers did not have a predetermined documentation system and did not distinguish between metadata documentation and data organisation. When the researcher asked about metadata documentation, they explained how they organised their data during the data collection phase. Some of the participants recounted the process they followed in data organisation:

Participant 3:

"Regarding file naming, I would give it the designation or the Office of the person I will interview. Government official 1,2,3, Participant 1,2,3, etc"

Participant 6:

"I named files systematically by including each respondent's data collection date, location, and unique identifier. This naming convention helps us organise and identify data efficiently".

The responses provide insight into some tactics, including file naming rules based on interviewee designations, dates, and locations. The institution's RDM policy outlines a solid dedication to metadata documentation across the entire research data lifecycle. For example, the policy states that to comply with international FAIR standards, all research proposals/plans must contain a DMP with adequate metadata for discovery. According to the RDM deposit guidelines, the researchers are instructed to submit data to the institutional data repository their research data along with descriptive metadata, underscoring the university's view on the vital role of metadata in making research outputs accessible and usable (HEI, 2023b).

4.3.1.3 Data preservation

Regarding data preservation, the researcher asked the participants if they would preserve their data. The researcher framed the interview question: "Do you ensure that your research data is preserved for future use and accessibility? If so, how?". The results showed that the participants have not considered data preservation but know that their university has a platform or tool to assist it. One of the participants said:

Participant 4:

"I will keep my data on Google Drive as long as the platform exists".

Participant 7:

"My university will handle the data preservation because they encourage us to upload our data in the repository".

During the interviews, the researcher observed several positive body language cues that indicated the participants' confidence in their ability to handle data preservation. For example, many participants maintained good eye contact, utilised purposeful gestures, and exhibited an upright posture throughout the discussions. When analysed collectively, these non-verbal cues suggest a high confidence level in their understanding and proficiency in data preservation processes. Most participants relied on the institution to preserve the datasets, and only a minority relied on the google drive platform for preservation.

The RDM policy specifies that research data should be retained for at least ten years from publication unless specific funder requirements dictate otherwise. Additionally, it highlights the importance of complying with the University's Records Management guidelines, which says that if research data is not retained, it should be disposed of according to the University's Records Management guidelines.

4.3.1.4 Data sharing

To investigate participants' data-sharing practices, the researcher asked the question: "Do you plan to share your research data with others, such as collaborators, funding agencies, or the public? If so, how?". The questions served as a foundation for gaining the participant's perception of data sharing, and it led to a follow-up question that was phrased as follows: "What do you feel about data sharing?".

Most participants perceived sharing data as unjust, as they had invested significant effort in data collection and were now expected to distribute it without compensation. Participants identified two factors that could make this practice equitable: compensation and acknowledgement if others sought to use their data. Many participants mentioned that their data-sharing decision was influenced by university policy, as expressed by these participants:

Participant 3:

> *"Honestly, if I am funded for the study, yes, I can share. But if I incur all the expenses. I wouldn't be comfortable just giving that data free to someone."*

Participant 4:

> *"The researcher will access the data I collected. What are they going to do with my data? Are they going to write or publish papers? I am sceptical about that because that is my work; someone else might master me or master what I have done on my data. It does not sound good. On the other side, sharing data can be beneficial in identifying new research gaps. I will only share my data if I am acknowledged".*

Participants, however, affirmed their intention to share datasets to fulfil the institutional graduation requirement: uploading their research dataset to an IR and including a descriptive file describing their datasets. The university's RDM policy stipulates that research data should be managed according to local and international standards, facilitating data sharing

and collaboration, enhancing data security, and reducing the risk of data loss. The policy encourages maximising opportunities for new research based on the reuse and recombination of data, in alignment with Open Science and OA principles. The institution's OA policy states that all published research generated should be made accessible and visible through the institutional repositories hosted by the library.

4.3.2 Factors that influence RDM practices

Gaining knowledge about factors that influence the RDM practices of emerging researchers is important for this study. The influencing factors that the study yielded include 1) Compliance with research ethics, 2) Compliance with FAIR principles, 3) Awareness of RDM Tools Offered by the Institution and 4) Development of DMP.

4.3.2.1 Complying with research ethics

The study wanted to understand how the participants dealt with the ethics related to managing data. The researcher asked how the participants guaranteed their research data adhered to ethical and legal guidelines. The study revealed that most participants had obtained ethical clearance and applied for site permission from their respective organisations; thus, these actions demonstrate their commitment to compliance and suggest potential contributions to the broader academic and professional community. Only one participant had not yet applied for ethics clearance because the participant was still in the proposal stage of their research. The participants were fully aware of the reasons behind ethical applications and showed respect for the processes followed in ethical applications. The participants showed dedication to ensuring that the data they acquired and fostered adhered to the highest ethical standards. Some responses were:

Participant 5:

> *"Right after completing my proposal, I applied for the ethics because I did not want surprises when I was done with my research."*

Participant 8:

> ***"**Yes, I applied for the ethics because my institution will never accept the final submission if my research does not comply with the right ethics standards."*

4.3.2.2 Complying with FAIR principles

The researcher wanted to determine if the participants were familiar with the FAIR principles and what measures they had taken to ensure their research data complied with FAIR

principles. The question, “Do you consider yourself compliant with FAIR principles? If not, do you think they are principles you could or would comply with in the future?” aimed to gain insight into the participant’s stance or knowledge on FAIR principles. The researcher explained what FAIR principles entail to contextualise the interview question. After the researcher explained, the results indicated most of the participants preferred their institution’s assistance in ensuring their research data aligns with FAIR principles; some participants remained uncertain about how to handle this matter, while others expressed confidence in the thorough documentation of their research methods. Some responses were:

