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Academic Library and Research Data management Roles: The Case of Norwegian Libraries

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ABSTRACTS

Within the knowledge society, data constitutes a significant fragment. The management and sharing of data especially with respect to research data coupled with the influx of information communication and technology is thus becoming paramount for not only researchers but also academic librarians. In the case of Norway the research council of Norway in 2014 came up with a policy recommendation requiring researchers to include data management plans to their research activities and hence advance innovations and knowledge sharing. To meet up with these recommendations, the responsibility therefore lies on traditional academic libraries and librarians as to how they can position themselves in this ever-changing environment of research data (e-Research) management.

This thesis therefore investigates the roles of academic libraries in supporting researchers who are mandated by their research funders to comply with the principles and guidelines of open access research data. Hitherto, the willingness of academic libraries and librarians to take up this new mandate in response to the Research Council of Norway published policy remains part of the core of this study. Towing a constructivist lane, the study employed a qualitative case study through the use of semi-structured interviews augmented by documentary analysis to some selected Norwegian academic librarians.

The study revealed three-fold key role, which academic libraries could play in the university community. Additionally the study observed that academic libraries might be required to improve their technical skills and competency sets through training and other capacity building programmes by collaborating with national agencies like Norwegian Center for Research Data (NSD) and Norstore.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS VIII

CHAPTER 1: INTRODUCTION 9

1. Background information 9
1.1 Overview of Norwegian Academic Libraries 10
1.2 Statement of the problem 12
1.3 Research Question 13
1.4 Aims and Objectives 13
1.5 Methodology 13
1.6 Scope 14
1.7 Limitations 14
1.8 Significance of the research 15

CHAPTER 2: LITERATURE REVIEW 16

2.0Introduction 16
2.1 Definitions of Research data management? 16
2.2 Concept of Research Data 19
2.3 Awareness of RDM among Libraries 21
2.4 The Roles of Academic libraries in RDM 25

CHAPTER 3: METHODOLOGY 30

3.1 Research Approach 30
3.2 Research Method 31
3.4 Data collection techniques 32
3.4.1 Interview Process 33
3.4.2 Document Analysis 34
3.5 Data Analysis 34
3.5 Ethical consideration 35

CHAPTER 4: ANALYSIS OF RESEARCH FINDINGS 36

4.0 Data Analysis 36
4.1 Awareness of RDM mandate 36
4.2Perceived roles of Academic Librarians in RDM 37
4.2.1 Advocacy and Support 37
4.2.2 Providing access to data 38
4.2.3 Managing data collections 39
4.2.4 Challenges of RDM Roles in Libraries 41
4.2.5 Document Analysis of Supplementary Literature 43

5.0 CHAPTER FIVE: FINDINGS AND RESULTS 48

5.1 Discussion of Results 48
5.2 Theme 1: Awareness of RDM mandate 48
5.3 Theme 2: Perceived roles of Academic Librarians in RDM 50

5.3.1 Advocacy and support role 50
5.3.2 Providing access to data 51
5.3.3 Managing data collections 52
5.4Theme 3: Challenges of RDM Roles in Libraries **53**
5.4.1 Complexity nature of RD 53
5.4.2 Conclusion 55
CHAPTER 6: CONCLUSIONS AND RECOMMENDATION **56**
6.1Summary of findings **56**
6.2 Recommendations **58**
6.2.1 Academic librarians' awareness of RDM mandate 58
6.2.2 Academic librarians' perceived roles in RDM 58
6.2.3 Challenges confronting academic librarians in providing RDM 58
6.3 Suggestions for Further Research **59**
REFERENCES: **60**
APPENDICES **73**
Appendix 1: Interview Guide **73**

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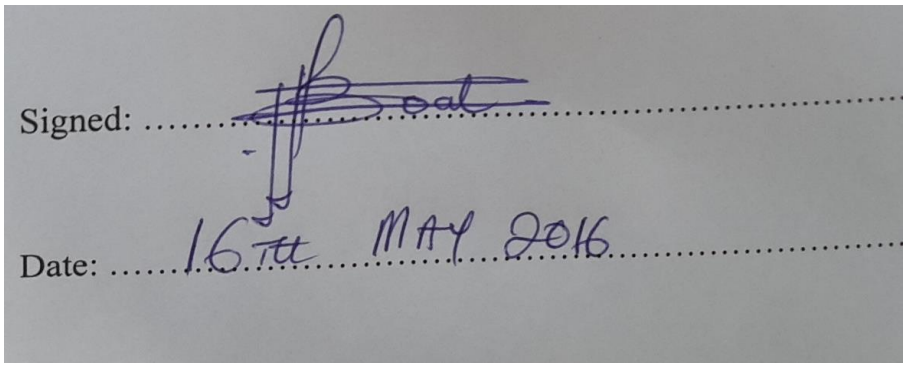
DECLARATION AND PLAGIARISM DISCLAIMER

I certify that all material in this dissertation, which is not my own work, has been identified, And that no material is included for which a degree has previously been conferred upon me.



DEDICATION

This work is dedicated to Mrs. Vida Mensah (Late) from whom I draw my professional, spiritual, and academic ambitions in life.

LIST of abbreviations

IR	Institutional Repository
OPAC	Online Public Access Catalog
NCHE	Norwegian Council for Higher Education
RCN	Research Council of Norway
OPENDOAR	The Directory of Open Access Repositories
NSD	Norwegian Social Science Data Service
NORA	Norwegian Research Archive
RDM	Research Data management
DCC	Digital Curation Center
BIRD	BI Research Data

List of Figures

Figure 1: The Process of Research data sets components 21

Figure 2: Components of RDM support services by DCC 29

Table 1: 44

Key roles of academic libraries mapped to RDM practices and their examples of support roles

CHAPTER 1: Introduction

1. Background information

The influxes of Information Communication Technologies (ICT) in research generate huge volumes of research data and are a key tool in conducting research. Some Scholars refer to this phenomenon as e-Research (Henty, 2008; Cox and Pinfield, 2013).

Furthermore, data constitutes knowledge and is a valuable asset in the knowledge society. Sharing of research data allows for the use of data for purposes other than originally intended, linking of data across different data sets and validation of data (DAMVAD, 2014, pg.1). Lately, research datasets funded or sponsored by public funds compels researchers to develop a data management plan and subsequently willingly share the data-sets of their research. This was also declared by OECD Guidelines (2007)[1] that.

"Sharing and open access to publicly funded research data not only helps to maximize the research potential of new digital technologies and networks, but provides greater returns from the public investment in research".

The Research Council of Norway (RCN) [2]has drawn up a policy on open access to research data in November 2014, requiring researchers to include a data management plan to the research activities in order to advance research innovations and knowledge sharing. (Source)

In the UK academic institutions are also prioritizing their research data management (RDM) needs (Cox and Pinfield, 2014). Though the universities are strategically taking measures to support e-Research, however both at the institutional level and the individual level, the technical capacity and infrastructure support to take up the project has been questioned. (Pryor, 2012;Whyte and Tedds, 2011). Henty, (2008, p.2) made a similar claim that institutions with the requisite skills have not been able to assist researchers

[1]CheckOECD:Principles and Guidelines for Access to Research Data from public Funding: http://www.oecd.org/sti/sci-tech/38500813.pdf

[2]The Research Council of Norway(RCN) http://www.forskningsradet.no/en/Article/Open_access_to_research_data/1240958527698

in this regard. This means that of course the mandate from the research council will deter researchers from engaging in research since they lack the requisite skills required to write up the data management plan. Consequently public funds would not be made available for the projects.

Traditionally, institutions such as academic libraries have had a track record in the provision of research support services to researchers and their activities involved managing, preserving, and providing access to information (Gold, 2010; Monastersky, 2013). Carol et al (2014, p1) argue that academic libraries and librarians are encouraged to develop a research based services in tune with the changing research activities of their users. For this reason, the focus in this study is on academic libraries and Librarians, as they are considered as one of the main stakeholders of RDM, and are affected by changes in research practice (Lynch & Carleton, 2009).

1.1 Overview of Norwegian Academic Libraries

Over the last five years, Norwegian academic libraries services provisions have been continuously and rapidly changing, due to the changing needs of library patrons within the institutions of higher education. (Lomheim, 2004).The Quality reform of the Norwegian government came into effect at the beginning of the 2003 academic year. The reform policy focused on a new degree structure from Bachelors to PhD level, new methods of evaluating students, a new system of funding and lastly promoting internationalization for education in Norway. (Norwegian Center for International cooperation, 2003). Against such a backdrop of quality in Norwegian Higher Education, in January 2014,Torbjørn Røe Isaksen, the Minister of Education, believed that good academic environment in Norwegian higher education would provide good quality research and would assist in providing solution to the major problem areas in health, education and welfare. (Isaksen, 2014)

Academic libraries for a long time have been recognized as the core of their institutions. To align with the profound ongoing reforms and structure of higher education in Norwegian higher education systems, recently, Norwegian academic libraries have transformed their traditional method of providing services to

suit the quality reform policies (Norwegian Library Reform, 2014). Lomheim (2004) noted that academic libraries are changing their services into a library into a new learning environment which is characterized of having a flexible learning space, employing ICT tools in teaching and learning and finally, adopting a learning center model which caters for spaces and rooms for different academic activities. It is apparent that most Norwegian academic libraries have introduced the learning Centre model. Examples of academic library based learning centers the University college of Oslo and Akershus Libraries, the University of Oslo Libraries, Norwegian business School etc.

In creating a flexible learning space for the academic libraries, academic libraries regarding the electronic library, academic libraries in Norway have very close relations. First, this is due to having one common library system, BIBSYS. This is also functioning as a common "OPAC", and is an integrated library system with different modules taking care of all the major internal operations in the libraries. The work in developing and maintaining BIBSYS[3] has brought the libraries together and strengthened cooperation over the last 30 years. At a political level, the academic libraries work together in a special library committee within The Norwegian Council for Higher Education.

