Development strategies as catalysts for provision of the RDM services in the South African higher education institutions

Mpilo Mthembu[1] and Dennis Ocholla[2]
mthembusm@unizulu.ac.za ORCID: 0000-0002-0144-7643
OchollaD@unizulu.ac.za ORCID: 0000-0003-3860-1736

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A strategy in this paper was viewed as a plan of action for achieving the mission and vision of an organisation. This paper presents preliminary findings of the larger study which aimed to determine the strategies for research data management (RDM) at selected universities in KwaZulu-Natal. The current study used the community capability maturity model framework (CCMF) and the digital curation centre (DCC) lifecycle model as theoretical support to determine the strategies for RDM service provision with specific reference to the University of Zululand. The interpretive paradigm, following the qualitative research approach through a single case study, was used. Primary data was gathered through online interviews using Zoom and Teams with Librarians, Technicians, HODs, and DVC Research due to the Covid-19 pandemic and availability of technologies. The findings of the study revealed the University of Zululand does not have an RDM policy; however, research activities are practiced. The University lacks the infrastructure and investment to support RDM services and activities. The study is significant for providing the background for developing RDM in the public university through RDM strategy and policy. The findings also sought to inform the university's RDM agenda.

Keywords: Research Data Management, research policies, research infrastructure, research capacity building, South Africa

1 Introduction and background

Strategy, in this paper, refers to a plan of action for achieving the mission and vision of an organisation. Without a research data management strategy in an institution, it is like a central ship without a rudder. Thus, it is necessary to have policies, strategies, infrastructure, and adequate human resources. These are essential to manage data and understand its lifecycle, availability, accessibility, security, use, and reuse in an organisation, such as a university in this context. Chiware and Becker (2018) acknowledge that it is crucial to have research data management (RDM) policies to support the service delivery to researchers by responsible personnel such as librarians. Unfortunately, not all universities have RDM policies regulating their research data management, whereas some have procedural guidelines that help support RDM activities. Unal et al. (2019) acknowledge the United Kingdom as the most advanced nation regarding research and development of technologies, tools, and policies for RDM. The second aspect of the development strategies includes infrastructure. Proper infrastructure is a requirement for RDM services. However, most organisations are marked with improper infrastructure due to a lack of funding and support from parent organisations and external bodies (Lötter 2014; Cox & Pinfield 2014; Shearer 2015; Avuglah 2016; Chiware & Mathe 2015; Nhendodzashe & Pasipamire 2017; Morgan, Duffield & Hall 2017; Gunjal & Gaitanou 2017; Cox et al. 2017; Chigwada, Chiparausha & Kasiroori 2017; Yoon & Schultz 2017; Ng'eno 2018; Cox et al. 2019; Chawinga 2019; Avuglah & Underwood 2019; Anduvare 2019). Normally, organisations invest highly in infrastructure for service provision to their users. Therefore, organisations such as universities would consider the research needs before investing in infrastructure to support the development and provision of RDM services.

Another significant development strategy that supports RDM is capacity building, which is a process by which individuals and organisations acquire, improve, and retain the skills and knowledge required to do their job effectively. In most instances, organisations offer capacity-building programmes in the form of short courses and training. However, in the context of the current study, it is observed that very few universities in South Africa offer RDM capacity-building programmes. Examples of such universities are the University of Cape Town, the University of Pretoria, and the Cape Peninsula University of Technology. The whole idea of RDM policies, infrastructure, adequate resources, and programmes

1. Mpilo Mthembu is Lecturer in the Department of Information Studies at the University of Zululand
2. Dennis Ocholla is Senior Professor in the Department of Information Studies at the University of Zululand

are essential components that facilitate the proper management of research data in universities and other organisations dealing with abundant data.

2 Purpose of the study

This study aimed to determine the strategies for RDM service provision in South African higher education institutions particularly at the University of Zululand by answering three research questions:

- What is the status of RDM policies in South African universities?
- What is the infrastructure and investment for supporting RDM services in South African universities?
- Which capacity building programmes are available in South African universities to support RDM services?