Participant 7:

> *“I’ll work with my institution to ensure that when the data is placed in the repository, it follows FAIR principles”.*

Participant 11:

> *“Intend to make the datasets FAIR compliant by providing comprehensive metadata, ensuring data accessibility, and making data available in standard formats. FAIR will enhance the discoverability and usability of our research data.”*

Participant 14:

> ***“****The data repository that I will use to share my data has metadata fields that I will need to complete, and I will also upload a readme file that will give context to the data that I will share. The university repository is open access.”*

Notably, the results indicated that some participants had limited knowledge of the FAIR principles. Some of the responses that indicate limited information:

Participant 7:

> *“I will ask the librarian allocated to my faculty for assistance to comply with this principle.”*

Participant 12:

> *“My supervisor has not told me the FAIR principles, but I guess I still need to read up on them.”*

4.3.2.3 Awareness of RDM tools offered by the institution

In terms of participants' familiarity with available RDM resources, the study aimed to understand their knowledge of the tools and support systems provided by the institution for effective data management. The researcher asked the participants: "What services or tools do you use for your RDM?". The findings revealed that most participants were well-informed about these tools. The DMP tool was widely recognised among participants. The participants alluded that they know the DMP tool because when they submit their research proposals and ethical clearance applications, they must develop the DMP. The participants noted that the libraries offer technical support for researchers facing challenges with data management tools or systems, specifically in the areas of DMP tools and the institutional data repository.

Nevertheless, it is worth noting that a minority of participants were uninformed about these tools, indicating a potential need for enhanced communication and awareness initiatives concerning the display of RDM resources available at the University. One of the responses was:

Participant 4:

> *"I did my Masters in 2017 and was not required to know about any RDM tools but I hear that [the institution] has made this a requirement."*

4.3.2.4 Development of DMP

The institution investigated in this study has adopted the DMP online tool. As already mentioned, most participants knew about this tool. The researcher asked the participants if they had created a DMP, and the results showed that eleven participants had created a DMP by using the DMP online tool. Two participants created the DMP without using the tool because the DMP online platform was not available when they started their Doctoral studies. One participant has not used the DMP online because they were still in the research proposal stage. The response concerning the development of the DMP is as follows:

Participant 3:

> *"I did the DMP before starting my research and outlined how I would handle the data."*

Participant 6:

"I was obligated to develop the DMP at the early stages of my research because my institution wants it to be submitted along with the proposal."

The RDM policy emphasises the significance of DMPs as an essential component of the research process. It underlines the importance of including DMPs in research proposals to ensure compliance with standards and principles such as FAIR. The policy includes the expectation that DMPs should consider adherence to applicable legal frameworks, such as NRF statements on data protection, intellectual property and human rights and National Archive guidelines on information management.

4.3.3 Support in RDM adoption

This section sets the stage for understanding the collaborative network of stakeholders involved in RDM. It highlights their roles in ensuring the institution's ethical, legal, and efficient research data management, which is crucial for the success and integrity of research activities.

4.3.3.1 Training and support in RDM services

To understand whether the institution effectively provides support and services to its emerging researcher, the researcher inquired about participants' experiences with the training provided by their institution. The interviews revealed that most participants had received training on using the DMP online tool and had also undergone training for the Institutional data repository. These training sessions were deemed valuable, as indicated by the comments provided by the participants that follow.

Participant 7:

"*Yes, the institution offers training sessions, and they have been quite helpful in improving my data management skills".*

Participant 9:

"I received training on developing a data management plan (DMP) from my supervisor. Additionally, workshops are available for post-graduate students, which I found very helpful in understanding the research data management process".

Among the participants who indicated that they had not received training, participants alluded to the fact that they had never seen an advertisement for the training. They suggested that the

institution should have marketed the workshops so that all the post-graduate students could attend these sessions.

The RDM policy document highlights that there will be training and awareness campaigns as part of the policy implementation plan. However, specific details about the nature of the training, its scope, and frequency are not explicitly outlined. The university library is responsible for providing training and consultation services to assist researchers with their RDM requirements.

4.3.3.2 Challenges in applying good RDM practices

Adopting RDM practices is a multidimensional process influenced by various institutional and individual factors. In concluding the interviews with emerging researchers, the researcher wanted to determine if the participants experienced challenges adopting RDM practices. As seen in the quotes that follow, the participants showed confidence in adopting good RDM practices, believing they did not encounter significant challenges. The responses of the emerging researchers stand in contrast to the challenges highlighted by RDM stakeholders, specifically concerning slow adoption and awareness issues (as shown in the upcoming section focusing on the perceptions and roles of stakeholders in RDM).

Participant 4:

> *"When I started my research, I was told by my supervisor that I need to submit my proposal with a DMP and data after the research will be uploaded in the data repository".*

Participant 6:

> *"No challenges. Because I attended the post-graduate workshops that my institution provided."*

Participant 10:

> *"While we did face some challenges in adopting research data management practices, such as learning to use new tools and ensuring all team members were consistently following data management protocols, the benefits of organised and secure data management outweighed the initial difficulties."*

Participant 13:

"Fortunately, I encountered no significant challenges in implementing research data management practices. However, I credit this to the training and support from my institution, which prepared me well for handling data throughout my research".

Participant 14:

"I did encounter a few challenges, particularly in ensuring data security and navigating ethical considerations. I sought guidance from the library to overcome them, and they provided valuable advice and solutions".