Academic libraries have been engaged in data management for years, and a handful of institutions in Norway have already developed robust institutional repositories (IRs) (Alemayehu, 2010). For instance, the academic open access directory of OpenDOAR[4] reveal that Norwegian academic libraries have created more institutional repositories. According to Alemayehu (2010), the creation of institutional repositories in Norway have increased from "two in 2006 to twelve at the end of 2010" (p.12). This indicates a very high priority given to institutional repositories in Norwegian academic libraries. It also implies that, academic libraries have positioned themselves to take up a leading role in research data management support services.

[3] Check Bibsys at www.bibsys.no

[4]The Directory of Open Access Repositories - *Open*DOAR: http://www.opendoar.org/index.html

1.2 Statement of the problem

Research data management has become a pressing issue in every research institution worldwide. Research council mandate researchers to write up a research data management plan to secure funds for their research projects, in May 2014, Siri Lader Bruhn Senior Advisor of the Research Council of Norway (RCN), stated that a majority of researchers support the idea to share research data openly. (Bruhn, 2014) Again, a research carried out by DAMVAD (2014) indicates that majority of Norwegian researchers often use and share colleagues' research data in their work. The survey confirms that;

"Researchers in Norway see benefits of sharing and archiving their research data. Around 80 percent of the respondents agreed that open access to research data enhance re-search and that it is an ethical obligation to make their data available f or validation. These are also the two reasons for open access to research data agreed to by most researchers. Further, 77 percent agreed that open access to re-search data facilitates the education of students and new researchers, and 74 percent agreed that open access to research data stimulated research collaboration respectively" (DAMVAD, 2014,P.6).

In spite of researchers' positive attitude towards sharing and archiving of research data, evidences show that there are also many challenges that researchers encounter in their attempt to comply with the mandate from the Research Council. As reported by Bruhn (2014), "The main challenge will be ensuring that data can be stored in a secure manner while remaining accessible and not inhibits, researcher careers,"

Previous studies from DAMVAD outlined factors that inhibit researchers to perform data management work. According to the studies, researchers do not have the technical skills to do the metadata work, which is mostly technical in nature. Moreover, there are no standardised storage infrastructures, time constraints to organise the data and finally no incentives for researchers who have agreed to share their data.

Academic libraries for a long time have provided research support to researchers and have been involved in managing, preserving, and providing access to information. Until recently, discussions are still raging that academic libraries and librarians should provide a leading role in research data management support on behalf of the researchers. Consequently this will help to minimise the hurdles that researchers face as they envisage fulfilling the mandate from the Research Council. There are several studies written by

scholars who have argued that most of the research data support services could be seen as a natural extension of existing library work and it is just an issue of renaming the services that the library offers. (Cox and Pinfield, 2013; Gary, 2013; Lewis, 2010).

Presently Norwegian academic libraries' participation in research data management support services is in its early stage. This study focuses on the attitude towards integrating Research data management (RDM) into library services.

1.3 Research Question

This study will attempt to answer the following research question: How do academic libraries perceive their roles and responsibilities in research data management support services?

1.4 Aims and Objectives

The study aims to explore academic librarians' perceptions on their roles and involvement in research data management support services. Among others, the specific aims of the study are :

- To explore librarians awareness of RDM mandate.
- To explore and analyse the roles that are suitable for academic libraries in research data management work.
- To identify factors that hinder academic libraries from providing research data management.

1.5 Methodology

The study is a qualitative study, which makes use of the case study approach. Creswell (2009,p.13) explains case studies as a qualitative research strategy of inquiry in which the researcher explores in depth a programme, event, activity, process, or one or more individuals. This research is based on a qualitative approach using both primary and secondary data collection methods. It makes use of primary sources in the form of semi-structured interviews in obtaining insight from library directors and library staffs in Norwegian academic libraries. The sample for the study is chosen through a purposive sampling

technique. The study also collects data from secondary sources such as the Internet, articles, databases, and books, and analyses and interprets them.

This research uses constant comparative analysis as a method in qualitative analysis. As stated by Pickard, (2013) it involves "taking one piece of data and comparing it with all others that may be similar or different in order to develop conceptualizations of the possible relations between various pieces of data." (p.269).

1.6 Scope

The present study intends to examine the perception of research data management support roles of Norwegian academic libraries. It also tends to look at other current activities in taking up the leading role in research data management services. Research data management support services have not been fully implemented in Norwegian academic libraries. For example only the Artic University of Norway Library, Telemark University College and the Norwegian Business School have begun research data management projects. In view of this, the research has not been restricted to a particular academic library. It is a case study of selected Norwegian academic libraries.

1.7 Limitations

The limited time and lack of financial resources required to write up the thesis has been a problem. Additionally, language has been a big hurdle, as materials required to assist in supporting the thesis is mostly in Norwegian and this makes it difficult to get much information to support the debate.

Research data management support services are still in the early stages of development. Few institutions in Norway have started planning to include research data management support services into their policies, and therefore it becomes very difficult to select a particular institution as a case study. Hence multiple institutions are used as a case study.

1.8 Significance of the research

This research could be of interest to groups, such as the Research Council in Norway, and institutions, which makes strategic decisions and formulate research related policies for the organizations. It can include University libraries staff, such as library directors, institutional repository managers and other key staff who are responsible to establish systems and assign roles for the setup of research data management support services.

CHAPTER 2: Literature Review

2.0Introduction

This chapter begins with a review of relevant works within the literature with a direct link with libraries' role in data management support work and other themes unfolding from it. The central theme of this study is to highlight how academic libraries and librarians perceive their roles and responsibilities of research data management support services. This chapter would critically examine themes such as Research Data life cycle, roles of research data management in academic libraries, and the challenges of academic libraries etc. These themes provide background information in general and would be focused in the Norwegian context since the researcher is undertaking a case study in Norwegian academic libraries.

This review involves themes related to librarians' roles in RDM and the roles that are already in place to help provide RDM services in academic librarians. Before this however, a survey of RDM terminology shall be understood.

To cover the theme widely, relevant literatures were retrieved from scientific, academic databases such as Emerald, Library Journal, and LISTA (Library, information science & Technology Abstracts). Search terms and tools employed to retrieve relevant results include "Academic Libraries roles research data management "or "Research data management AND Academic libraries roles". Relevant results displayed include abstracts of conferences proceedings, eBooks, Journals and articles. Endnote was sometimes used to manage bibliographies and references.

2.1 Definitions of Research data management?

National research councils, researchers and information professionals are increasingly using the term research data management in most of their discussions, policies and planned projects (Lord and Macdonald, 2003; Henty, 2008; Cox and Pinfield, 2013 ;). Other scholars also prefer to use related terms such as "data curation, "digital curation", "digital archiving" and "digital preservation". According to Beagrie, (2006) the term "research data management" (RDM) is a new concept, and there has not been any accepted definitions, it is significant to recognise that these terms can be understood differently

depending on the academic discipline of the individual person**.** For Beagrie, the challenge for assigning a suitable term persisted until 2001, when specialists in the field of information science adopted the term "digital curation". The term digital curation was primarily used at a seminar dubbed "Digital Curation: digital archives, libraries and e-science"[5]. An explanation to the use of the term "Digital curation" "implies not only the preservation and maintenance of a collection or database but some degree of added value and knowledge".(Beagrie, 2006).

To give a more concise clarification on the above subject matter, the e-Science Curation report[6] differentiated digital curation from archiving and preservation as follows:

Curation: The activity of managing and promoting the use of data from its point of creation, to ensure it is fit for contemporary purpose, and available for discovery and re-use. For dynamic datasets this may mean continuous enrichment or updating to keep it fit for purpose.

Archiving: A curation activity, which ensures that data is properly selected, stored, can be accessed and that its logical and physical integrity is maintained over time, including security and authenticity.

Preservation: An archiving activity in which specific items of data are maintained over time so that they can still be accessed and understood through successive change and obsolescence of technologies.

In clarifying the distinction between digital curation and research data management,

Furthermore, the Digital Curation Centre (DCC), an expert leading curation activity in the UK, [7] defines digital curation as:

"*An activity of managing data for as long as it continues to be of scholarly, scientific, research and/or administrative interest, with the aim of supporting reproducibility of results, reuse of and adding value to that data, managing it from its point of creation until it is determined not to be useful, and ensuring its long-term accessibility and preservation, authenticity and integrity*". (P.3).

[5]Check the seminar at *http://www.ariadne.ac.uk/issue30/digital-curation*

[6]See E-science curation report http://www.jisc.ac.uk/publications/publications/pub_escience.aspx

[7]See Digital Curation definition by digital curation Center UK
http://www.dcc.ac.uk/sites/default/files/documents/DC%20101%20What%20is%20Digital%20Curation.pdf

Relatedly, the Association of Research Libraries report (ARL, 2006)[8], defined data curation as involving "ways of organizing, displaying, and repurposing preserved data". Similarly,Rusbridge et al, (2005,p.2) also point out RDM is the, scientific data, which is preserved and put into a situation that can be retrieved and reused by everyone.Yakel(2007), further developed the definition as an "active involvement of information professionals in the management, including the preservation, of digital data for future use''

In simplifying the term digital curation, Yakel, (2007) summarised the various definitions and regrouped them into five (5) themes, namely;

1. Life cycle/continuum management of the materials perhaps even reaching back to the creation of the record keeping system.
2. Active involvement over time of both the records creators and potentially digital curators.
3. Appraisal and selection of materials.
4. Development and provision of access.
5. Ensuring preservation (usability and accessibility) of the objects.

In conclusion to Yakel, (2007) claim, digital curation is however a big "umbrella" under which other concepts such as digital preservation, data curation, and digital asset and electronic records management emerge.(p. 338)**.** In reference to the aforementioned concluding claimed by Yakels' (2007), the "research data management" term would be used in a narrow sense as the focal point for the study.

