Management and maintenance of research data by researchers in Zimbabwe

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Abstract

Purpose – The concept of research data management (RDM) is new in Zimbabwe and other developing countries. Research institutions are developing research data repositories and promoting the archiving of research data. As a way of creating awareness to researchers on RDM, the purpose of this paper is to determine how researchers are managing their research data and whether they are aware of the developments that are taking place in RDM.

Design/methodology/approach – A survey using a mixed method approach was done and an online questionnaire was administered to 100 researchers in thirty research institutions in Zimbabwe. Purposive sampling was done by choosing participants from the authors of articles published in journals indexed by Google Scholar, Scopus and Web of Science. Interviews were done with five top researchers. The data was analysed using NVIVO. The results were presented thematically. The questionnaire was distributed using the research offices of the selected 30 research institutions. There was a 75% response rate.

Findings – The findings indicated that all the researchers are aware of the traditional way of managing research data. A total of 70% of the respondents are not aware of the current trends in RDM services, as they are keeping their data on machines and external hard drives, while 97.3% perceive RDM services as useful, as it is now a requirement when applying for research grants. Librarians have a bigger role to play in creating awareness on RDM among researchers and hosting the data repositories for archiving research data.

Practical implications – Research institutions can invest in research data services and develop data repositories. Librarians will participate in educating researchers to come up with data management plans before they embark on a research project. This study also helps to showcase the strategies that can be used in awareness creation campaigns. The findings can also be used in teaching RDM in library schools and influence public policy both at institutional and national level.

Social implications – This study will assist in building capacity among stakeholders about RDM. Based on the findings, research institutions should prioritise research data services to develop skills and knowledge among librarians and researchers.

Originality/value – Few researches on RDM practices in Zimbabwe were done previously. Most of the papers that were published document the perception of librarians towards RDM, but this study focused mainly on researchers' awareness and perception. The subject is still new and people are beginning to research on it and create awareness amongst the stakeholders in Zimbabwe.

Keywords Research data management, Research data sharing, Research data services, Awareness and perception, FAIR data principles, Research data awareness, Research data perception

Paper type Research paper

Introduction

Research data management (RDM) is a new concept in most countries including Zimbabwe and institutions are finding ways of moving along with the current trends in RDM. Previous research done in Zimbabwe (Chigwada *et al.*, 2017; Ndhlovu and Ngwenya, 2017; Nhendodzashe and Pasipamire, 2017; Chigwada *et al.*, 2019; Chiparausha and Chigwada, 2019) indicated that some researchers are not willing to archive and share their research

data and there are no data repositories in their institutions. The findings from these studies also revealed that librarians are spearheading most of the RDM activities in research institutions. The process of RDM help to have high quality data sets, as a plan is used to manage the data from the research project planning stage. The data sets from these research projects would be complying with the scholarly, legal and ethical requirements and ensure the long-term preservation of these data sets through archiving. Using the FAIR (**F**indable, **A**ccessible, **I**nteroperable, **R**eusable) data principles, it makes it easier to share and reuse the data sets if the data management plan is well laid out.

According to the University of Oxford (2019) RDM covers the organisation, structuring, storing and curing of data that is generated during the research project. It is now a requirement when applying for research grants where researchers are supposed to provide data management plans and the new concept of data sharing amongst researchers had increased the importance of RDM. Research institutions are generating a lot of research data in various formats forcing these institutions to develop policies and procedures to manage the data and assist researchers to create, collect, manipulate, analyse, store and preserve the data sets (Majid *et al.*, 2018). The advent of open research data has also pushed researchers to consider managing and archiving their research data especially those from publicly funded research projects (Johnson and Åhlfeldt, 2015). The objectives of this study were:

- to ascertain the role of researchers in RDM;
- to determine how researchers manage their data;
- to assess the awareness and perceptions of researchers towards RDM; and
- to discuss the challenges faced by researchers when managing research data.