3 Theory and literature review

The current study jointly applied the community capability model framework (CCMF) and the digital curation centre (DCC) lifecycle model. The CCMF is a tool designed to assist institutions, research funding bodies, and researchers in strengthening their communities' capabilities to conduct more data-intensive research (Lyon et al. 2012). Lyon et al. (2012) opine that data-intensive research can be performed by profiling the community's current readiness or capability, indicating priority areas for change and investment, and developing roadmaps for achieving a target state of preparedness. Lyon et al. (2012) also highlight two characteristics of the CCMF that are major indicators of data-intensive research in an institution: the involvement of intense computational analysis of data and a large amount of data, known as big data, that a research team could not review without software aid. The eight capability factors that form the basis of the CCMF are collaboration, skills and training, openness, technical infrastructure, standard practices, economic and business models, legal and ethical issues, and academic culture (Lyon et al. 2012).

The DCC Curation Lifecycle Model was developed in 2007 by the Digital Curation Centre (Constantopoulos et al. 2009). Higgins (2008: 134) asserts that the "Digital Curation Centre (DCC) Lifecycle Model has been developed as a generic, curation-specific tool, which can be used, in conjunction with relevant standards, to plan curation and preservation activities to different levels of granularity."

In this study, the two models (CCMF and DCC lifecycle model) were jointly used to investigate the status of RDM policies in South African universities; establish the infrastructure and investment to support RDM services and identify capacity-building programmes in the universities.

3.1 Status of RDM policies in universities

Not all universities have RDM policies in place. However, the United Kingdom (UK) is the most progressive in the practices of RDM and its policies among other nations of the world. For example, Horton and DCC (2016), in their "overview of UK institution RDM policies," highlight more than 20 universities with RDM policies, including the University of Southampton, University of Edinburgh, University of Warwick, University of Essex, University of Sheffield, Oxford Brookes University, University of Durham and Aston University, among others. Huang, Cox and Sbaffi (2021) concur that 80 universities in the United Kingdom already had an institutional RDM policy by 2016. Among other Western nations, Australia, Canada, and the United States have made significant progress in RDM.

Unfortunately, most African countries are in their infancy stage in providing RDM services. Encouragingly, Chiware and Becker (2018: 2) have identified the southern African region, among other African regions, to have "well established tertiary education institutions and leading research centres." For example, South Africa has some universities with RDM policies, namely, the University of Cape Town, University of South Africa, University of Pretoria, Stellenbosch University, and the Cape Peninsula University of Technology, whereas some like the Durban University of Technology have procedural guidelines, not necessarily RDM policies. RDM policies are required to provide uniform RDM services in a university context. Shearer (2015) believes that RDM policies cannot be adopted in isolation; therefore, good research data management practices depend on multiple factors such as incentives, skills/expertise, services, infrastructure, funding, and procedures. Such factors are trusted to create a background that supports RDM in an institution, a university in this context. Though RDM policies are perceived as significant for providing RDM services in universities, most universities currently have no RDM policies.

Elsewhere, Huang, Cox and Sbaffi (2020) reveal that Chinese universities (like African universities) are still at the infancy stage of RDM; there was only one university with an accessible RDM policy, which was adopted, with no record of revision afterwards, from Oxford University policy. Ng'eno (2018) highlights that RDM policies and regulations were outdated from the study surveyed research institutions in Kenya. The findings of Piracha and Ameen (2019) on ‘policy and planning of research data management in university libraries of Pakistan’ show that most of the libraries surveyed did not have formal

RDM policies, and some of them had no policy and are not planning to have one. It is revealed by Piracha and Ameen (2019) that RDM is a very new area in Pakistan. They suggest developing a uniform RDM policy from the Higher Education Commission (HEC) for universities. This idea, we believe, is something worth pursuing in South Africa if already not in progress.