4.4 Interviews with RDM stakeholders (librarians)

The upcoming section highlights emerging themes identified through semi-structured interviews aimed at extracting perspectives from key RDM participants about the adoption of RDM practices by emerging researchers. RDM stakeholders in this study are librarians. The data has been organised under specific themes based on the discussion points. The goal of interviewing RDM stakeholders in the institution was to gather information about their involvement in RDM practices, support strategies, collaborative efforts, educational initiatives, challenges encountered, and any other insights that can contribute to the research project on RDM practices and factors that influence RDM practices of emerging researchers in HEIs. The researcher structured the interview schedule to gain insight into what RDM stakeholders are doing for emerging researchers.

4.4.1 Uptake and awareness of RDM practices

The RDM stakeholders raised the issue of uptake and awareness of RDM practices when responding to the researcher's question: "Have you faced any challenges in providing RDM services and resources to researchers in general or Masters and Doctoral students in particular? If yes, can you describe them and how you addressed them?" The librarians characterized the slow uptake and awareness of RDM among researchers as the most significant challenge in implementing RDM practices and policies. The researcher wanted to understand why the RDM uptake was slow in the institution by asking the RDM stakeholders to elaborate on the cause. The RDM stakeholders responded by mentioning that, while RDM guidelines exist, there is a lack of enforcement strategies. The stakeholders added that the institution's lack of clearly defined RDM roles hindered its adoption. They said:

RDM stakeholder 2:

"Many researchers seem to have limited awareness of RDM practices and their importance."

RDM stakeholder 1:

"The difficulty has been the slow adoption of research data management procedures since researchers tend to apply these practices only when necessary. Despite marketing and advertising efforts, researchers frequently only use these services when needed, such as when publishers require them to contribute datasets for publication".

RDM stakeholder 3:

"The departments still need to be trained on the RDM practices, and each person in the university can assist."

Regarding the uptake and awareness, the consensus among the librarians is that there is a need for increased education and awareness.

4.4.2 Timing of adoption of RDM practices

The RDM stakeholders mentioned the timing of adopting RDM practices because researchers typically only engage with RDM practices when they are at the point of needing them, such as when publishers require them to provide datasets along with their research publications. The RDM stakeholders highlighted that emerging researchers often seek RDM knowledge when obligated to use it, and this shared behaviour is related to awareness. The RDM stakeholders recounted:

RDM stakeholder 1:

"Researchers may not be aware of RDM practices until they are required to comply with them. They might be surprised to learn about the available services and policies, which can result in a lack of preparation."

RDM stakeholder 2:

"Many researchers use RDM practices only when necessary, and it is often challenging to make them aware of these practices even when they are in place."

RDM stakeholder 3:

> *"Our researchers are not interested in attending workshops that teach them about RDM, and some researchers adopt RDM practices when their ethics applications are rejected."*

4.4.3 Sharing of research data

The researcher discovered more about the data-sharing practices of emerging researchers while asking RDM stakeholders about the strategies employed to promote RDM services and resources within the institution. Among the objectives of RDM emphasised by the librarians, a key goal was data sharing. This primary objective emanates from the RDM policy and the OA policy of the institution. The RDM policy intends to foster collaboration among researchers, improve transparency in research processes, and promote the widespread reuse of data for future studies (HEI, 2021b). According to the RDM stakeholders, the practice of sharing research data, which is becoming increasingly important, is relatively new to emerging researchers, and they may not fully understand the benefits and implications of sharing their data. They said the following:

RDM stakeholder 2:

> *"Sharing research data is a novel concept, and not all researchers understand the significance of data management or its potential benefits regarding reproducibility and collaboration."*

RDM stakeholder 3:

> *"When integrating RDM in information literacy, the researchers need to be educated about the positive impact data sharing has."*

4.4.4 RDM roles within academic institutions

The researcher questioned RDM stakeholders about their collaboration with other stakeholders within the academic institution. The goal was to explore how they work together to encourage RDM practices and aid emerging researchers. Participants were also requested to describe any existing partnerships or collaborations, which would provide insight into the nature and scope of these collaborative activities. The emphasis was on understanding their collaboration activities. In response to this question, RDM stakeholders stressed the importance of their participation in establishing and implementing the institution's RDM policy. They also noted that they played a crucial role in the process by promoting the

development of these policies and related services through collaboration with other key stakeholders. They said the following:

RDM stakeholder 1:

> *"The library provides the RDM infrastructure and services to Masters and Doctoral students. We work closely with the Research directorate and centre for post-graduate studies".*

RDM stakeholder 2:

> *"As faculty librarians, we organise and coordinate open communication channels with faculties, and our role is to provide RDM seminars where post-graduates are encouraged to adopt RDM practices".*

RDM stakeholder 3:

> *"When we started with RDM in our institution, we collaborated with faculties, IT, ethics department and research directorate. This collaboration is ongoing because different stakeholders in the University are involved in the data review process."*

The RDM policy provides an overview of the roles and responsibilities that different stakeholders need to play in the host institution. Table 4.1 outlines these roles using extracts from the policy.

Table 4.1: Roles and responsibilities (HEI, 2021b)

Roles	Responsibilities
Principal Investigators (PI) / Lead Researchers (LR):	The role involves effective research data management, acting as stewards and custodians of the data. The default ownership of research data is with the University unless alternative agreements exist.
Higher Degrees Committee (HDC):	Ensures that the research proposal submitted by post-graduate students includes a comprehensive DMP.
University Library:	Offering training and advisory solutions around RDM. Managing a repository for research data. Offering curation services and a tool for DMP.
Technology Transfer Office (TTO):	Responsible for negotiating and advising on intellectual property and data ownership matters in collaborative projects.
Research Directorate:	Facilitating and assisting in the governance of research data. Advocating for and raising organisational understanding of challenges related to research data management.