Contextual setting

In Zimbabwe, there are research institutions responsible for generating new knowledge including universities, both private and public and non-governmental organisations. RDM is a new concept in Zimbabwe and a study done by Chigwada *et al.* (2017) showed that researchers are responsible for managing their research data and research institutions are worried about their research output only which they archive in institutional repositories. A study done by Nhendodzashe and Pasipamire (2017) showed that the University of Zimbabwe Library was preparing for RDM services, as it had the technological infrastructure and economic resources, but they lack the legal framework and skills needed throughout the research data lifecycle. Ndhlovu (2018) looked at the preparedness of the National University of Science and Technology (NUST) to offer digital curation and preservation services.

International initiatives

There have been major developments in the international arena concerning the issue of RDM. The Brussels declaration (STM, 2007) advocated for the free availability of data sets and this has been stressed by the Bermuda principles as well. The 1996 Bermuda Principles were declared at a summit in Bermuda where leaders of the Human Genome Project agreed on a revolutionary set of principles requiring all DNA sequence data to be publicly accessible 24 h after generation (Cook-Deegan *et al.*, 2017; Jones *et al.*, 2018). The White House Office of Science and Technology Policy (White House Office of Science and Technology, 2013), stressed that research conducted using public funds should be accessed freely. Major journals such as Nature, Science, PLOSONE and other publishers like Elsevier and Springer are emphasising that researchers should submit manuscripts accompanied by the raw data that was used to get the findings (Tripathi *et al.*, 2017). The data sets should be

publicly accessible and reusable. Grant applicants of the National Institutes of Health (NIH), National Science Foundation, USA, are required to write proposals with data management and sharing plans to indicate how their data sets are managed. According to the Wellcome Trust (2016), all the Zika virus outbreak research data and other public health emergencies should be available as open data. A global research data repository, Re3data was developed to register research data repositories from different subject areas (Re3data, 2019). Currently, the registry indexes about 1,500 data repositories from all the countries.

Problem statement

There are no research data repositories in Zimbabwe to suit the need for archiving open research data to meet the requirement of some research grant funders. Although the issue of open access has been talked about for a long time, researchers are not willing to open their research data. A study that was done by COAR (2017) showed a 2% response from Africa of researchers who were prepared to participate in RDM services. Kennan and Markauskaite (2015) stated that little is known about researcher's data management and concerns. However, there is increasing pressure from funders, publishers, the public, universities and other research organisations for researchers to archive their research data as a way of improving data management and sharing practices (Chiware and Mathe, 2015; Bezuidenhout and Chakauya, 2018; Tenopir *et al.*, 2018; Zhou, 2018; Cox *et al.*, 2019). This study gives answers to how researchers are managing and maintaining their research data.

Role of researchers in research data management

Researchers have a bigger role than other stakeholders to play in RDM to ensure that their data is properly managed although they work with other players. These are the creators and users of research data and they are responsible for ensuring that RDM is part of the grant proposal to cater for cost and time implications of data storage, management and sharing. Researchers should be aware of the FAIR data principles so that they incorporate them when writing the data management plans. This will assist them in developing and recording appropriate procedures to collect, annotate, store and back-up data, as well as to use, reuse, access and retain research data. Researchers should ensure that the integrity and security of the data is maintained and good practices in RDM are consistently followed. If researchers are aware of how to manage their research data, there is greater efficiency and improved transparency of the scientific process (European Commission, 2013). Bezuidenhout and Chakauya (2018) stressed the need for buy-in from scientists and incentivising them for data sharing to increase the visibility of the researchers' data leading to more citations.

How do researchers manage their data?

Marchionini (2012), Whitmire *et al.* (2015) and Chigwada *et al.* (2017) stated that some researchers were managing their own research data and most were not aware of the trending issues in RDM. Those researchers who are aware of research data services were using university provided services or external services using the registry of research data repositories to identify those that fit their subject areas. Buys and Shaw (2015) added that some researchers store their data on local hard drives, departmental servers or cloud based storage facilities. There was a study in India which indicated that researchers kept their data in computer storage options such as CDs, DVDs, portable hard disks and pen drives (Tripathi *et al.*, 2017). These researchers will maintain their research data using graphs, tables, SPSS spreadsheets, CSV and .xls files. Ndhlovu and Ngwenya (2017) stated that some researchers were collecting data using out dated formats and data management was not informed by good practices. They added that most researchers in communication and

information science were not willing to share their data while those in applied sciences pointed out that access restriction to data should be done for some period of time when sharing research data.