Wilson et al. (2010**)** explains research data management as a series of activities, which "involves all the process that information from research inputs undergoes as it is manipulated and analysed en route to becoming a research output." In a similar research data management explanation, Lewis (2010**)** affirms that the storage, curation, preservation, and provision of continuing access to digital research data constitutes the concept of RDM.

[8]Association of libraries (ARL) report see at

Elaborating further on the term, the Sudamih Project, Oxford University Computing Services,[9] noted that research data management occurs in three stages in the research process, from the start of research through to the end result of research. This entails,

a. Organization and structure of materials
b. Storage and back-up
c. Material analysis and sharing (p.1)

According to Whyte and Tedds (2011,) Research Data Management is still developing, and that it refers to the early creation and organisation of research data sets, through to the management of preserved data sets in order to ensure that preserved that sets can be easily retrieved for reuse. Similarly Pinfield, et al, (2013) share the same concept of RDM, and explained RDM further as "a number of different activities and processes associated with data lifecycle, involving the design and creation of data, storage, security, preservation, retrieval, sharing and reuse, all taking into accounts technical capabilities, ethical considerations, legal issues and governance frameworks."

From the definitions and explanations above, this study defines RDM as: a set of prepared research data sets aiming at sustenance and preserving the data sets for future reuse in a research life cycle.

2.2 Concept of Research Data

In recent times, researcher's uses of information communication technologies in research processes have improved their practices. Each day, they are generating huge volume of data. However, the spontaneous growths of volumes of data generated by researchers are hindered by storage infrastructure. (Hey and Trefethen, 2003)**.** Additionally the challenge created is to be able to store the data sets in a form that can be managed and having in mind the "fragile, vulnerable and sensitive" characteristics of the data sets (Cox and Pinfield, 2013).

The Engineering and Physical Sciences Research Council **(**EPSRC)[10] defined Research data

[9]See Sudamih Project, Oxford University Computing Services, http://sudamih.oucs.ox.ac.uk/docs/Research%20Data%20Management%20Factsheet.pdf

"As recorded factual material commonly retained by and accepted in the scientific community as necessary to validate research findings; although the majority of such data is created in digital format, all research data is included irrespective of the format in which it is created."

Similarly, Research data is defined as any organised digital data from any discipline, which academic researchers can use in their research as an evidence record. (Beagrie et al, 2009, p2). Researchers generate research data for various reasons, while other generate research data for academic projects. Some of the data sets are used for commercial gain. In other situations, research data sets are generated from the by-product of the research (Beagrie et, al, 2009).

The research Council of Norway outlines the processes of research data sets components –output data, storage, Archiving with identifiers, Preservation with metadata and Access to data and metadata. This is illustrated with the following process.[11]

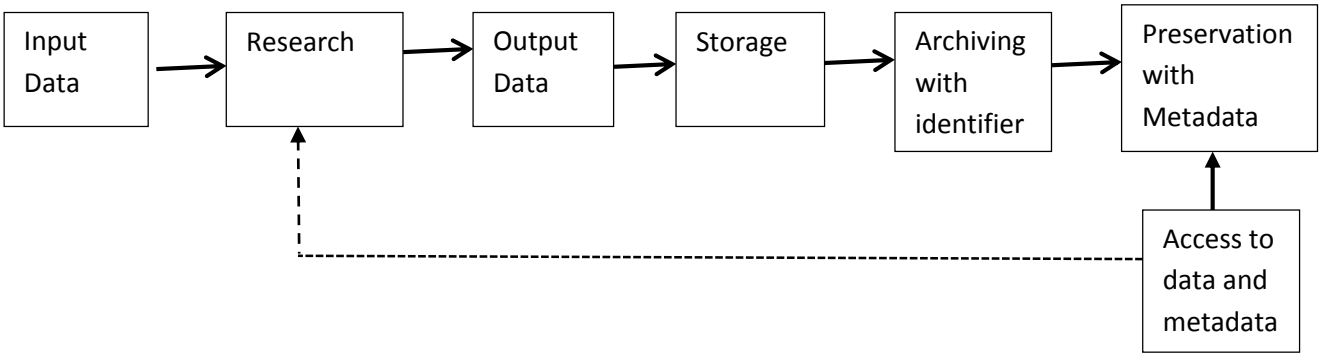


Figure 1: The Process of Research data sets components

In figure 1, the research data sets created is stored in a storage infrastructure. When the data is stored in secured manner, they must be archived. This stage involves employing tools and techniques to ensure that data sets can be retrieved through the use of identifiers. The next stage involves improving the quality of the datasets by classifying them and making them more usable. The stage is often the preservation stage and it is the stage where the data is enhanced by the metadata tools to describe information about the data sets. For example metadata tools are used to describe the date for creating the data, the name of the creator and other relevant details of the datasets.

[10] See EPSRC definition of Research data http://www.epsrc.ac.uk/about/standards/researchdata/Pages/scope.aspx

[11] Check the research data process at http://www.clir.org/initiatives-partnerships/data-curation

In the preservation stage, the application of good metadata improves searching for data sets. After the preservation stage, the next stage ensures that others reuse the preserved datasets. This stage is commonly referred as curation. Curation involves adding more value to the preserved data sets prolong the lifespan of datasets and for reuse.

The research datasets comes in different varieties,Beagrie et, al, (2009), explained that research data sets come in different formats and it also influenced by the subject background of the researcher. Some research data sets are created from social science discipline, whiles others are also generated from the physical sciences disciplines. Typical examples of these datasets includes

"Complex data used in climate modelling, aerodynamics, molecular modelling, bioinformatics; video and image archives used in archaeology, art history, anthropology and performance works; digital images/investigatory data of primary physical sources in the humanities; quantitative and qualitative data used in the social sciences; or electronic data and indices for fossils or skin tissue examples."(Beagrie et al, 2009, p.3).

In summary, research data sets are produced in different forms. This it usually influenced by the subject discipline of the researcher and the intended purpose of the research outcome.(Burnham, 2012, p.3).

2.3 Awareness of RDM among Libraries

Open access to research data is gaining a high level of popularity across countries. Norway is not an exception. Globally, research councils and other government agencies increasingly are requiring that researchers who seek for public grants make their data publicly accessible. This phenomenon is referred to as deposit mandate; a set of policies that requires researchers to make their published content available in open access repositories (Calhoun, 2014,p.190).

In Norway, the Research Council Norway published policy on open access to research data is seen as recommendations and best practices in RDM but not mandatory. This may be due to lack of infrastructure and standards to implement (Research Council Norway, 2015). Among other reasons, Nielsen (2011) claims, "the bottleneck of open science is lack of recognition". He stressed that open access activities has created lots of opportunities in our knowledge society; however, it still lacked the desired implementation. Henty

(2008a) supported the claim and further explained that the lack of available policies to ensure the implementation of open access contributes to its lack of recognition.

In spite of the challenges in implementing open access mandates to research data, since its inception in Norway, there have been some activities aimed at creating awareness. The Norwegian Social Science Data Services (NSD)[12]national archive for research data for example organise workshops, seminars, and conferences to promote their services. The NSD promotional services aim at national, international research groups and academic librarians and other interested professionals to encourage the practices of open access to research data. In an effort to give a better reflection of wide range of disciplines the services they offer, the NSD recently changed its name to "The Norwegian Centre for Research Data" (Henrichsen, 2016). In the same RDM activities, the Norstore[13] hosted a RDM seminar, facilitated by the management at Norstore, in Trondheim in May 2015.They aimed at sensitizing the RDM interest groups on their services for managing data.

Within the academic community, researchers are increasing their research capacity through technology in their research activities and this has impacted the research terrain (Tammaro, 2014)[14]. Manipulating the data sets in a more collaborative process, more computative, and more data intensive characterise the sudden transformation in research. This new approach to research is often coined as the "fourth paradigm" unlike until recently where science researches were involved in conducting experiments, developing theories etc.(Hey, Tansley and Tolle, 2009).

The Association of Research Libraries (ARL) defines e-research as

> *"Computationally intensive, large-scale, networked and collaborative forms of research and scholarship across all disciplines, including all of the natural and physical sciences, related applied and technological disciplines, biomedicine, social science and the digital humanities"***(**E-Research, Association of Research Libraries, 2013).

[12] Check NSD at www.nsd.uib.no/news

[13]Check Norstore at www.norstore.no

[14]See Tammaro lectures videos Digital Library services: creativity beyond Access on http://videoconferenza.unipr.it/p4314545

E-research is probably named differently in different countries. For example in the USA, it is termed as "cyberinfrastucture", the "grid" in Europe and in the UK; it is termed as "e-science". (Atkins, 2003;O'Brien, 2005;Borgman, 2006). The three key characteristics of e-research is as follows:

- Data –intensive: generating and often using large volumes of data
- Collaborative: involving researchers across multiple institutions, and often transnationally
- Grid-enabled: using high-capacity networks and middleware**.** (p.8).

Although more researchers see the opportunities in e-research and look to the library to assist, the academic librarians perhaps also see it as an opportunity to play a part in the new research life cycle**.** (MacColl, 2010). One major challenge found in the e-research projects is that, researchers lack the technical skills to manage the massive data they generate. (Henty, 2010,p.2). The library community is encouraged to respond to the fourth paradigm.

Previous studies over the years have attempted to discuss libraries involvement in RDM activities. In more general terms, e-research data service is still in its early stage; only few university libraries have been able to roll out some services (Tenopir et al, 2012). Steinhart et al. (2008) conducted a study on the Data Working Group at Cornell University Library. The study found that few university libraries in the United States (US) are actively involved in Data Curation. Some academic university libraries have proven examples and have published lessons for others to follow suit (Pinfield et al, 2013).