4.4.5 Integration of RDM into IL programs

The researcher wanted to determine if the host institution integrated RDM into the information literacy program which the library runs. The question was, "How do you integrate RDM practices into library instruction and information literacy programs?" The RDM stakeholders' feedback was as follows:

RDM stakeholder 1:

> *"While certain RDM [DMP development & data deposition guide in the institution repository] components are being explored within third-year levels with specific groups engaging in research projects, our primary focus has been integrating RDM practices elements into the Advanced Information Literacy program which is aimed at equipping emerging researchers with good RDM practices. A dedicated advance information literacy [RDM]*

module has been established to impart this knowledge to fourth-year undergraduates, Masters, and Doctoral students".

RDM stakeholder 2:

"The advanced information literacy is made available on Blackboard to our post-graduate students, and RDM practices are the core subject matter".

RDM stakeholder 3:

"Faculty members also conduct winter schools or specific post-graduate programs, where they dedicate a week or more to cover various aspects of their curriculum. The library consistently plays an integrated role during these sessions, contributing to the training courses throughout the designated weeks".

4.4.6 Most used RDM services and resources

The researcher sought insights from RDM stakeholders to explore the influence of RDM tools on emerging researchers, aiming to identify the most widely used tools among these student groups. The RDM stakeholders revealed that the predominant RDM tools among the academic community are the DMP tool and the data repository, as shown in these quotes:

RDM stakeholder 1:

"Most of our emerging researchers use our DMP online tool to develop their plans. Our institutional repository is growing because, as a graduation requirement, the researcher is expected to upload their datasets."

RDM stakeholder 2:

"The DMP is mostly used, and the library provides expert knowledge or guidance on constructing a compact plan."

These tools have emerged as the most extensively utilised resources, underscoring their significance in supporting effective data management practices within the University's research endeavours.

4.5 Chapter summary

The chapter offered insights into RDM practices, the factors shaping these practices, and the challenges researchers encounter within HEIs in the Western Cape, South Africa. The data,

drawn from emerging researchers and RDM stakeholders overseeing RDM services and tools (librarians), as well as from institutional RDM and OA policy, contributed to an understanding of the emerging researcher's behaviour on adopting good RDM practices, highlighting factors that are the driving force in the adoption process and presented influencing factors in the adoption of RDM practices. Also, the data drawn from the RDM stakeholders provided insight into the current state of RDM practices in the HEI.

CHAPTER 5:
DATA INTERPRETATION, RECOMMENDATIONS, AND CONCLUSIONS

5.1 Introduction

This chapter discusses the main findings from the collected data, integrated where appropriate with the reviewed literature and the guiding theory. Based on the findings, recommendations and suggestions for future studies are provided.

In this research, the dynamics within RDM at the case study site were unravelled by focusing on the interactions among its core elements using the framework of AT. By emphasising the interconnectedness of subject, tool, object, rule, division of labour, and community, AT offers a lens for understanding the factors that influence RDM adoption.

5.2 Discussion of the findings

The study's findings are examined in connection to the research questions, and where appropriate, AT will be used.

5.2.1 RQ1: What RDM practices are employed by emerging researchers in the HEI in the Western Cape, South Africa?

In investigating the first research question, the study wanted to discover what RDM practices emerging researchers employ. Several factors contribute to emerging researchers at the HEI adopting RDM practices. Researchers' awareness and willingness to participate in RDM emerge as pivotal determinants.

5.2.1.1 Storage

The study's findings shed light on researchers' diverse and sometimes complex storage practices for their data. The results show that emerging researchers use a variety of data storage methods. Google Drive was a popular backup option, alongside hard drives, flash drives, and cloud storage. The fear of data loss triggered the emerging researchers' use of multiple storage platforms. Some researchers even use traditional paper-based data storage. This variety emphasises researchers' preferences and needs, demonstrating a lack of one-size-fits-all data storage solutions. As noted in the literature by Savage and Cadwallade (2019), it is challenging to support good RDM practices in HEIs due to different research procedures and data formats across fields. Cox et al. (2017: 54) suggested that effective RDM practices can prevent data loss. According to Avuglah and Underwood (2019), inadequate storage practices may contravene ethical norms or regulatory requirements for data management and protection, harming researchers' reputations or resulting in legal penalties for institutions.

Avuglah and Underwood (2019) suggest that researchers and institutions must prioritise proper storage practices, including regular backups, secure storage solutions, and adherence to data management policies and guidelines to mitigate these risks.

Therefore, where data storage is concerned, the emerging researchers revealed that they were influenced by the features and capabilities of the tools and policies referred to as rules in theory, which influenced the direction in which the emerging researchers preserved and handled the data.

5.2.1.2 Metadata and documentation

Regarding metadata and documentation, the findings suggest that emerging researchers often lack a predetermined system for documenting their data. The responses indicate a tendency to mix metadata documentation with data organisation during the collection phase. The RDM policy of the host institution has clearly defined metadata in the definitions and acronyms section of the policy, and the policy went further and highlighted that the DMP must include sufficient metadata to aid discovery and in compliance with international FAIR principles (HEI, 2021b). The HEI also provided a mandate that when researchers are depositing data in the IR, sufficient descriptive metadata is needed to ensure that this deposited data can be found and understood. Qasim, Davis, Garnett, Marks and Moosberger (2018: 5) recommend that organisations must create and maintain robust metadata to assure the dependability, validity, and usability of digital objects under their care. The host university library is even given the responsibility to conduct basic curation, including brief checking and metadata or documentation to enhance curation (HEI, 2021b: 10). Therefore, the host's RDM policy serves as a strong support for emphasising the critical need for researchers to follow careful and detailed practices in documenting metadata.