Awareness and perception of research data management

Mosha *et al.* (2019) noted that RDM for researchers in Sub-Saharan Africa is still in its infancy and there is need to create more awareness of the service and researchers should have motivation to share their data. Some researchers are aware of certain data management support services that are offered by their institutions according to Marchionini (2012). According to Buys and Shaw (2015), researchers perceive RDM as important and most of them are willing to share their data after publishing or when it is a requirement by funders. However, some of the researchers indicated that they can only share the data upon request. Kennan and Markauskaite (2015) stated that there is lack of awareness of researchers' needs and researchers are not involved in the development of policies and infrastructures which discourage the uptake of good data management practices. In terms of data sharing, most researchers are worried about their rights to the data sets while others observed that publishing the data in journal articles is enough for data sharing. However, this does not include enough data which can allow replicating the results (Tripathi *et al.*, 2017).

A study by Tenopir *et al.* (2018) concluded that the attitudes of researchers towards data sharing were positive but they had concerns about sharing their own research data fearing misuse of the data. Ndhlovu and Ngwenya (2017) shared the same sentiments, as the findings from their study showed that although researchers know the subject of RDM, their perception towards data sharing is negative, as there are no institutional standards and policies to protect their data from misuse. This perception can be changed by offering training on RDM and providing assistance to researchers on good data management practices. Tenopir *et al.* (2015) and Wallis *et al.* (2013) stressed that researchers are willing to share their data if there is a guarantee of citations for their work and if their rights as researchers and authors are protected.

Challenges faced by researchers when managing research data

The challenges that are faced by researchers with regard to RDM vary according to their discipline, institutional and national context (Erway, 2013; Flores *et al.*, 2015; Tenopir *et al.*, 2018). Researchers are faced with the challenge of determining an appropriate repository for data preservation and sharing. Some data stewards impose data repositories upon researchers and researchers should know different features, functionalities, fees and limits on the number or size of data sets that can be archived in a repository (Baker and Yarmey, 2009; MetaArchive Cooperative Outreach Committee, 2015). Some researchers struggle with creating metadata for their research data and some use non-standardised methods in documenting their data or fail to document the data (Tenopir *et al.*, 2011; Steinhart *et al.*, 2012; Rolando *et al.*, 2013). Yoon (2017) and Tenopir *et al.* (2018) added that lack of metadata standardisation prevents researchers to share research data. The proposed solution for this challenge was to train researchers and improve metadata standards to increase the discoverability, validity and accessibility of data sets.

The availability of digital data led to the increased use of computer based data collection and analysis leading to big data and data overload (Kennan and Markauskaite, 2015). According to Harvey (2010), challenges that emerged from digital data management and curation are technology obsolescence, technology fragility, lack of guidelines on good practice, inadequate financial and human resources to manage the data and lack of evidence about best infrastructure. Ndhlovu and Ngwenya (2017) added that most researchers do not

have the necessary skills to create data management plans and inability to handle research materials proficiently owing to the growing amount of scientific data. This is coupled by the unavailability of data management policies in universities and the time and effort required in doing proper RDM. Chiware and Mathe (2015) pointed out that challenges being faced in South Africa include limited data management skills by library staff, lack of resources and infrastructure for RDM. Cox *et al.* (2012) added that librarians lack the skills and understanding of the diversity of research data in different disciplines as well as the various data practices. Therefore, it is important for institutions to create and raise awareness on good data sharing practices and librarians have a responsibility of changing the perception of researchers towards RDM. Tenopir *et al.* (2012) and Tenopir *et al.* (2014) indicated that the skillsets challenge can be overcome by reassigning the existing staff roles and offer the appropriate training to the librarians.

Tenopir *et al.* (2018) indicated that geographic location also affects the attitude of researchers towards data sharing, for example, in middle or low income countries, there are challenges of research support, poor infrastructure and limitations in resource provision leading to a negative attitude towards RDM by researchers. Bezuidenhout and Chakauya (2018) stated that researchers are concerned about losing their intellectual property rights, data misuse and failure of attribution. They added that lack of funding, the digital divide, absence of ICTs, internet provisions and lack of computer literacy lack of commitment from the government, international science community and key stakeholders and the disincentivisation of data sharing all contribute to low perception towards RDM by researchers. The findings of a study done by Tenopir *et al.* (2018) showed that researchers are not aware of the availability of information experts on RDM in their institutional libraries. This calls for a need for librarians to market their RDM role in the research life cycle so that researchers are aware of the assistance they can get from the library.