3.2 Infrastructure and investment of RDM in universities

Investment and infrastructure in RDM are crucial for its development. Björnemalm et al. (2020), in the white paper 'on advancing research data management in science and technology, describe a reliable research data infrastructure as a central component of any RDM service. Ramoutar-Prieschl and Hachigonta (2020) strongly believe that research infrastructures form an integral part of science, technology, and innovation (STI) and are used by the scientific community to conduct leading-edge research, knowledge transmission, knowledge exchange, and knowledge preservation. Ramoutar-Prieschl and Hachigonta (2020: 31), citing the Group of Senior Officials (2017), states that "global research infrastructures (GRIs) are critical enablers for advancing scientific knowledge, research outputs and innovations, as well as accelerating the training and development of the next generation researchers." Mushi, Pienaar and van Deventer (2020) observe that RDM policy and strategies are relevant for sustainable RDM services in a university setting. The authors further highlight that institutions appear to be investing heavily in infrastructure to address the challenge of data storage. Ramoutar-Prieschl and Hachigonta (2020) suggested the need to carefully plan, implement and invest in infrastructure by considering the strategic leveraging and sharing of resources among key stakeholders at the national, regional and global levels.

This suggestion correlates with the submission by Chiware and Mathe (2016) that Cape Peninsula University of Technology libraries had to run a pilot project with some research groups before fully setting up the infrastructure for RDM support. Several studies (Lötter 2014; Cox & Pinfield 2014; Shearer 2015; Avuglah 2016; Chiware & Mathe 2016; Nhendodzashe & Pasipamire 2017; Cox et al., 2017; Chigwada, Chiparausha & Kasiroori 2017; Ng'eno 2018; Cox et al. 2019, Chawinga 2019; Avuglah & Underwood 2019; Anduvare 2019) note the paucity of infrastructure, due to a lack of funding, as one of the biggest challenges affecting RDM services in most universities. Funding has been seen to be problematic in both developing and developed nations of the world. In 2006, Piperakis and Pouris observed a huge deficit of modern research equipment in South Africa, which required infrastructural investment. On the same note, Mushi, Pienaar and Deventer (2020) mention that investments have been made through the National Research Foundation (NRF) to help improve research equipment in research institutions in South Africa during the past decade. Again, these authors point out that the NRF awarded a total of 408 grants to 33 research institutions, including 23 universities and ten other research performing institutions, in February 2019.

3.3 Capacity building programmes for supporting RMD services in universities

Normally, capacity building is a platform that allows individuals and organisations to acquire, improve, and retain skills and knowledge required for effective job performance. Capacity building programmes are usually offered as short courses and training in universities. In the literature, the Leeds Building Capacity Project (LBC) is one of the global projects in which libraries participate in RDM practices. The project also aims to apply the "outputs and outcomes from existing JISC projects, services and intelligence to enhance research, learning and teaching at Leeds" (Gunjal & Gaitanou 2017: 2). In the South African context, Kahn et al. (2014: 29) mention that there is already available activity with regards to awareness and capacity building, and they further highlight the Network of Data and Information Curation Communities (NeDICC), which is said to "arrange seminars, workshops and conferences to promote awareness around digital (including data) curation aimed at practitioners and managers involved with digital object management and encourage the growth of knowledge in this area". Another example of a capacity-building platform in SA is the UCT's Library and Information Studies Centre (LISC), which offers a master’s degree module in Digital Curation.

On the other hand, LIASA's Higher Education Libraries Interest Group hosted an RDM workshop facilitated by the Digital Curation Centre (DCC) in Cape Town in March 2014. Capacity building programmes can enhance collaboration between departments, institutions, or external bodies regarding the relationships they form during research processes. Collaboration is one of the eight capability factors in the employed CCMF. The Cape Peninsula University of Technology (CPUT) has set out several working groups at collaborative and institutional levels to help implement RDM (Chiware & Mathe 2016). In contrast, Van Wyk (2018) reports five (5) pilot projects implemented using Alfresco as a testing platform in 2013-2015 at the University of Pretoria to get an insight into researchers' needs for RDM services and activities. Further, Wiljes and Cimiano (2019) point out that the university also offers a workshop on RDM, particularly designated for researchers, by recognising wide-ranging capabilities of managing research data in various disciplines.