5.2.1.3 Data preservation

The findings from the interviews on data preservation reveal a nuanced picture among participants. While participants generally had not actively considered data preservation, a thread was their awareness of institutional support, particularly the university's platform or tool, such as IR. Notably, some participants expressed differing preferences, with one relying on personal platforms like Google Drive while another trusted the university's repository. The majority leaned towards relying on institutional mechanisms for data preservation, contrasting with a minority choosing platforms like Google Drive. The RDM policy establishes a ten-year retention period from publication, unless specified by funders,

emphasising compliance with the university's Records Management guidelines, which dictate proper disposal procedures for unrestrained research data (HEI, 2023: 7). Qasim et al. (2018) report that data preservation contributes to the cultural and historical record by conserving vital digital artefacts for future generations.

5.2.1.4 Data sharing

In the context of data-sharing practices, emerging researchers had different perspectives. Many participants view data sharing as potentially unjust, especially without compensation or acknowledgement for the efforts of the data collector. Participants suggested two measures that could improve data sharing equity: remuneration and acknowledgment. They believed that if others wanted to utilise their data, they should be compensated and recognized for their contributions.

Some participants expressed scepticism about sharing data, particularly regarding how others might use their data. Concerns included the potential for others to write or publish papers using their data, leading to a fear of being overshadowed or surpassed in their own field. The university's RDM policy encourages data management according to local and international standards, promoting data sharing, collaboration, and reducing the risk of data loss (HEI, 2021b). The institution's OA policy emphasises making all published research accessible and visible through institutional repositories hosted by the library (HEI, 2021a). This underlines a commitment to transparency and accessibility in research outputs.

Despite reservations, participants affirmed their intention to share datasets to meet institutional graduation requirements. This typically involved uploading research datasets to an IR and providing a descriptive file. This aligns with the university's RDM policy, emphasising adherence to standards, data security, and promoting collaboration. The acceptance of RDM practices seems to be significantly influenced by researchers' attitudes, beliefs, and their level of training in this field.

5.2.1.5 Ethics

The findings of the study indicate a strong commitment among the participants to comply with research ethics in managing data. The majority of participants demonstrated proactive measures by obtaining ethical clearance and seeking site permission from their respective organizations. This dedication to ethical considerations highlights a responsible approach towards research practices. The participants' awareness of the importance of ethical applications, their respect for the processes involved, and their desire to avoid surprises or

potential rejections from their institutions highlight their commitment to upholding ethical standards in their research endeavors.

5.2.1.6 FAIR compliance

The study reveals varying levels of familiarity and compliance with FAIR principles among participants. While some show a strong understanding and commitment, others have limited knowledge and seek guidance. Many participants prefer relying on their institution's support for adherence to FAIR principles, emphasising collaboration. Some emerging researchers expressed confidence in implementation through metadata, data accessibility measures, and standard formats. However, a notable portion admits limited knowledge, suggesting a potential awareness and education gap in the research community regarding FAIR principles.

'Emerging researchers mentioned that their decisions on data sharing were influenced by university policy. For instance, Participant 3 indicated a willingness to share if funded but hesitated if they incurred all the expenses. Concerns about someone else benefiting from their work were also raised, emphasising the need for acknowledgment.

5.2.2 RQ2: What are the factors that influence these researchers' RDM practices and how do they relate to the RDM environment at the institution?

The findings shed light on several key factors influencing RDM practices among emerging researchers. These factors include compliance with research ethics, adherence to FAIR principles, awareness of RDM services offered by the institution, and DMPs.

The RDM stakeholders who were interviewed mentioned the timing of adoption of RDM practices as a significant factor influencing the uptake of good RDM practices. The findings underscore a common theme of reactive rather than proactive engagement with RDM practices where researchers sometimes become aware of and adopt RDM practices only when external factors necessitate compliance. This timing of adoption may result in a lack of preparedness for RDM and a limited understanding of the available RDM services and policies. Addressing the timing of adoption requires strategies to shift from a reactive to a proactive approach. This could involve ongoing education and communication efforts to instil a deeper understanding of the benefits of RDM practices throughout the research lifecycle.

The emerging researchers however generally exhibited awareness of available institutional RDM services, with the DMP tool being widely recognised. The emerging researchers highlighted that the host institution requires a DMP with their proposal. This requirement (a

‘rule’ as per AT) has influenced emerging researchers to adopt the development of a DMP, and the study findings have shown that most participants developed a DMP.

Overall, awareness of RDM practices is crucial because it enables researchers to efficiently manage their data, comply with regulations, increase research productivity, and contribute to responsible research practices (Bryant et al., 2017). By analysing the interplay of these elements through an AT lens, institutions can develop a comprehensive strategy that considers the rules, roles, tools, and cultural aspects influencing the success of RDM training initiatives. This holistic approach can ensure that improvements are not only task-specific but also align with the broader goals and dynamics of the RDM community.