Methodology

An online questionnaire was created on Survey Monkey and administered to 100 researchers in 30 research institutions in Zimbabwe. Purposive sampling was used to choose the respondents who were drawn from authors who published journals indexed on Google scholar, Scopus and Web of Science. Telephone interviews were done with top five researchers who were purposively chosen from the participants. These researchers were chosen on the basis of their number of papers they had in the three databases combined together using purposive sampling. Purposive sampling was used for both the interview and questionnaire, as there were pre-requisites of publishing in a journal that was indexed by Google scholar, Scopus or Web of Science. These indexing databases were selected because most of the journals are now requesting authors to archive their research data when submitting manuscripts. The databases also index journals which are favoured by most researchers because of their high impact factor which is needed by most research institutions in Zimbabwe.

The questionnaire was mixed whereby both open ended and closed questions with the option of "other" were included to get the views of respondents on the subject of RDM. The questionnaire had 10 questions which are accommodated by the free version of survey monkey. The objectives of the study guided the crafting of the questionnaire, and it was pilot tested with librarians who are researchers at Bindura University of Science Education. The results of the pilot study were presented at the International Data Week SciData Conference in Botswana as a poster. There was a 75% response rate and content analysis and NVIVO software were used to analyse both the qualitative and quantitative data. The findings were presented thematically from both data sets.

GKMC

In Sub-Saharan Africa, Tanzania and South Africa were regarded as countries which are practising RDM services, while RDM is still in its infancy in other countries (Mosha *et al.*, 2019). In Zimbabwe, previously, the subject of RDM focused more in the health and medical fields as stated in the Handbook of Cancer Research in Africa (World Health Organisation, 2013). It stated that the domain of data management applied to health research or clinical and public health data which was used for research purposes. The issue of poor data quality and data integrity were pointed out as the challenges in data management in Africa, and these are caused by lack of skills in using the data collection systems, infrastructure and the available resources.

Findings

The summary of the findings revealed that 8% of the respondents were not sure what RDM is, 70% were not aware of the current trends in RDM, 97.3% indicated that it is necessary to manage research data (73 out of 75 respondents), 2.7% (2 out of 75) strongly disagreed on the importance of managing research data, 50.7% get assistance from librarians to identify a research data repository, 100% indicated that they face challenges in RDM.

The respondents were asked whether it is necessary to manage research data and the findings are shown in Figure 1. A total of 66 respondents strongly agree on the need to manage research data and this shows that they are aware of the importance of RDM in research and they perceive it as a noble cause.

The five researchers who were interviewed pointed out that it is very important to manage research data when doing research as indicated below:

When you are a renowned researcher who had worked in many research projects and received some research grants, you will understand the importance of research data management. Nowadays, the management of research data is very important since it is a requirement when applying for grants. Therefore, as a researcher, I should be knowledgeable about how to draw a workable and meaningful data management plan.

It's important to manage research data throughout the research process.

I have received some grants where it was a requirement to submit a workable data management plan. Therefore, it is important to know the subject of research data management.

I encourage all the researchers to learn about research data management since it is key in the research process.
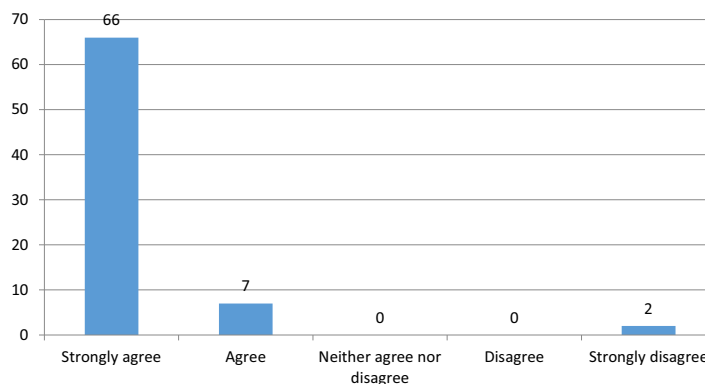

Figure 1.
Is it necessary to manage research data?