3.3 Gaps or limitations in the literature

This study provides evidence that RDM is an emerging global practice in universities and other research centres. However, there is limited literature on RDM in African studies. RDM has received the most attention in western nations dominated by European publications. The review of the related literature has revealed several gaps that are believed to hinder the proper provision of RDM services in universities. The first identified gap relates to the lack of RDM policies. Some universities simply have procedural guidelines that support RDM activities or nothing at all. A university's lack of relevant RDM policies is more likely to hinder research data management, as research data is ever-growing and abundant. The second gap is the scarcity of financial support for RDM services. Financial constraints are experienced worldwide but are most prevalent in developing countries. It is widely recognised that institutional resources or infrastructure are highly dependent on finance. The third limitation is a lack of resources or proper infrastructure to support the services of RDM. Proper infrastructure is a requirement for RDM; however, most organisations do not have proper infrastructure due to a lack of support from parent organisations and other stakeholders. Human resources and skills or expertise are deficient. Most authors affirm that staff responsible for RDM provision and researchers lack relevant skills and knowledge. The literature reviews also highlighted that very few universities have RDM development programmes, usually offered through short courses and training. More work is therefore required to fill the gaps identified in the related studies.

4 Methodology

This study employed an interpretivist research paradigm. A qualitative research approach through a case study was used to collect primary data from study participants. The purposive sampling technique grounded under the nonprobability sampling method was used to select two (2) Librarians dealing with metadata and electronic resources, one (1) Technician, four (4) Heads of the Departments (HODs) and one (1) Deputy Vice Chancellor (DVC) Research as the study participants from the University of Zululand for a start. Owing to the current COVID-19 pandemic regulations, all interviews were conducted online through Zoom and Teams. At the beginning of conducting each interview, a brief description of the study was articulated. After the introduction and briefing, permission was requested to record the interviews before each interview began. The use of semi-structured interviews in the present study was informed by previous related studies (Avuglah 2016; Patterton 2016; Chiware & Mathe 2016; Ng'eno 2018; Chiware & Becker 2018; Chawinga 2019).

There are several qualitative data analysis techniques, such as discursive, thematic, structured, and instrumental, and thematic data analysis, among others (Ngulube 2015), but the thematic method was deemed suitable and employed for the current research. Thematic data analysis is predominantly a fundamental analysis for qualitative research studies. The choice of qualitative thematic data analysis was informed by related studies (Avuglah 2016; Ng'eno 2018; Chawinga 2019). In the current study, narrations from interviews were organised, sorted, arranged and transcribed. All data were carefully read through to get a general sense of the information gathered on RDM, which helped to get a reflection of the overall meaning. After studying the data, it was coded. Coding is the process of categorising the text data collected and labelling them with terms, which are usually the actual language of the participants (Creswell 2014; Kumar 2011). The coding of responses for this study was achieved by categorising the collected data into themes derived from the set objectives of the study. This was done to create a text-based version of the original audio that was recorded during the interviews. Coding was achieved through the use of direct quotes or verbatim narratives and by paraphrasing some responses from study participants. The results of this preliminary study are reported in the next section.

5 Results

The results of this study are from the eight participants from different departments or sections interviewed at the University of Zululand, as there was a very low participation at the time of reporting- from the three targeted institutions due to the Covid-19 pandemic. The study participants were identified, and their responses are coded as P1- Librarian 1, P2- Librarian 2, P3- Technician, P4- HOD 1, P5- HOD 2, P6- HOD 3, P7- HOD 4 and P8- DVC Research. The results are interpreted per the following research themes:

5.1 The status of RDM policies in universities

Participants were asked about the RDM policies available in the institution. Also covered under this question were the issues of intellectual property rights. The eight interviewed participants indicated that the institution (University of Zululand) does not have any RDM policy. P3 brought to attention that "we have been planning to have RDM policy as we have a quite close partnership with the research office". P8 added that "though the University does not have any available RDM policy, it defines its research practices through using related policies like research ethics policy." P8 also indicated that only one department "planning" has started RDM in the institution (UNIZULU). These submissions imply that UNIZULU is still in the infancy stage in terms of RDM services. Regarding participants' views about ownership of the intellectual property rights for

research data in the institution, seven (7) of them mentioned the institution's intellectual property rights. P8 further indicated that "intellectual property rights are owned by both the institution and the researcher".