The study found that there is a concerted effort by the HEI to embed RDM practices within its fabric. The collaboration among various stakeholders (the ‘community’), integration of RDM into educational programs (‘tools’), and the precise definition of roles and responsibilities (‘division of labour’) contribute to a more comprehensive approach to RDM. Researchers in the HEI are guided by established policies (e.g., RDM policy) (‘rules’) and emerging researchers are able to participate in training programs that equip them with essential RDM skills, to help to ensure the responsible and effective management of research data throughout the research lifecycle.

The RDM community encompasses all RDM stakeholders, such as librarians, the IT department, the research directorate, and researchers. This study focused on librarians as a group representing the community, with the emerging researchers also being part of the community. Their collaboration, communication, and shared goals are essential for successfully implementing RDM practices. This emphasises the necessity for a unified and collaborative approach among all involved parties in RDM. Table 4.1 outlines the roles and responsibilities of various stakeholders as defined by the host institution’s RDM policy. Principal Investigators, Higher Degrees Committees, University Libraries, Technology Transfer Offices, and Research Directorates each have specific roles in ensuring effective RDM. The precise delineation of responsibilities emphasises the coordinated effort required to manage research data comprehensively. This collaboration should ensure that researchers have the necessary support and infrastructure for successful RDM and failure of one stakeholder in the activity system of adopting RDM practices can influence the quality of RDM practices in the institution. Therefore, the division of labour in RDM is critical for streamlining processes, encouraging collaboration, and ensuring that all aspects of data

management are handled by persons or groups with the necessary skills. This method helps to ensure the overall success of research data management practices in an institution or research community.

The integration of RDM into IL programs, particularly the Advanced IL program, plays a role in shaping the practices of emerging researchers because the program incorporates services and tools that are essential for effective management of data. Baro (2011) states that possessing IL skills is essential for college students. This is attributed to the growing significance of information, the requirement for continuous learning throughout one's life, and the acknowledgement of its pivotal role in successful higher education. Creating dedicated modules and courses focused on RDM within the academic curriculum is a proactive approach, on the part of the institution, to equipping students with the necessary RDM skills which would influence RDM practice. The involvement of faculty members, and librarians and the utilization of online platforms like Blackboard further underscore the integration of RDM practices into broader educational initiatives.

5.2.3 RQ3: What challenges do emerging researchers face in adopting good RDM practices?

Knowledge of the FAIR principles is one of the factors that can affect the adoption of RDM practices. The study uncovered a general lack of awareness among participants, prompting a call for more straightforward guidance and institutional support in assimilating these principles into research practices. Lack of awareness is a significant barrier to adopting FAIR data practices. If researchers are unaware of the principles, they are unlikely to implement them in their research (Jacobsen et al., 2020). Some participants expressed uncertainty and limited knowledge about FAIR principles. Many emerging researchers relied on institutional assistance to ensure their research data aligns with FAIR principles.

Support and services the host institution provides, particularly the training in RDM practices, were discussed in interviews. Most participants reported receiving training on using the DMP online tool and underwent training for the Institutional data repository. The feedback from participants suggests that these RDM training sessions were valuable in improving their data management skills. However, not everyone attended training or knew the available training opportunities. The lack of awareness implies a problem with communicating or promoting these sessions within the host institution. Participants recommended that the institution

should have promoted the workshops more effectively to ensure a broader attendance among postgraduate students.

The host institutions' RDM policy document emphasises the inclusion of training and awareness campaigns in the policy implementation plan (HEI, 2021b). However, the document does not explicitly outline specific details regarding the nature, scope, and frequency of the training. The data collected from the emerging researchers highlighted a concern that some participants were not clear about how to conduct good RDM practices and so, perhaps, that training was not appropriate to their RDM needs.

5.3 Study recommendations

Several recommendations may be made based on the study findings. Firstly, prioritize research training programs that enhance researchers' RDM skills and understanding of data preservation, and promote them vigorously. According to Chiware and Mathe (2015), individuals who receive training in RDM are more inclined to embrace RDM practices. Secondly, establish clear communication channels for institutional RDM policies to ensure informed compliance. Thirdly, facilitate collaborative platforms for more effective stakeholder engagement, fostering a communal RDM approach and increase researcher awareness of all institutional RDMS (not just the DMP tool and IR) and responsibilities through targeted campaigns and practical demonstrations, emphasising proper utilization. Lastly, the study suggests that ongoing (not just one-shot) support and education on RDM practices may benefit emerging researchers, ensuring a more standardized and informed approach to managing their research data.

5.4 Future studies

The study's findings suggest possible future research directions. First, the hurdles preventing researchers from engaging in data-sharing practices should be further investigated. Examining the barriers to the widespread adoption of data-sharing mechanisms and researchers' attitudes and concerns about data-sharing can be studied. Implementing effective solutions requires an awareness of the elements contributing to or hindering the long-term adoption of data-sharing policies.

Since RDM training exists, evaluating its impact to test its effectiveness should result in long-term changes in researchers' data management and sharing habits, and an impact study could measure those.

It is essential to understand the significance of institutional support. Future research could investigate more deeply how institutional policies, resources, and incentives influence researchers to adopt responsible data management practices in a specific discipline.

Lastly, the extent to which RDM practices are integrated with broader Open Science initiatives requires exploration. While there would be a relationship between RDM strategies and principles such as OA, open data, and collaborative frameworks, it is essential for institutional practice to reflect this.

These suggested avenues for future research could contribute to a further understanding of the challenges and opportunities in promoting and developing RDM practices within academic institutions, ultimately facilitating the development of effective strategies for fostering a culture of responsible data management among researchers.