Macdonald and Martinez (2014) mention a few examples of university libraries' involvement in e-research services that include a "staging repository" research data service developed by a project group, DataStar[15] at Cornell University in the US. Similarly the John Hopkins University's Sheridan Libraries collaborated with faculty members on developing RDM plans.

In the University of California Digital Library, librarians have "played an active role during the development of a new tool, the DMPTool that helps researchers create data plans online". The DMPTool has a repository feature, which stores data. In the discovery feature, librarians assist users to find and access data

[15]See DataStar project at http://datastar.mannlib.cornell.edu

(Schottlaender and McDonald 2007). Australian University libraries have been quick to implement RDM services (Henty, 2008a) notable among them is the Monash University Library, which has initiated several RDM activities.

Furthermore in UK particularly, interests in e-research projects remain high among the various universities and higher education sector. The JISC-funded DISC-UK Data Share project, led by EDINA[16], arises from an existing UK consortium of data support professionals working in departments and academic libraries in universities (DISC-UK), and builds on an international network with a tradition of data sharing and data archiving. (Lewis, 2010; Martinez 2007), The strong connection between the two partners have assisted some Universities such as the University of Southampton Library, Oxford University Library to develop RDM services. The University of Southampton Library launched Computing services "isolutions". The isolutions have been developing programmes in RDM areas. The Library runs training programmes and practically supports researchers in their RDM needs. (Brown, 2013)

Back in Norway, with growing interest and awareness creation of RDM projects in academic libraries. The developments of institutional archives for storage of data sets are taking shape in the various university libraries. The researchers and scientists in Norway have opportunities to store in different types of institutional archives since the library or the IT department provides such services**.** (Skagen, 2015). One of the prevalent examples in RDM projects initiated by Norwegian academic institutions include the Artic University Norway Library established an open data archive (Trolling)[17]. The "Trolling" is a small-scale research data archive to cater for the storage needs of researchers on subject arrears in linguistic. Secondly, the Norwegian Business School in collaboration with Bibsys is lunching another institutional local data arrive BI research data (BIRD) in "Brage".The BIRD project[18] is a pilot project to create a structure that scientists at the Norwegian School of management can make use of to save and share their research data.(Skagen ,2015 pg.2.) .Sometimes through collaborative initiatives with the IT department ,research academic

[16]See EDINA at http://edina.ac.uk

[17]Check Trolling: http://opendata.uit.no/dvn/dv/trolling

[18] BIRD from http://brage.bibsys.no/

libraries perform RDM support .One example for a collaboration is the University college of Telemark library in collaboration with the IT department in the development phase to lunch another research open data archive "TORD"[19].

In summing up, Pinfield (2005, cited in Calhoun, 2014,p.191), an early advocate for deposit mandates assures that deposit mandates of research data will result in the widespread adoption of open access, which will in turn improve the scholarly communication process. He continues that the end result of these initiatives will be greater impact of published papers and free availability of high quality scholarly content.

2.4 The Roles of Academic libraries in RDM

O'Brien**,** (2005) argued "libraries may risk fading from existence if they don't respond effectively to the changing environment. In e-research, it is the primary research data that must often be managed, made accessible and curated" (p.68). Furthermore, academic libraries play implicit roles in research through librarians' involvement in the provision of access to data; advocacy and support; and managing data collections. These three roles form the nucleus of academic librarians' roles in RDM.

Librarians' have ongoing roles in ensuring access to critical data sets for researchers. Librarians are involved in managing and preserving scholarly resources, creating more digital resources and making these resources accessible to the researcher through methods such as digitization and other digital library initiatives. These are often achieved through collaborations and partnerships with other stakeholders (Henty, 2008c). Librarians have already invested resources to digitize materials and house, preserve and disseminate digital collections of materials in institutional repositories and developed the expertise needed to manage these repositories (ACRL, 2007).

Libraries are seen to be involved in current policy making within institutions, of course recognising that the work should be done in a collaborative manner (Cox and Pinfield, 2013). Gabridge (2009) highlights the importance of subject librarians initiating a direct contact, to understand the needs of researchers, as well as the needs of the institution. This may be forming a major component of the work of the Library. Librarians

[19] See TORDTelemark Open Research Data in its development face

are experienced not only in navigating complex information environments, but in understanding the architecture of these environments and how they connect to the needs of research communities. (Carlson and Garritano 2010)

Areas where the library can support researchers in their research activities includes: Offering advice on funding sources, embedded or support roles conducting literature reviews or current awareness alerts for research projects or groups, bibliographic software training, advocacy for open access/institutional repository, data analysis advice, advice on copyright issues and advice on archiving of research records. (Auckland, 2012; Garritano and Carlson, 2009).

Lewis (2010:2) declared that "taking institutional repositories acts as a starting point for data curation. Many universities libraries for a long time have been engaged in it and it is entering the mainstream of academic library work". Later various authors also proposed different models of Libraries roles within academic university settings. Paramount among them is the Lewis pyramid model: Lewis (2010) proposed a pyramid model of nine areas of RDM activity for libraries. At the top of the pyramid is influencing national policy; at the second level, leading on institutional policy, developing local curation capacity and working with LIS schools to identify required skills; and at the third level, developing LIS workforce confidence with data, teaching undergraduate and postgraduate students, and advice services and data awareness creation among researchers. Whiles Corrall (2012) proposes and discuss the range of possible roles, and further pointed out the need for collective involvement of national policy and partnership, a data collection development and access management role, reflecting an extension of the library collection concept to data, and reflecting part of the data lifecycle. Furthermore, Corrall's model describes how academic libraries can collaborate with other departments within an institution, and the extent to which libraries position themselves to lead institutional policy is, of course, a debatable point. Indeed, all the roles could be seen to require a "multi-professional" approach. (Tenopir, 2012:302). Furthermore Lyon (2012) identifies a number of opportunities for Libraries and then connect it the proposed roles of the library to a research lifecycle model, in 10 stages. The roles are outlined below;

- RDM requirements gathering – through auditing (with academic departments);
- RDM planning – advocacy and guidance to researchers at all levels including PGR (with doctoral training centres).
- RDM informatics – technical advice on data formats and metadata; research data citation;
- RDM training – training to researchers including PGR (with doctoral training centres);
- Research data licensing;
- Research data appraisal -guidance on which data to keep;
- Research data storage (with IT services);
- Research data access;
- Research data impact (with research support offices)

Lyon's (2012) research identified opportunities that libraries could perform in RDM services; however the precise services that the library would perform will be dependent on the context and needs of each institution. Furthermore Cox et.al. (2014) argued from a wider institutional perspective that the stakeholders involved in RDM roles are complex and though libraries are playing essential roles in RDM work, there is a need for the library, as an important stakeholder to examine the roles and relationships of other stakeholders involved in RDM projects.

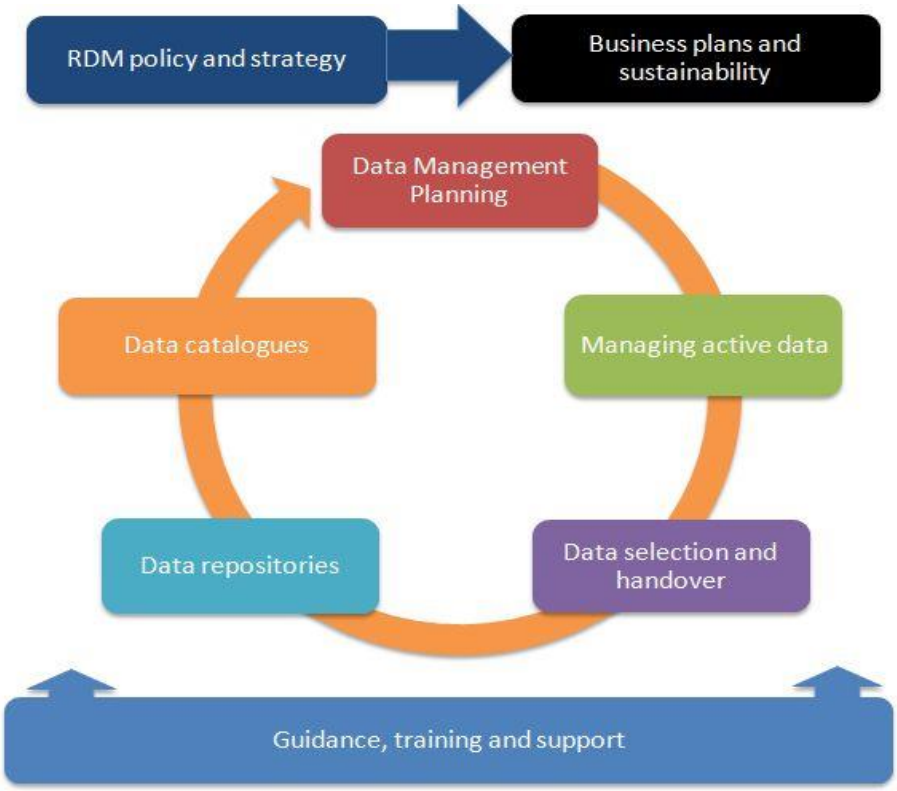


Figure.2 Components of RDM support services by DCC

Figure 1 shows a component of RDM support services developed initially by the Digital Curation Centre. It describes the various "infrastructures" and "services" that universities require to develop to support research data management (Jones et.al 2013). They further broadly grouped the structures into three categories:

- An overarching governance framework to shape the delivery of services;
- Specific infrastructure and services provided at key points in the data lifecycle;
- Assistance from support staff to aid the uptake and the use of service;

The model is used as a guide for academic libraries who envisage initiating effective data management. It outlines a "coherent strategy" and suite of services at every stage. Similarly, it address all the components to be addressed when delivering RDM services, together with a description of the roles and responsibilities of those who may deliver and use them (Hodson and Molloy, 2014).