5.2 The infrastructure and investment for supporting RDM

Participants were asked to share their opinions on the infrastructure and human resources for RDM practices and services. Most of the participants indicated that there are insufficient resources to provide RDM services at the institution. However, P4 felt that their department has enough resources to provide RDM services as they have research-related information that is readily available. However, they only need a database that will belong to the department to avoid the duplication of resources. P7 also indicated that there is a need to have sufficient resources for the provision of RDM services and activities. In terms of human resources, the majority of the participants felt that there is a scarcity of human resources to provide RDM services in the institution. Most of the participants vouched for RDM training for already employed staff to provide and support RDM services in their departments. The relevance of training is also affirmed by Lyon et al. (2012), who allude to the significance of training, which can be provided through early education and professional development. Skills/training is one of the eight capability factors employed by CCMF.

5.3 Capacity building programmes available in universities to support RDM services

Participants were asked to share their perceptions about the capacity-building programmes and strategies available to develop skills to provide RDM services. Most of the participants indicated that there are no specific capacity building programmes and strategies to develop RDM skills. Their departments are currently not offering any RDM services. Instead, P7 articulated that "there are other capacity-building programmes for those who want to update or improve their qualifications, for example, seminars on SSDP and other research-related tools, other than those specifically addressing RDM". In terms of the external opportunities for developing staff for RDM, P4 stated that "not RDM specifically". P7 was not sure if there is any external opportunity. P3 acknowledged that "we organised the RDM training, and the research office was participating". The training was helpful, but there is no progress after the training because the library had to redefine its services as far as the Covid-19 pandemic is concerned". The findings are discussed in the next section.

6 Discussion of findings

The research questions guide the discussion of the findings in this section.

6.1 What is the status of RDM policies in universities?

The findings revealed that the participating institution currently does not have an RDM policy that facilitates its research data management. This aligns with the findings of previous relevant literature, which revealed that most higher education institutions, predominantly those in Africa, do not have RDM policies, as they are still in the implementation stage of the RDM services. Among other countries around the world, Unal et al. (2019) acknowledge that the United Kingdom is the most advanced nation in terms of RDM. In the South African context, very few universities have RDM policies, like the University of Cape Town, the University of Pretoria, and the Cape Peninsula University of Technology. Macanda, Rammutloa and Bezuidenhout (2015) report that the University of South Africa (UNISA) has completed an investigation on RDM as part of the plan to establish their research data management. The Durban University of Technology (DUT) does not have an exact RDM policy. Instead, it provides the guidelines for research data storage to facilitate good practise in research data storage and maintenance.

Chiware and Becker (2018) acknowledge that it is extremely important to have or develop and implement RDM policies in organisations, particularly universities, to help support the delivery of RDM services. Legal and ethical issues are covered in the CCMF as the seventh capability factor of this model, which Lyon et al. (2012) view as exclusively addressing the ethical issues that are usually embedded in data sharing practices, which could then help in the provision of restrictions for data-intensive research institutions. Shearer (2015), Chigwada, Chiparausha and Kasiroori (2017) also affirm the necessity of having an RDM policy to answer claims of misconduct in research studies and assist in the guarding of intellectual property. Though RDM policies are perceived as significant for providing RDM services in universities, they have been marked with some deficiencies. For example, the study by Ng'eno (2018: 28) brought to attention that the "RDM legal framework did not exist in the institutes surveyed; the RDM policies and regulations were outdated; there was limited RDM awareness and advocacy; the institutes lacked RDM security systems; the institutes suffered from lack of inadequate RDM guidelines on standardisation and technical infrastructure". In this sense, Kahn et al. (2014) emphasise a need for RDM policy to be developed by more than one stakeholder.

6.2 What is the infrastructure and investment for supporting RDM services in universities?

The responses from participants showed that the institution lacks resources and well-equipped staff for the provision of RDM services. The narration from participants confirms the findings by Nhendodzashe and Pasipamire (2017); Mushi, Pienaar and van Deventer (2020) report that RDM practice in developing countries is very limited due to several deficiencies, including infrastructure, resources, financial constraints, a collaboration between stakeholders, and human capabilities; all of which are strong threats hindering the provision of RDM services. Therefore, good infrastructure in a university context is the key to the provision of RDM services. This submission is confirmed by Lyon et al. (2012), guided by the CCMF, that technical infrastructure supporting research is marked with necessary tools and services in line with different stages of the research life cycle. Chiware and Mathe (2016) also postulated that the Cape Peninsula University of Technology libraries invested in a pilot project before providing full-service infrastructure that supports RDM.