5.5 Study summary

This case study aimed to explore and understand the adoption of RDM practices among emerging researchers in a higher learning institution. The research followed a purely qualitative approach, employing two sets of semi-structured interviews and document analysis to gather insights from students and RDM stakeholders within the institution. The researcher used AT as the theoretical framework guiding research question two of the study. AT also allowed the researcher to interpret practices in light of the network of players in RDM at the institution. The key findings demonstrated a wide range of storage practices, the significance of metadata and documentation, preferences for data preservation methods, various attitudes toward data sharing, strict adherence to ethical practices, and varying levels of FAIR compliance among participants. The study revealed that RDM adoption is influenced by institutional support, the timing of engagement with RDM techniques, and the availability of training programs. The emerging researchers had mixed feelings about data sharing and concerns over recognition and misuse of data. Some emerging researchers suggested compensation and acknowledgment as prerequisites for sharing their data, indicating a need for policies that address these concerns to promote open data practices.

5.6 Conclusion

The study not only provided insights into the RDM practices of emerging researchers, highlighting their behaviours, challenges, and decision-making processes at the institutional level, but also highlighted the pivotal role of institutional support and training in promoting effective RDM practices. The data revealed that some participants were unaware of the RDM

training opportunities offered by their institution, suggesting a need for better promotion and communication of these resources.

Adoption of RDM practice was often reactive rather than proactive, with emerging researchers tending to adopt RDM practices only when external requirements, such as funder mandates or institutional policies, necessitated compliance. This reactive approach indicates a gap in education and engagement with RDM practices throughout the research lifecycle as evidenced by, for example, the general lack of awareness about FAIR principles and the inconsistent participation in RDM training sessions.

As researchers navigate the ever-evolving landscape of research data, it becomes increasingly evident that effective data management requires continuous adaptation, education, and collaboration. The insights gleaned from this study contribute to the ongoing discourse on RDM practices, offering a foundation for future research and interventions to cultivate a robust and sustainable framework for data management in the academic sphere.

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APPENDICES

APPENDIX A: SEMI-STRUCTURED INTERVIEW GUIDE FOR MASTER'S AND DOCTORAL PARTICIPANTS

Title of research project:

The Adoption of Research Data Management Practices by Emerging Researchers at Higher Education Institution in the Western Cape, South Africa

Name of principal researcher:

Xabiso Xesi

Department/research group address:

Department of Knowledge and Information Stewardship

Telephone:

Email:

Part A: RDM practices of Masters & Doctoral students

1. Can you tell me about your current degree, your research project and the kind of data you are collecting?

2. Do you have a data management plan in place for your research project?

    a. If yes: Why do you have a DMP, and how does it guide your RDM practices?
    b. If no: Why do you not have a DMP?

3. Can you walk me through your process for organising, storing and backup of research data?

4. Will you be preserving your research data for future use and accessibility?

    a. If yes: How?
    b. If no: Why not?

5. Do you plan to share your research data with others, such as collaborators, funding agencies, or the public?

    a. If yes: How?
    b. If no: What are your reasons of not sharing your research data?

6. How do you guarantee that your research data adheres to ethical and legal guidelines such as privacy, confidentiality, and data protection?

7. The FAIR principles are …. Do you consider yourself compliant with FAIR principles? If not, do you think they are principles you could or would comply with in future?

Part B: Support and training

8. What services or tools do use in your RDM?

9. Have you received any training or support on RDM practices? If so, what kind, from whom, and to what extent has it been helpful for your research?

Part C: RDM challenges

10. Have you faced any challenges in your research data management practices, and if so, how did you overcome them?

11. Do you have anything else you would like to say about …

Thank you for participating in this research.

APPENDIX B: SEMI-STRUCTURED INTERVIEW GUIDE FOR LIBRARY MANAGER

Title of research project:

The Adoption of Research Data Management Practices by Emerging Researchers at Higher Education Institution in the Western Cape, South Africa

Name of researcher:

Xabiso Xesi

Department/research group address:

Department of Knowledge and Information Stewardship

Telephone:

Email:

Questions

1. Can you describe the role of the library in supporting research data management (RDM) practices at your institution?

2. What strategies have you implemented to promote RDM services and resources to Masters and Doctoral students at your institution?

3. How do you collaborate with other stakeholders at [HEI] to promote RDM practices, support Masters and Doctoral students, and share resources? If you have established any partnerships or collaborations, can you describe them?

4. How do you integrate RDM practices into library instruction and information literacy programs?

5. What are some of the most popular RDM services and resources offered by your library, and how do you measure their impact and usage?

6. Have you faced any challenges in providing RDM services and resources to researchers in general or Masters and Doctoral students in particular? If yes, can you describe them and how you addressed them?

7. Finally, is there anything you would like to add about the role of libraries in promoting good RDM practices in higher education institutions?

Thank you for participating in this research.

APPENDIX C: ETHICAL CLEARANCE FROM UCT

Department of Knowledge & Information Stewardship
University of Cape Town Upper Campus
Private Bag X1, RONDEBOSCH, 7701 South Africa
Level 5 Hlanganani, Chancellor Oppenheimer Library Tel: +27 (0) 21 650 4546
E-mail: dkis@uct.ac.za Website: www.dkis.uct.ac.za

7 June 2023

Mr Xabiso Xesi
Department of Knowledge and Information Stewardship Chancellor
Oppenheimer Library University of Cape Town

Dear Mr Xesi

Ethics approval for Master's research

I am pleased to inform you that ethical clearance has been granted by the Ethics Review Committee of the Department of Knowledge and Information Stewardship (DKIS), on behalf of the Humanities Faculty of the University of Cape Town, for you to proceed with collecting data for your Master's study entitled: ***The Adoption of Research Data Management Practices by Emerging Researchers at Higher Education Institution in the Western Cape, South Africa***

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

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

Yours faithfully,

SIGNED

Ms Theresa de Young

Chair: Department (DKIS) Research Ethics Committee

"Our Mission is to be an outstanding teaching and research university, educating for life and addressing the challenges facing our society."