Summary

Academic libraries want to secure their existence in the academic sphere; they are widening their scope to cater for the changing needs of researchers in e-research.(Amada, 2013).Others also say that librarians ought

to close the gap created between librarians and researchers due to insufficient knowledge of the research process**.** Perhaps the fundamental question to bring to the forefront about librarian and research data role is whether research data management roles are librarian's responsibilities? Or whether, librarians are seen as the major institutional stakeholder taking a leading role in establishing research data support services? Swan and Brown (2008) proposed three key roles for librarians. They include; "Increasing data awareness among researchers; providing archiving and preservation services within the institution and through institutional repositories; developing a new professional strand of practice in form of data librarianship". According to O'Brien, (2005) that "Linking people to resources, researchers to scholarly materials have been the role of the Librarian for centuries"(p.72). Librarians are better placed to identify the needs of the researcher and raise awareness**.** The changing needs of researchers activities would require libraries to provide services to support researchers in the early stages of their research activities.(Auckland, 2012).

CHAPTER 3: Methodology

This chapter describes the methodology of the thesis process such as interview: definitions used, how participants were selected, and analysis of respondents.

3.1 Research Approach

The thesis employs a qualitative research approach of enquiry. A qualitative method was chosen because the thesis aims is to explore over time the current trends and activities of RDM practices in relation to academic librarians roles and responsibilities. Qualitative research can best fit explorative studies. Secondly, it is also suitable to study the human attitudes, intentions, perception, behaviour as well as human intuitions' in context (Gonzales et al., 2008:3). In this case, Norwegian academic Librarians roles in the university institutions are examined and it consist of humans and their relationship with the institutions. Accordingly, the choice of a Finally, a qualitative research approach enables one to study and understand the meanings of one's actions, feelings and the underlying principle of behaviour between two parties. The researcher activities are not isolated but then it comprises of employing the human instrument to interact with individual research participants and uses suitable data collection method to form meaning or "theory" from the research. (Pickard, 2013, p. 16).

Louis et al., (2011) states further that, a qualitative research approach "gives voices to participants, and probes issues that lie beneath the surface of presenting behaviours and actions"(p.219). Essentially the data collected through interviews with individual participants helps the researcher to draw meaning out of it.

In most qualitative research approaches there is a tendency for a researcher to use theories to guide him. Maxwell warns "researchers to recognize that theoretical premises may not always be clear at the outset of the research; they may emerge, change be added to and so on over time as the qualitative research progresses" (Maxwell, 2005,37) (as cited by Louis et al, 2011, p.227). For this reason, a review of literature on roles of academic libraries in RDM would be used but "will allow the design to emerge as the study progresses."(Pickard, 2013, p. 16).

3.2 Research Method

According to Bryman (2008) research by nature is a multifaceted process; therefore, it is very important for the researcher to adhere to certain methods in collecting, analysing, and interpreting data in order to best secure the legitimacy of the findings. Case study, as employed in this research, has been defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between the phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 2008,p.23)(cited in Pickard, 2013,p.101)

Essentially, the study is centered on the roles of academic Libraries in RDM process. This phenomenon has recently being under discussion in conferences and workshops. Moreover in a real life context various research councils in Europe and America have introduced a policy on Open research data management, which recently was also incorporated by the Norwegian Research Council. Three different universities' individual academic librarians were used in the case study, since the researcher aimed to obtain sites that had sufficiently advanced plans to enable them to generate detailed and rich information about RDM activities in the Libraries.

In explaining the types of case study; Stake (1994) explained a collective case study as "groups of individual studies that are undertaken in order to gain a fuller picture."(As cited by Louis et al, 2011, p.291).

3.3 Sample and sampling methods

What determines the quality of a research is not limited to the appropriate methodology, it is essential that a suitable sampling method is used in research. (Louis et al, 2011, p.143). The researcher considered it appropriate to select a sample based on the knowledge of the population, its elements, and the purpose of the study. This is termed as purposive or judgemental sampling (Babbie 2010, 193).

The researcher selected Academic Librarians in senior management roles of the various university libraries of higher education in Norway. The institution includes;

University college of Telemark, Arctic University of Norway, and the Norwegian Business School. These persons were selected because of their experience and involvement of RDM projects in the various higher education institutions in Norway. Secondly, they have expressed viewpoints on the subject matter and have been to conferences to present papers relating to libraries and RDM processes. Additionally, these persons were sampled because they had initiated RDM activities in their academic libraries. At the outset of the project, it was planned that ten individual academic librarians would be invited to participate in the data collection process. However, only four persons were identified and willing to participate in the in the data collections.

In view of this, the researcher decided to enrich its sample by selecting articles, journals and other document set which contains cases of Academic Libraries roles in RDM projects and examine its contents until reaching the salient point. The selection of articles also conformed to the "purposeful sampling" method. Again the goal of purposeful sampling is to yield "insights and in-depth understanding rather than empirical generalizations" (Patton, 2002, p. 230)

3.4 Data collection techniques

A semi-structured interview was employed as the main instrument for data collection. Subsequently, a document analysis was employed as to find supporting data. This is due to the inadequacy of the interview as a sole methodology for the study. This gave way for the analysis of documents. As argued by Campbell and Fiske, (1959), a triangulation method would ensure the best possible internal validity and reliability data in qualitative research. The researcher decided to enrich the data with document analysis. Pickard (2013) argued that "providing sufficient information about the research can often be problematic, particularly in qualitative studies where the design of the research is likely to emerge and your needs could well change"(p.90).

Moreover the researcher was conscious of the reality that the duration of the writing of the thesis and the data techniques spans between the periods of four months. (February-June). The short time required going to the field for data collection and hassle involved in identifying the right people.

3.4.1 Interview Process

As defined by Cannell and Kahn, (1968), a research interview is "two persons conversation initiated by the interviewer for the specific purpose of obtaining research –relevant information and focused by him on content specified by research objectives of systematic description, prediction, or explanation". The interviews were unstructured and consisted of open-ended questions. The purpose was to allow the respondents to "freely tell their own story in their words"(Pickard, 2013 p.199). Even so the questions posed to the respondents were guided by the research questions and therefore needed to be planned carefully. (Kerlinger, 1970). During the interview process, the researcher in some instances had to intervene on some issues that did not align with the scope of the study.

Participants were sent an invitation of participation, together with a short formal research proposal in advance via email. The reason was to seek their consent and also set a suitable time at their own schedule. The interviewees were contacted in April and May 2015. Interviews were schedules for approximately thirty-five minute. The interviews were carried out between 15 May and 30 June 2015. In all out of twelve (12) invitation letters sent requesting for participation, only three (3) agreed to participate.

As argued by Cater, (2011) that in consideration of limited time, financial constraints, geographical dispersion, and long distance involved to reach research participants, it becomes difficult for one to conduct face-to-face interviews. With the high trends in the growth of the usage of technology, online interviewing in qualitative research has reduced the problems face in the pursuit of face-face interview (Hooley et, al, 2012). Concerning the approaches of online interviewing, Pickard, (2013) distinguished two types of online interviewing methods; synchronous and asynchronous. Emails, bulletin boards and discussion groups are the most commonly used methods of asynchronous online interviewing (Hooley et al.2012). Synchronous on the other hand consist of text-based chat rooms, instant messenger protocols and videoconferencing (Stewart & Williams, 2005). Bearing in mind that, the researcher main focus was to use an interactive synchronous method. Skype was used to conduct the online interview. Skype

presents the best option for the researcher who had to try new things in place of already established face-to-face interviews. (Janghorban et.al. 2014 p.2).

Verbal consent was deemed appropriate as interviews were recorded through the online software TechSmith Relay. Participants were given the opportunity to set a time for the schedule of the online interviews. Participants came from a number of different sorts of institutions (large universities and small universities colleges) and were either senior library managers with a strategic overview or middle-level managers with direct responsibility for RDM. The process was carried out based on the principles of voluntary contribution, informed consent and anonymised reporting. The data generated through interviews covered three main themes. Firstly the library roles and readiness to provide RDM service, secondly, the skills and competences to provide RDM service and thirdly the challenges of RDM roles in Libraries.

3.4.2 Document Analysis

A variety of document sources were analysed, including, annual reports of the European policy on research data management, RCN published policy document on open research to data management, research data journal articles, and textbooks. All sources were critically examined, taking into account the social, economic, educational, and political relationships that assist in relating to Academic libraries roles in RDM in Norwegian context. (Louis et.al, 2011, p.253)

3.5 Data Analysis

A thematic analysis method was used as an approach to manage the data gathered from the data collection. Considering it benefits as an approach for data analysis, Braun and Clarke, (2006) argue that thematic analysis provides a "flexible, relatively easy and quick method to learn and do and most importantly accessible to novice researchers." Analysis of the data started immediately during the data collection process in order that themes and theories would be established. (LeCompte and Preissle, 1993, p.238).

Braun and Clarke (2006) recommended the following approaches for using thematic analysis, which the researcher used as a guide for the analysis; getting to know the data, this was achieved by listening and re-listening to recorded data as well as thorough reading of extracts from a articles, blogs and document report from literature; transcribing the recorded data and extracts from documents; Generating of codes to identify interesting features; putting all the codes together to identify potential themes. Various themes were linked with the coded extracts. The themes were arranged to ensure that it was well organized to give clearer definitions; finally generated themes were used to answer the research questions or research objectives.

3.5 Ethical consideration

The research was guided by ethical rules set by the community of researchers. Before the researcher began the data collection process, an invitation letter was sent to the participants'. In the enclosure of the letter consisted of a prepared formal informed consent form, which explained the purpose of the research as well as the privacy and confidentiality of their response. Additionally, respondents were not subject to any act of coercion during their participation. The data collection was successfully carried out through a consensual response from the participants. The researcher acted on this principles to support a claim made by Schinke and Gilchrist (1993) that "all informed consent must meet three criteria: participants must be competent to give consent; sufficient information must be provided to allow for a reasoned decision; and consent must be voluntary and un coerced" (p.83). The interests of participants were protected. This means that information collected from participants was kept private during data analysis and was only used for the intended purpose.