> I strongly agree that researchers should manage their research data. We have been doing this since time immemorial. The difference now is that we have to archive the data in a data repository now unlike long ago when we destroy the data after publishing an article.

The study sought to find out how the researchers store their research data during and after the research. Only 7 respondents indicated that they use the data repositories on their institutional repositories which are being piloted, while 16 use external research data repositories as indicated by Figure 2. Respondents who chose "other" were 20 and 12 of them use their e-mails and laptops, 5 use external hard drives, 1 uses one drive, 1 uses Mendeley data, and 1 indicated that he/she uses all of the above methods. These results show that researchers have some knowledge of RDM in Zimbabwe although they are not willing to share their data.

Those who were interviewed stated that they have been managing their data ever, as they started to do research although they were keeping it for a short period of time in their drawers. They indicated that:

> I have been keeping my collected data in my drawer ever since I started research before the invention of computers. Now I am using information communication technologies to collect my data and it has been easy to manage my data. I keep my research data on my laptop and external hard drive for a period of five years. Since it is a new concept, I am trying to study the concept of research data management so that I would be in a position to manage my data throughout the research process.

> I learnt about research data management when I was on sabbatical leave, and I now deposit my research data in a research data repository. I get assistance from the library in identifying the correct data repository.

> I have a dropbox account where I put all my important documents including my research data.

> I used to keep my research data in the files at work but now ICT allowed me to use Google drive for storing my research data.

> I use my external hard drive for storing my research data.

The results showed that some researchers are new to RDM, and there is need to build capacity to ensure that they move along with the current trends. The findings also showed that librarians have a major role to play in assisting researchers to manage their research data as indicated by 38 respondents who seek assistance from librarians to identify the correct research data repository to archive their data, 14 uses the repository finder, 20 use
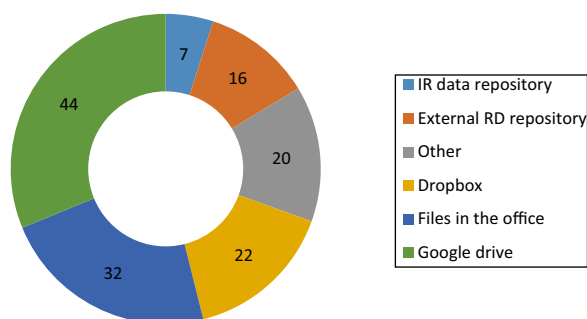

Figure 2.
Where do you store
your research data?

repositories recommended by research funder, while 15 use other methods. Figure 3 shows how researchers find appropriate repositories for archiving their research data.

A total of 15 respondents who chose "other" pointed out that 3 do not have data management policies at their institutions and researchers do it on their own, 3 get assistance on the internet online, 4 self-discovery, 2 never used repositories, and 3 IT technician team. This shows that researchers are aware of the data repository finders and are willing to explore and learn more about these repositories.

Researchers who were interviewed indicated that they are working with the librarians to fully understand the concept of RDM and gain the skills and knowledge needed to efficiently manage their research data. The researchers interviewed stated that:

> The concept of research data management is still new to me and I am still learning on how I can fully utilise the benefits of research data management. I have been working with the librarian who has been assisting me with the requisite skills needed in drawing a data management plan but I am yet to grasp the concept. As a result, I am still depending on the librarian on that part.

> The librarians introduced the concept of research data management to me and ever since, I have been working with them to manage and archive my research data.

> Librarians at my institution are very innovative and have been building their capacity in that area to help us as researchers to understand the concept.

> The librarians are information professionals who teach us about emerging issues in the research process and the development of data management plans was one of the areas we were taught during various research clinics.

> I enjoy working with the librarians because they assist me throughout the research process. I collaborate with them from idea generation up to impact assessment. When they introduced the research data management concept, I was happy to partner with them.

Librarians and other researchers had also been instrumental in creating awareness towards RDM. The findings revealed that 16 researchers knew about RDM from librarians while 29 got the information from other researchers. Respondents who indicated "other" stated that they got to know about RDM through the Medical Research Council of Zimbabwe (one), internet (three), Faculty seminar (one), MSC library (one) and information science course and from own research (one). Figure 4 indicates how researchers knew about RDM.