Similarly, Shearer (2015) observes a divided infrastructure for research data management in Canada, with some fields having very good coverage and others having very little. This eventually resulted in the poor provision of RDM services. It could be argued that a proper infrastructure should support all the processes of the research lifecycle right from the beginning of the research data management plan until the publication of the final results. In terms of investments, Lyon et al. (2012) report the economic and business models, which are part of the eight capability factors of the employed CCMF. The authors highlight that investments will be made in organisations to achieve the goal of data-intensive research. In this sense, universities should invest in existing and new infrastructure to support their research data management.

6.3 Which capacity building programmes are available in the universities to support RDM service?

There are currently no specific capacity-building programmes and strategies for developing RDM skills in the studied institution. There is only one department currently offering RDM in the whole university. This department (planning) is still in the infancy stage of implementation. However, it is worth noting that there are some capacity building programmes and projects for supporting RDM in some universities in South Africa and other countries. For example, Kahn et al. (2014: 298) highlight the Network of Data and Information Curation Communities (NeDICC), which is said to "arrange seminars, workshops and conferences to promote awareness around digital (including data) curation aimed at practitioners and managers involved with digital object management and encourage the growth of knowledge in this area" in South Africa. Another example of a capacity-building platform is the UCT Library and Information Studies Centre (LISC), which offers a master's degree module in Digital Curation. Kuhn et al. (2014) believe that since there has been a growing interest in RDM in South Africa, with the attendant need for capacity building in this area, the LIASA's Higher Education Libraries Interest Group hosted a workshop on RDM, which was facilitated by the Digital Curation Centre (DCC) in Cape Town in March 2014.

Again, Chiware and Mathe (2016) point out that the Cape Peninsula University of Technology (CPUT) has set out several working groups at a collaborative and institutional level to help implement RDM. The working groups include communication tools and researcher profiles; reference management system and visualisation of data; research plan and electronic project journal; and search functionalities, semantic methods, and search engine optimisation. Van Wyk (2017) discussed five (5) pilot projects implemented in 2013-2015 at the University of Pretoria to provide insight into researchers' needs regarding RDM services and activities. Globally, Gunjal and Gaitanou (2017) highlight the Leeds Building Capacity Project (LBC) as one of the global projects whereby libraries participate in RDM practices. Hence, it is important to note that capacity-building programmes are relevant platforms to enhance collaboration across departments, institutions, or external bodies during research processes.

7 Conclusions

This is a preliminary study based on qualitative research conducted at the University of Zululand that is part of a larger study on RDM covering three universities in KwaZulu Natal. Guided by the Community Capability Model Framework (CCMF) and the Digital Curation Centre (DCC) lifecycle model, this study examined development strategies as catalysts for providing RDM services in a South African higher education institution based in the province of KwaZulu-Natal. The study revealed a lack of RDM policy in the studied institution and a scarcity of resources that support the provision of RDM services. There is also a lack of well-trained staff to support RDM activities in the institution. In addition, there are currently no known capacity-building programmes in the institution. Some capacity-building programmes in the institution mentioned in the study are not specifically designed to aid RDM. There is a glimpse of the RDM initiative within the planning unit of the university that is still not widely known within the institution.

The study only presented preliminary findings based on qualitative data collected from one of the three institutions targeted in KwaZulu-Natal due to the Covid-19 pandemic restrictions. As this study employed a case study, as a rule, the

results cannot be generalized. However, the preliminary findings do provide new information for informing RDM at the Institution and for comparative studies.

Given that there is a lack of RDM policies in most universities, the study recommends that more than one stakeholder develop an RDM policy in an organisation, including publishers, information professionals, and researchers. The study also recommends that institutions of higher learning first do proper planning before choosing an infrastructure to support the provision of RDM services. They should also invest in some already implemented infrastructure (e.g., institutional repository) and new ones to avoid duplication of efforts. Again, the study suggests a strong need for RDM training for already employed staff to provide and support the services of RDM in their departments. Capacity-building programmes should be offered as short courses, workshops, training and/or seminars in universities to support RDM services.

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