CHAPTER 4: Analysis of research Findings

4.0 Data Analysis

This chapter presents an analysis of data findings derived through individual interviews, and a further detailed discussion of the results. Again, the interviews were obtained from selected academic librarians in the Norwegian community all the three participants were in senior library staff positions in charge of planned RDM projects in their respective institutions. Two of the participants were men and one of them was a woman. In addition, two of the participants were involved in RDM projects in the Social Science discipline, while one of the participants was also involved in the Business discipline.

The organization of the themes derived from the response is based on the aims and objectives of the study and include; Awareness of RDM mandate, Roles of Academic Librarians and Challenges of RDM roles in Library.

4.1 Awareness of RDM mandate

Regarding the Research council of Norway's published policy on Open access to research data and other policies requiring researchers to adhere to a Research data management plan, the response to the answers revealed that all the participants had prior knowledge of their roles towards RDM service. One of the respondents commented that:

"I think lots of Librarians are aware of this and are working with it but few visible results yet. I am also aware of the research council mandate and the formulation of it. I think is good thing that the research council is launching these guidelines" (ST1).

Two of the participants also stated that the knowledge gained from the published policy have also influenced the services of the libraries.

"The mandates of the research council also affects the Library services since we are a service institutions to help researchers to comply with such obligations." (ST1).

"I am very well aware of it, we have started building a repository for research data and it is the Library that does it" (ST 2)

Researchers and faculty members were seen as the primary stakeholders of RDM projects. For the respondents, the libraries exist to assist researchers and therefore libraries ought to participate in providing research data management service.

"I am aware and in an institutional level that the Library is planning to provide research data management services on the next five years to assist researchers" (ST4).
"We are trying to support researchers what they like to do. It our roles to establish how they should their job .We are just trying to support them. As a library, we are here to help researchers to fulfil such mandates"(ST3).

4.2Perceived roles of Academic Librarians in RDM

On the bases of the responses emanating from some selected Norwegian academic librarian's on their perceived roles, it is therefore analysed in the following categories: advocacy and support, providing access to data and managing data collections role.

4.2.1 Advocacy and Support

The participants were asked about the kind of roles academic libraries and librarians need to perform RDM work. In many cases, the participants commented that academic libraries roles in RDM were not something new and therefore majority of the participants indicated that the services and the experiences they have acquired in the traditional library services would be used to take up the new roles in RDM. Examples of their answers suggest that the experience attained from working with the open access projects gives them the edge to perform RDM work. Two views from the respondents were:

"We are building on our long lasting operation in open access to research publications and so we have a lot of competences in dealing with open access infrastructure"(ST4)

"We have tried to build an experience from the services the library have, For example the Library render service, such as institutional repository and open access awareness"(ST2)

Moreover librarians tactfully negotiate with faculty on legal issues such as copyright agreements in the management of data. One respondent stated that:

"Open access to publications has given libraries experience with copyright and licensing, management of publishing and handling of embargo periods as well as retrieval and storing of publications in an international context."(ST5).
When asked whether libraries and librarians have responsibilities in RDM service, all the respondents indicated that they have a major responsibility. However, two of the participants mentioned a shared responsibility with the IT department.

"It is the Library that does it together with the IT department and also in collaboration with some researchers"(ST2)

"We are engaged with the IT staff to involve in our service, to take care of the technical stuff, which the installation of the software, and the Hardware". (ST1).

Another common comments on academic libraries' roles revealed are the disclosure of information and provision of informational and advisory services to the researchers. Two respondents mentioned that:

"Information about where the data set can be found can be integrated into the library's services with respect to creating discovery services. Many scientists do not know the services that are available for data storage or may have problems of selecting between different services. The library is seen as a player who can assist with information about good data management, the benefits of data sharing and the opportunities that are available within specific subject areas and what the best and most reliable service is. Information about where data sets can be found, It can be integrated into Library's services in order to create the discovery services. Optionally, it can be worked out a protocol harvesting to a common Norwegian platform after model from NORA that today is administered by CRIStin " (ST5)

"We can assist with information disclosure about where the data set can be found, and will be integrated into the library's services with respect to creating the discovery services" (ST1)

4.2.2 Providing access to data

Academic librarians' active participation in open access projects equips them with in-depth skills in setting up institutional repositories. From the respondent statement, the skills they acquire in this area have prepared them for the management institutional repositories projects. Three participants declared that:

"I think that I didn't know much about this before I started working with it in the last four months but I have been working with open access and there are a lot of similarities in the way that these two fields are moving and growing forward, so I think we can transfer a lot of skills that we have been working with open access projects into research data management field. For us now, we are now involved in building this repository, try to make the workflow okay and to ensure the quality of the metadata"(ST2)

"The truth is that we have been working with open access to publication anything from Masters, Doctor thesis and also journal publications so that the research community at our institutions including the linguistics faculty staff are aware of the Library as an institution with knowledge on how to prepare, preserve and disseminate research when it comes to publications of document. From there, they infer that they could also do something about research data and we were so glad because we were thinking of quite some years to get started of research data and something that we should look into it to get started with" (STI)

Furthermore, academic libraries encourage researchers to provide the necessary information about their data. They often apply the appropriate metadata description schemas or tools to describe the datasets so that other researchers can also find, use and properly cite their datasets. Two participants stated that:

"Libraries can assist other parts of the organization/data storage Centre with recommendations about metadata and the corresponding international standards for the retrieval of the data set."(ST1)
"Libraries can give recommendations about metadata and the corresponding international standards for the retrieval of the data set. Libraries can support the work of the constant linking/persistent identifiers,

and citation standards. Libraries again can encourage the development of common metadata description schemas and the common citation practices. Libraries also can promote the use of common standards and tools among researchers. Libraries can create overviews of how data sets can be found (discovery services for datasets) Moreover they provide assistance to researchers to understand Metadata descriptions for data sets" (ST5)

It may be disturbing to spend a considerable amount of time and resources to develop an RDM service for the researchers and the service is not patronised. A starting point for the library to take is to conduct a needs assessment of the researchers to ascertain their needs.

One of the respondents revealed that:

"Libraries need to find researchers who need a service, collaborate with the researcher and get started. Try to build an experience from the services the Library have."(ST3)

4.2.3 Managing data collections

Commenting on a shared responsibility with the IT department. In the Norwegian context, one participant considered "Bibsys", an IT company as important stakeholder for libraries to partner to develop RDM service because of its technical competence. However as at the time of the interview, Bibsys did not have any new services on RDM for the libraries. Two participants recommended Bibsys products as a collaborative tool for libraries to succeed in the provision of RDM services. They commented that:

"One of our Libraries we are engaged with Bibsys to provide technical solution for RDM project. Libraries can sometimes come together to seek technical solution in Library services. This can be done in a round table discussion"(ST3)

"Based on the past experience with institutional repositories, Bibsys can be a central player in this work with its knowledge of the discovery services, information and metadata standards"(ST5)

The majority of respondents indicated that some of the roles require technical know how. The librarian is requiring to team up with the IT staff to work together or vice versa. Admittedly, the academic librarians are of the view that the IT personnel cannot perform the role alone due to their limited knowledge in metadata, archiving, and preservation. A comment to this effect means that the IT role in RDM projects requires the assistance of the librarians. Consequently librarians are also involved in the technical roles. Three of the participants had this to say:

"The IT is required to do all the technical skill stuffs, however, the lack of the knowledge of the research subject in question, so the IT need to have knowledge of the research fields to be able to do the curation of the data. Therefore the IT department alone is not the answer on how to do it." (ST1)

"Libraries can together with the scientist build up services to design systems that manage research data, operate the systems and guide users in applying these"(ST5).

"The researchers came to us the librarians and said; we need help to store our data and to make them available, can you help us? And for them, it was quite natural to tend to librarians and ask for help. So i think that they know that we know something about research data infrastructure and also we know about storing and retrieval and metadata"(ST2)

"Libraries experience with creating and managing institutional archives and open access to research publications can be seen as a parallel to the preservation and dissemination in a national archive"(ST5)

Researchers may want to archive their datasets at the end of the research process. Academic librarians assist in evaluating the data sets according to the subject discipline of the data. One respondent stated that:

"Librarians make sure to evaluate the research data when they are uploaded so that they can check if they are reusable, sorted or labelled in the correct way"(ST2)

When asked the kind of skills and competencies required to perform RDM roles. Majority of respondents indicated that much of the skills and competencies required to perform RDM occurs at the storage, and preservation and reuse (Curation) of the research datasets. Issues they highlighted were libraries' involvement in designing and managing the institutional repository, which harness their capacity to provide infrastructure for storing data sets. However one of the respondents emphasised the need for collaboration when it comes to the storage role.

"There are two dimensions of research Data Management, One way is to save the data sets and the other task is to locate where to store the data sets. When you want to describe the data sets in the storage area, you need to be archiving, preserving, licensing and describing metadata, that is where the Library role comes"(ST4).

Another respondent also mentioned librarian's ability to communicate and interpret technical terms to the understanding of their users on the usage of software to manage the research datasets.

"Libraries can communicate to the researchers about the subject-specific storage arrangements, filing roles formats for storage, documentation information for procedure, licenses. Libraries can use Archive software required for reuse or verifiability, better utilization of data. Libraries can show under what conditions data set can be reused"(ST5)

"We make sure that we have someone with the competency to evaluate the research data when they are uploaded so that they can check if they are reusable or sorted or labelled in the correct way"(ST2)

With regard to the skills and roles attained from open access projects. The academic librarians were confident that they will extend their experiences derived from institutional repositories projects; one of the respondents mentioned some work related task in open access.