Information gathered from those who were interviewed pointed to the research grant funders and publishers. The interviewees had this to say:
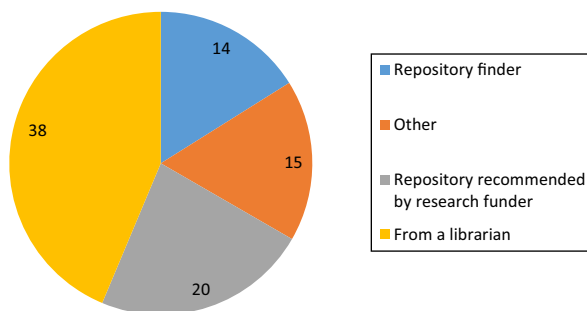

Figure 3.
How researchers find appropriate data repositories to archive data?

I was shocked when I wanted to submit my article for publishing and there was a note stating
that I should archive the research data which I used to get the findings. As a researcher, I didn't
expect this to be a condition since it is my choice whether I want to archive the data or not.

As I was applying for a research grant, I saw a statement which showed that I was supposed to
submit a data management plan as part of my application package. As a result, I was forced to
consult the librarian for assistance on how best I could come up with such documents.

I attended a conference where it was stated that researchers should manage their research data
and archive it at the end of the project to ensure that it is accessible to other researchers to avoid
duplication.

I was collaborating with researchers from other institutions who indicated that we should manage
the research data of our project.

During the open data day, librarians talked about the issue of research data management and
from that time, I was interested in knowing more. I kept in touch with the librarians and I have
been working with them.

The respondents were taking advantage of the following staff development opportunities
indicated in Figure 5. Those who indicated "other" stated that they were not sure if there
were any staff development opportunities on RDM (2) while 15 stated that there were no
staff development opportunities at their institutions.

It can be noted that researchers are used all the various platforms available to grasp the
concepts of RDM. The interviewees pointed out that:

I am someone who is very passionate about research and I strive to move along with trending
issues in the research process. When I heard about the new concept of research data
management, I was eager to know what it is so that I remain relevant in the academic writing
processes. I took my time to look around on how I can learn the skills and concepts. I was
happy to note that there were many free online courses that I could utilise. I enrolled to the
research data management course on Coursera and gained a lot of knowledge and skills
though I am still learning.

The library held a one day training session on research data management where they introduced
Mendeley Data and other data repositories that I am using up to now.

I have taken a course on research data management in order to grasp the concepts since the
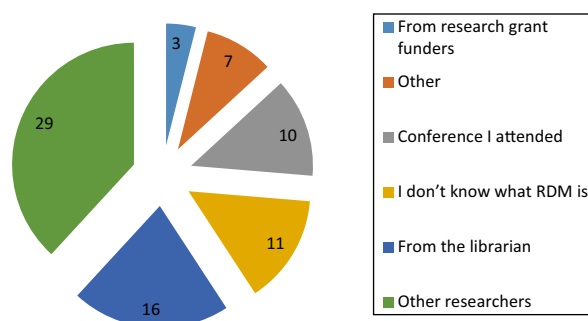subject is still relatively new.

Figure 4.
How researchers
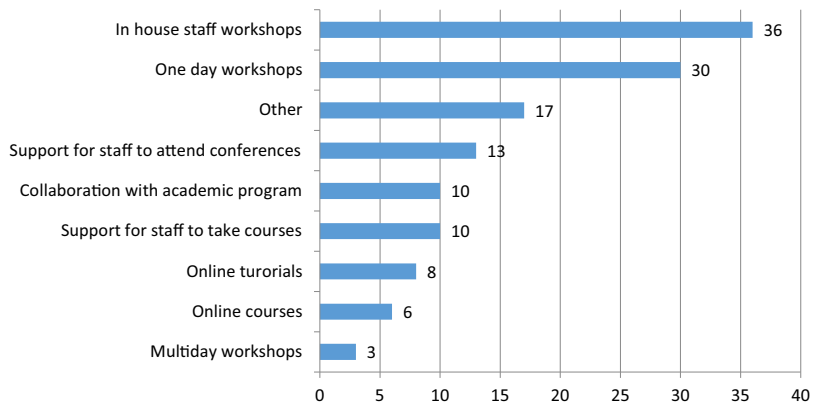knew about research
data management?