APPENDIX D: CONSENT FORM FOR INTERVIEWS

Title of research project:

The Adoption of Research Data Management Practices by Emerging Researchers at Higher Education Institution in the Western Cape, South Africa

Name of researcher:

Xabiso Xesi

Department/research group address:

Department of Knowledge and Information Stewardship

Telephone:

Email:

About the study:

Introduction

You are being invited to participate in a research study being conducted by Xabiso Xesi, a master's student in the Department of Knowledge & Information Stewardship at the University of Cape Town. The purpose of this study is to better understand the adoption of research data management practices among Masters and Doctoral students at [HEI].

Purpose of the study

The study will identify RDM practices and understand factors that influence practice.

Procedures

If you choose to take part, you will be asked to participate in a semi-structured interview. The interview will take approximately 45 minutes and will be conducted in person or via telephone/online communication, whichever is more convenient for you. If permitted, the interview will be recorded, and the audio recording will be used for transcribing the interview. The transcripts will be used for the analysis of the data. Your participation in this study is completely voluntary and you may decline to participate or withdraw from the study at any time without any negative consequences.

Confidentiality

Your confidentiality will be protected. The audio recording will be used to create the transcription for analysis and will not be shared. The anonymised transcription of the interview will be stored securely, and access will be restricted to the researcher and his supervisor. Any quotes used in the final report will be de-identified.

Benefits and risks

There are no direct benefits to you for participating in this study. However, the information gathered from this study may contribute to a better understanding of the adoption of research data management practices among Masters and Doctoral students at [HEI]. There are no known risks associated with participation in this study.

Compensation

There is no compensation for participating in this study.

Contact information

If you have any questions about the study, please feel free to contact Xabiso Xesi at xsxxab001@myuct.ac.za.

Informed consent

Your participation in this study is completely voluntary. By signing this consent form, you are indicating that you have read and understand the information provided and agree to participate in the study. A copy of this consent form will be provided to you for your records.

I have read this consent form and agree to be interviewed for the study. I agree / do not agree to it being recorded.

_____	_____	_____	_____
Full name of participant	Date	Time	Signature

I, Xabiso Xesi, herewith confirm that the above participant has been fully informed about the nature of the above study.

_____	_____	_____
Signature	Date	Time

APPENDIX E: DOCUMENT ANALYSIS CHECKLIST

Title of research project:

The Adoption of Research Data Management Practices by Emerging Researchers at Higher Education Institution in the Western Cape, South Africa

Name of principal researcher:

Xabiso Xesi

Department/research group address:

Department of Knowledge and Information Stewardship

Telephone:

Email:

Document Analysis Sheet		
	Document 1	**Document 2**
POLICY REFERENCE AND VERSION NUMBER	5/7/P; 8/3/P	5/7/P; 8/1/P; 8/3/P
TITLE OF DOCUMENT	Open Access (OA) Policy	Research Data Management (RDM) Policy
DATE OF DOCUMENT	04/10/2021	04/10/2021
TYPE OF DOCUMENT	Policy	Policy
PRIMARY SOURCE	DVC: Research, Technology Innovation & Partnerships	DVC: Research, Technology Innovation & Partnerships

DOCUMENT DESCRIPTION	In recognition of the global movements Open Science, Open Data and Open Access focused on promoting unlimited access to research outputs in all domains and digital formats in pursuit of the advancement of science, knowledge creation and dissemination and preservation, this policy intends to make published research generated by CPUT more accessible and visible through institutional repositories hosted by the library.	The intent of this policy is … to establish the standards that govern the management of research data at CPUT.

Complete after reading the document

1. **DOCUMENT DESCRIPTION (E.G., TITLE, LANGUAGE, LOCATION)**

2. **WHAT IS THE INTENT OF THE DOCUMENT?**

3. **WHAT RULES DOES THIS DOCUMENT ENFORCE?**

4. **WHAT IMPORTANT FACTS CAN I LEARN FROM THIS DOCUMENT?**

5. **WHAT INFERENCES CAN I MAKE FROM THIS DOCUMENT?**

6. WHAT ARE THE THEMES EXTRACTED FROM THE DOCUMENT?

7. HOW DOES THIS DOCUMENT HELP ANSWER THE RESEARCH QUESTIONS?

Points	Tick
Provides a clear framework for data management.	
Promotes the sharing and re-use of research data.	
Provides training and support for researchers	
It requires researchers to create data management plans.	

APPENDIX F: GRAMMARIAN LETTER

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10 February 2024

LANGUAGE & TECHNICAL EDITING

The adoption of research data management practices by emerging researchers: A case study of emerging researchers at a higher education institution in the Western Cape, South Africa

A minor dissertation submitted in partial fulfilment of the requirements for the award of the degree of Master of Philosophy

Supervisor: Michelle Kahn

This is to confirm that I, Cheryl Thomson, executed the language and technical edit of the above-titled Minor Dissertation of **XABISO XESI, student number XSXXAB001**, at the UNIVERSITY OF CAPE TOWN, in preparation for submission of this dissertation for assessment.

Yours faithfully

Signed by Cheryl

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