"We are already providing advice on open access and other aspects of scholarly communication such as institutional repository storage"(ST2).

The participants also mentioned libraries' role in applying Metadata application tools to improve retrieval of data sets. One participant explained that:

"I think we at the library we need to proactively and to offer our services and to show that we have something to offer when it comes to RD Archiving and the Preservation also the dissemination of research data in open archive" (ST1)

4.2.4 Challenges of RDM Roles in Libraries

There were no ready policy for the institutional libraries; all the participants disclosed this. Some of them are of the reason that, in the institutional level, the research data management efforts were in the early stage of development, and that, there are no clear-cut policies on RDM. This also reflects the absence of policy on the institutional level as a whole. One respondent mentioned the library was playing the role of a leading partner in contributing to the drafting of the institutional policy on RDM projects.

"There are no policies on roles of Library in RDM services spelt out by the research council or individual institution and therefore performing providing certain roles without any policy backing creates difficulties"(ST4)

One participant also had this to say that:

"We are working together with the research department, IT department of the University to make possible official policy for the University concerning research data .I think there will be a good cooperation between Research department and IT department and the Library together should take the responsibility to provide a good service to the researchers". (ST4)

The respondents acknowledged the lack of human personnel was their major challenge. The subject librarian with a background in a particular field or discipline is seen as an essential player in the RDM

project. In this regard, Most of the libraries did not have subject librarians to work in RDM projects. One of the respondents commented that:

"There are lots of challenges may be the biggest challenge is to be able to do it properly. It takes human resources; we need people who are having the time and knowledge to do these things. For instance the RDM project in our institutions consist of two subject librarians who are looking into the repository also to do some metadata description. As we want to expand to other areas, we will need to find academic librarians who know the subject in question. That is the biggest challenge". (ST1)

Additionally, the participant's highlighted that, the size of institution affects the number of staff required to work in the library. In most situations, the larger the size of the universities, the more qualified staff are available to assist in various projects. Few of the respondents worked in large Universities. University colleges in Norway are normally small in nature and therefore they lack the financial capacity to hire more qualified staff One of the respondents attributed the lack of qualified staff to the small size of the institutions:

"It depends on how large the institution is, because in our university institutions, we are a university college and we don't have any persons with Library with research experience" (ST3)

Furthermore one participant mentioned that librarians working in small institutions are not usually exposed to research activities in their institution. Few researchers are engaged in research activities and librarians have no connection with them. Unlike large institutions, which the librarians can easily connect to researchers who have taken up national and international research projects .One respondent stated that;

"So I think may be the technical know-how or knowledge of the researcher might be a hindrance to libraries if the institution is a small one. In a large library institution where one does research because some of the Library staff understands the research process, they are engaged to access the quality of the research data before they are uploaded. This is something that small libraries are missing"(ST2)

RDM projects were seen to be expensive in terms of high cost of acquiring storage facilities, the software needed, and the expertise staff needed to manage such a project. Two of the respondents mentioned that:

"The knowledge of that and also of course the resources, its very resource demanding to try and build this repository and so the right form of competences and resources"(ST2)
"To build the necessary competences in the Library in a wide project since the one we have is a pilot project. We are also constrained with resources and infrastructure to embark such a project". (ST3)

The diverse nature of the research data sets was mentioned as a big hindrance. This because that one will require different metadata schemas and tools to manage the data sets At the moment such staff were inadequate or unavailable. One respondents comment;

"The human resources such as highly skilled staff needed to provide the work is limited .In this case we need staff who have indebt knowledge of a particular data sets in a different discipline "(ST4)

Librarians also see RDM projects as uncertain. This due to the fact that, the librarians are not sure whether the RDM service they introduce will be of relevant to the researchers. Three of the respondents mentioned that;

"There may be a challenge when you are introducing a new service to a user group" (ST1)

"We need people who have the time and knowledge to know the researcher's activities and need" (ST4)

"RDM projects are resourceful and therefore it is unclear and difficult to determine needs and demands of researchers is a big problem"(ST 2)

4.2.5 Document Analysis of Supplementary Literature

This section provides an analysis of supplementary documents with notes from ten articles found in journals, blogs, and document reports of countries in USA, Australia, UK, and other Europe countries. The university libraries in the above respective countries show examples of RDM support roles, in every stages of research data process. In view of this, an extract of their examples of RDM roles is used to map to the research data management practices or process outline in figure1.

Secondly, the perceived roles namely, advocacy and support, providing access and data and managing data collections is grouped into a table and then linked to determine whether the examples of academic libraries support services aligns well with the RDM practices.

These practices are shown below in table 1.For each RDM practice, an extract example of academic library support services is used to map to RDM practices. Furthermore the RDM practices are examined to see whether the practices align well with the clustered perceived key roles.

In the table, the role of advocacy and support aligns well with the research data management practices. In the literature we see examples of academic libraries assisting researchers on their RDM plans, advocating

for open access projects etc. Any libraries that are constrained with resources but then needed to provide RDM support for their researchers can initiate this role at this stage.

Table 1. Key roles of academic libraries mapped to RDM practices and their examples of support roles

Key Roles	**RDM practices**	**Example of Text**
1: Advocacy and Support	1.1 Assistance meeting funders policies and requirements	"The University of Southampton Library launched Computing services "isolutions". The Library runs training programmes and practically supports researchers in their RDM needs**.** (Brown, 2013)
	1.2 Data sharing options, open access, IPR, licenses	"The repository has been raising awareness about the possibility of housing certain types of datasets in DIGITAL.CSIC and about the very concept of disseminating raw data in an open access context along with the various benefits, management issues and other considerations and copyright issues" (Bernal and Molina, 2014)
	1.3 Data centres, repositories and collections	"University libraries' involvement in e-research service that include a "staging repository" research data service developed by a project group, DataStar at Cornell University in the US" (Macdonald and Martinez, 2014)
	1.4 Best practices for managing data, standards metadata and vocabularies and resources to find information about (like common data element databases, ontology databases, etc.)	"The UC San Diego Library's Research Data Curation Program (RDCP) and Metadata Services offers metadat consultation and services for researchers. We can help you understand metadata standards and options to bette sync your data with other practitioners of your disciplin as well as assist in metadata creation".(Jolla,2010).
	1.5 Articulate benefits of data sharing and re-use	"This experience led to a greater understanding regarding different types and levels of data, databases and the data –processing pipelines. Sheridan Libraries gained a tremendous amount of knowledge regarding scientific data and sustainability planning" (Choudhury 2010).
		"The Ozflux Repository standardizes and automates the

2: Providing Access to data	2.1 Data manipulation/analysis techniques and tools	collection of data, archives and controls the quality of measurements from a network of measurement stations (Beitz et al,2014)
	2.2 The way data are organized and structured within these collections	"The data conservancy has a distinct feature with a data centric architecture, discipline-agnostic data model, and a data feature extraction framework that facilitates data integration and cross-disciplinary queries" (Mayernik et al, 2013)
	2.3 Data licensing and intellectual property policies and principles	"Monash has chosen to use the Digital Object Identifier (DOI) service provided by ANDS and DataCite to encourage persistent identification of the data sets and facilitate citation and impact tracking"(Beitz et al,2014)
	2.4 Data citations and referencing	"In general, more academic libraries currently offer or plan to Provide reference support for finding and citing data" (Tenopir et al, 2015)
3.1Managing Data Collections	3.1 Data linking and data integration techniques	"Monash is acting as a local storage node as part of RDSI, and is considering how to maximize storage opportunities between the node and its own infrastructure"(Beitz et al,2014)
	3.2 Digital preservation metadata	In the University of California Digital Library, librarians have "played an active role during the development of a new tool, the DMPTool that helps researchers create data plans online". The DMPTool has a repository feature, which stores data. In the discovery feature, librarians assist users to find and access data (Schottlaender and McDonald 2007) "
	3.3 Data discovery tools and management Software's	"In the discovery feature, librarians assist users to find and access data" (Schottlaender and McDonald 2007)
	3.4 Data storage and backup while research is on- going	"Providing archiving and preservation services within the institution and through institutional repositories"**(**Swan and Brown, 2008)
	3.5 Selection and appraisal techniques for datasets	"*It is the responsibility of UCL Research Data Services to provide large scale, high performance networked storage for research projects and long term storage facilities for the preservation and*

		*dissemination of UCL research data" (*Ayris, 2013)

(Source by the author)

5.0 Chapter five: Findings and Results

5.1 **Discussion of Results**

In this section, the findings of the study, classified in various themes, are presented by comparing them with literature extracts from other countries who have also developed a keen interest in the subject matter, keeping in mind that what the Norwegian respondents are trying to do is to respond to the RCN published policy, even if they are not explicitly engaging in RDM projects, and how they respond to the situation. This chapter sheds light on what is discovered as a result of categorizing and analysing data taking note the research questions specified for the study.

5.2 Theme 1: Awareness of RDM mandate

The findings revealed that while most library professionals have knowledge about open policy on research data projects and most are aware of the RDM mandates. Moreover, the results showed that few academic libraries have started establishing institutional data repositories to cater for the storage and retrieval needs of their institutions. This is reflected in the recent set ups of institutional archives and repositories in most Norwegian academic libraries. This perhaps hints to the new development of services for the libraries. This brings about innovation in the academic library services. Innovations in libraries services are subjective because it depends on the available needs and the situations at hand. Though it is quite difficult to compare the perception and attitudes of academic libraries in USA, Australia and UK with that of academic libraries in Norway. In USA and Australia, while the research council mandates is compulsory for researchers who seek for funds to comply. However in Norway, the mandates from the RCN are just recommendations for the researchers. This implies that the response from academic libraries to offer their support will be different from that of the response from the Norwegian academic libraries. Bringing back to the point of innovation in academic libraries, Rogers give a description of an innovation as " an idea, practice, or projects that is perceived as a new by an individual or other unit of adoption"(p.177). Moreover, Sahin, (2006) declared that innovation

may have occurred a long time "but when individuals perceive it as new, then it may still be an innovation for them" (p.14). In the case of the response from the Norwegian academic librarians, they already perform a traditional role in managing digitally based materials, as can be seen by the take up of institutional repositories. (Henty, 2008 p.1). The declaration of open data policy from the research founders, library professionals worldwide see it as a new role or new services that they want to grapple with. As shows in the attitude of the Norwegian library professionals, they are incorporating new services into the main library services. Thus bringing innovations into the library services. In general, the picture appears seems to be promising for the academic libraries since their services and roles are dynamic and keeps changing.