In house staff workshops — 36
One day workshops — 30
Other — 17
Support for staff to attend conferences — 13
Collaboration with academic program — 10
Support for staff to take courses — 10
Online turorials — 8
Online courses — 6
Multiday workshops — 3

Figure 5.
Research data
management staff
development
opportunities

I took advantage of the conferences that were offered to learn more about RDM.

I have been supported by my institution to attend workshops on research data management.

The following challenges were pointed out by the respondents who indicated that there is lack of skills to manage research data, lack of knowledge of research data repositories, lack of institutional RDM policies, poor infrastructure for data storage and sharing, licencing issues surrounding data ownership and diversity of data as shown in Figure 6.

Researchers are experiencing various challenges in managing research data as indicated by those who were interviewed. They had this to say:

Although there is some training going on teaching researchers about research data management concepts, I have noticed that there is no institutional policy at my university.

It is difficult to get proper guidance on who is supposed to do what during the research data management process due to lack of policies.

As a researcher, I have to learn more to enhance my skills since I feel that I am lagging behind in terms of my skills of managing research data in the digital era.
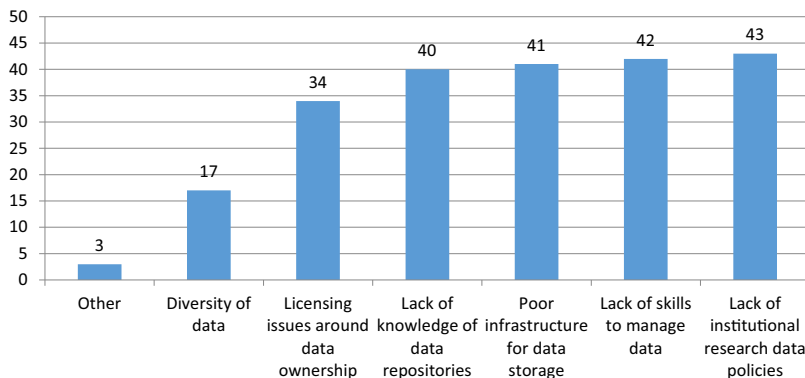

Other — 3
Diversity of data — 17
Licensing issues around data ownership — 34
Lack of knowledge of data repositories — 40
Poor infrastructure for data storage — 41
Lack of skills to manage data — 42
Lack of institutional research data policies — 43

Figure 6.
Challenges faced by
researchers when
managing research
data

I face the challenge of various data formats I work with when I am doing research. I have heard about the FAIR data principles but I am not too sure on what it entails.

I don't have knowledge about data repositories. I rely on the assistance offered by the librarians when choosing the correct data repository.

The researchers were asked whether it is necessary to consult research data archived by other researchers as a way of assessing how they view research data sharing. The findings revealed that 70 researchers agreed that it is important to use data by other researchers and this shows that they greatly value and perceive highly data sharing.

Discussions

The respondents who indicated that it is necessary to manage research data in Figure 1 reflect better penetration of RDM in research institutions in Zimbabwe. It shows that most researchers now understand the importance of managing research data. This is in line with what was stated by the European Commission (2013). There is an improvement from the findings of Chigwada *et al.* (2017) which showed that most researchers were not aware of the trending issues in RDM. A comparison of the interview results and responses from the questionnaire in terms of the necessity of managing research data shows that researchers value the need to manage research data throughout the research process.

Figure 2 indicates that the majority of the respondents store their research data on Google Drive and this reinforces what was stated by Marchionini (2012), Buys and Shaw (2015) and Whitmire *et al.* (2015). This tallies with what was stated by the researchers who were interviewed who indicated that they are now using various information communication technologies to manage their data as pointed out by Tripathi *et al.* (2017). Therefore, it shows that there is an improvement in RDM among researchers in Zimbabwe, as a study by Ndhlovu and Ngwenya (2017) had indicated that outdated formats were used to collect and manage data by researchers in the communication and information science field.

The following strategies can be used to create awareness of RDM among researchers. These are workshops, conferences, seminars, word-of-mouth in meetings, professional development courses and providing support staff with financial resources and time off to learn about RDM as stated by Majid *et al.* (2018). It has been noted that most of these activities can be spearheaded by librarians who were at the fore front of educating researchers and other stakeholders on the importance of managing research data. Researchers can also attend a number of massive open online courses that are available on platforms such as Coursera, future learn, edx among others to learn more on RDM. The findings also indicated that there is need to develop skills amongst the RDM stakeholders including researchers, librarians, administrators and policy makers to ensure that they are aware of what the subject entails. The challenges that were pointed out in Figure 6 concur with what was stated by Harvey (2010) and Tenopir *et al.* (2011), Cox *et al.* (2012), Tenopir *et al.* (2012), Chiware and Mathe (2015), Ndhlovu and Ngwenya (2017).

The findings on the importance of consulting research data archived by other researchers shows that the researchers are aware of the principle of data sharing. However, the researchers had some concerns with regard to RDM as pointed out by Bezuidenhout and Chakauya (2018). They pointed out that they need more training and support to fully understand what the subject entails. The issue of institutional support also came out where the researchers lamented over the unavailability of institutional RDM policies to guide the use, sharing and archiving of research data. Researchers also felt that there is need to build the capacity of librarians to ensure that they are in a position to assist in RDM.

Conclusion and recommendations

The findings of this study revealed that some researchers are aware of the normal way of managing research data but are not knowledgeable of the current trends in RDM. Researchers need to develop their skills and get assistance from librarians on how to develop data management plans and how to archive research data using various research data repositories that are available. Researchers are managing their own data and the majority are keeping the data on their machines for a period of five years and are not willing to share their data owing to fear of abuse and licencing issues. Librarians should continue creating awareness among researchers on how they can manage their research data throughout the research process from the grant proposal writing stage until the research output is published. Researchers should be taught about the FAIR data principles to ensure that the data is findable, accessible, interoperable and reusable in line with the international standards. Institutions should also support researchers by enacting enabling policies that encourage researchers to archive their research data and develop acceptable data management plans from the initial stages of their research projects. The research institutions should also ensure that the data infrastructure is developed to enable data storage and sharing. In Zimbabwe, there should be a deliberate effort to work towards the development of data repositories in research institutions.

The author recommends the need for capacity building among librarians and researchers to keep up with the developments in RDM services. This had been stated in the findings where some researchers indicated that they are aware of RDM and perceive it high but lacks the necessary skills to archive and manage research data. This helps in developing the knowledge and skills of all the stakeholders that are involved in RDM. Librarians are responsible for training the researchers on how to draw data management plans and give advice on where to archive the research data. Researchers are supposed to know how to apply the FAIR data principle so that the data is sharable and reusable. As a result, there is need for team work where all the stakeholders are involved to ensure that no one is left behind. This assists in ensuring effective implementation, as all the stakeholders are adequately trained on the policies, procedures and practices with regard to RDM. This calls for proper induction training programmes for new research staff and refresher trainings and inductions for established researchers.

The country should also invest in RDM infrastructure to enable researchers to archive their research data. To successfully implement this, there must be a national open data policy which should guide and mandate researchers to archive their research data. At institutional level, there should be RDM policies which should be adhered to, especially, the development of data management plans when applying for funding. Research institutions should also develop data repositories to avoid the challenges of looking for appropriate data repositories outside the research organisation. This means that more resources should be channelled towards RDM in building capacity and enhancing the research data infrastructure.

The library can also develop training and ready reference materials which can be accessible via the website. This shows that librarians should be intentional in offering academic research data services to address the needs of the researchers. They should always be available to ensure that they offer the service as and when needed. Researchers should not be stranded when they are working on their data management plans or looking for data repositories to archive their research data. The trainings that are offered by the library should always be in sync with the changes in RDM. This means that the librarians should be above board and be knowledgeable of the trending issues in RDM to provide the appropriate guidance. To increase the level of awareness of researchers on RDM,

researchers need to be educated on best practices for data storage and backup. Therefore, academic libraries should provide RDM services and training to ensure that researchers are knowledgeable about the subject and improve their perception to data management and sharing.

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