On the contrary, there is also some level of uncertainty since the concept of RDM and academic roles are in its infant stage. Sahin (2006) noted that the effects of innovations might create uncertainty.

The evidence in the response from the Norwegian library professionals depicts that there are no institutional policies on RDM. Librarians see it as an advantage to participate to claim a core role in RDM. One respondent revealed "Librarians do not have to wait for policies from the Directors of the University before it begins to act, we just have to get started, by building experience. We have to show to them that Librarians are able to this".(ST1interview 2015).

Although the Library professionals are trying to adopt new innovations, nevertheless, they are also uncertain about the new services they are introducing to the university community. One respondent indicated their uncertainty about RDM service that, if researchers are reluctant to request for RD services, the librarians might not be able to provide any RD services. Thus indicating that the researchers might reject or adopt the RD support service.

Furthermore, it is worth mentioning that the Norwegian academic libraries have recognised the need to learn more about the RDM practices and seeking to know more about the new innovation. It is worth mentioning that their effort to recognise the absence of institutional policy implies an attempt is made to find it. A similar study conducted by Ryan, (2014) revealed that researchers are more aware of their funders policy on RDM than their institutional policies.

The picture portrayed here is that academic librarians seem to have a keen interest in RDM issues even in the absence of official policy from the university authorities. Apparently, they seem to have a positive attitude towards RDM roles. Subsequently, the action of some of the Norwegian librarians affirms what Auckland (2012) declared, "the library is one of the service providers within a university that is seen by many as having a key role in engaging with the research community, particularly in regard to the management of their data."

5.3 Theme 2: Perceived roles of Academic Librarians in RDM

The skills required to address RDM were both technical and non-technical. At the technical end, there was mention of the installation and handling of software and hardware, the designing of data systems and infrastructure, metadata, database query, storage of data. While at the non-technical end, skills included communications, advice, and training of researchers, discovery and retrieval of data sets, team building, negotiation, copyright, information seeking, marketing of library services. It is important to note that from the literature, the major roles of librarians in RDM consist of provision of

A. Provision of access to data
B. Advocacy and support
C. Managing data and collections.

It may therefore be viewed that the perceived roles indicated by the participants in the study fall under any one of the three elements. In the next sections the findings shall be discussed under these three roles.

5.3.1 Advocacy and support role

It is interesting here that most of the skills correspond with the traditional skills of the libraries. There are several reasons for this; most of the respondents were already familiar with the open access projects and therefore see the new role as a "natural extension" of their role. As confirmed by one respondent that "we are building on our long lasting operation in open access to research publications and so we have a lot of competences in dealing with open access infrastructure" (ST4 interviewed, July 2015). While it clear that there many similarities between the Norwegian

library professionals and that of academic professionals in USA, Australia. In Table 1, the perceived role of advocacy and support map to the RDM practice of sharing data through open access aligns with the responses from the Norwegian library professionals. Additionally they seem to gain confidence on their activities of open access support services. This is not surprising that they view open access to research data management role as a natural extension of their roles.

The results also revealed that Norwegian academic libraries would not be hindered by any technical difficulties in an attempt to initiate any research data project. Besides the engagement with Bibsys, which provide an effective technical services and support solution to libraries, one interview provided a proposal for the formation of consortium of academic libraries to consent and contract Bibsys to provide RD solutions to the Norwegian institutions.

While the data analysis indicated that few Norwegian academic libraries have been quick to develop institutional research data repositories in this case, it is envisaged that other academic libraries in Norway would also initiate such projects. For instance the Norwegian School of management (BI) collaborating with Bibsys, is piloting a research data project "BIRD".

5.3.2 Providing access to data

In respect of the role of providing access to data, the findings show that Norwegian academic libraries have some level of expertise in providing access to data collections, just as in their role in the traditional library. Many librarians expressed their experience with institutional repositories, which they had used previously to provide relevant information objects to supports library users. It can therefore be concluded from the statements of the respondents that they perceive the role of providing access to data as a very plausible role that they can play with a high level of comfort.

Another issue that came to light was the technical RDM practice in the role of providing access to data collection. In view of this there was a general assertion from the Norwegian academic libraries that that this part of the role will be shared with the IT department to assist in the provision of RDM service.

A majority of the respondents shared a similar view in this respect and "One of our libraries are engaged with Bibsys to provide technical solution for RDM project. Libraries can sometimes come together to seek technical solutions in Library services. This can be done in a round table discussion"(ST3 interviewed, July 2015).

The aforementioned suggested roles mean that majority of the technical RDM practices had to do with provision of solution to storage; archiving and preservation of research data sets. These are viewed as the core area, which requires the services of academic librarians. One respondent mentioned, "Libraries can give recommendations about metadata and the corresponding international standards for the retrieval of the data set. Libraries can support the work of the constant linking/persistent identifiers, and citation standards. Libraries again can encourage the development of common metadata description schemas and the common citation practices. Libraries also can promote the use of common standards and tools among researchers" (ST5 interview, July 2015)

5.3.3 Managing data collections

Lastly on the role of managing data collections, the findings of the study reveal that the participating Norwegian librarians perceive a potential role in managing data collections. This finding came to light as the librarians demonstrated their skills in using discovery tools such as BibSys, Oria, to enhance data access and sharing. In a similar situation, the example given in the table 1,shows that some UK academic libraries provide RDM services by assisting researchers to find and retrieve datasets in the repository.

Furthermore most of the librarians' awareness of what constitutes data storage infrastructures and their purposes, application and description of metadata standards and schemas for efficient storage and retrieval of data sets, as well as other expertise points to the fact that they understand their potential role in managing data collections within the framework of RDM.

5.4Theme 3: Challenges of RDM Roles in Libraries

Considering the difficulties the Norwegian librarians reveal in the study. The results may seem to be a universal issue for academic libraries. They share quite similar opinions about major issues that hinder their attempt to initiate RDM services in the institutional level. The following offers a brief summary of difficulties affecting academic roles in RDM activities;

- Resource demanding for the provision of RDM support infrastructure.
- Uncertainty demands about RDM service
- Lack of collaborative relationship between national service providers and institutional level service

5.4.1 Complexity nature of RD

According to the analysis, with regard to resource demands for the provision of RDM service, the majority of the respondents indicated inadequate skilled human resources to be the major hindrance in their attempt to perform RD services. In the Arctic University of Norway, the library established "Trolling," an open data archive, based on the researchers demands in the linguistics department. The biggest challenge revealed here is that; they needed to find subject librarians with extensive knowledge in linguistic to analyse and to curate the data. Moreover, as they envisage expanding in other service areas, they will require academic librarians with a specific subject background. Carlson (2013) observes that "the challenges encountered by librarians seeking to engage in data management and curation issues are found at the individual level (acquiring skills and confidence) and at the organizational level (creating a supportive environment). Both levels will need to be addressed by libraries seeking to develop data services". (p.17). Carlson`s observations aligns with the opinion of one of the respondent. Furthermore, it as said that academic librarians with rich experience and expert in a particular field are confident and able to engage with the researchers. It may seem that this qualification is somehow missing in the context of the Norwegian academic libraries. They are some reasons for this, one respondent confirmed "So I think may be the technical know-how or knowledge of the researcher might be a hindrance to libraries if the institution is a small one. In a large library

institution where one does research because some of the library staff understands the research process, they are engaged to access the quality of the research data before they are uploaded. This is something that small libraries are missing"(ST2 interviewed July 2015).

In a different perspective, the inability of the librarians to know the researchers' needs was another challenge to them. Two respondents maintained that introducing a new service might pose a challenge, due to the fact that researchers had varieties of needs. In Norwegian context, small institutions such as the university colleges had few researchers that engaged in research projects. Arguably, another opinion from the respondent attributes the problem to lack of understanding the needs of the researcher.

Another possible explanation to the problem is that, academic librarians may have no connection with the researchers and therefore are not familiar with the research projects. This confirms the uncertainty of introducing a new product on the market.

This problem requires that academic libraries perform researchers needs assessment to know the needs and demands of the researchers. Brown et.al, (2015) claimed that, "whenever you develop a service you need to understand the perspective of the intended audience. In the case of supporting data management, librarians may encounter resistance. A challenge is a lack of buy-in from the data owners and data creators." (P. 231).

Furthermore, the analysis also showed that academic libraries are constrained with the resources infrastructure to embark RD projects. Infrastructure included the cost involved in acquiring storage facilities, the software to run and manage the programme; others also involve time needed to manage the facilities.

It is interesting to discover similar theme for the two key stakeholders, which is the researcher, and the Librarian. A study on researchers perceptions on RDM in Norway reveals the same theme. While the DAMVAD report claimed, "The time involved is a main barrier to sharing data. Almost one-third of the respondents pointed out that preparing data for open access takes away valuable time for research". (p.48). Similar to what was noted in the DAMVAD report

above, most of the academic librarians involved in RDM service shows that; inadequate infrastructure and time is the main challenge they encounter to perform RD service.

However in the two situations, the Norwegian researchers revealed time constrained to the main challenge in complying to RDM demands, on the other hand, in this study, the results also reveal the lack of infrastructure such as storage facilities, hardware and software as the main challenge for the Norwegian academic librarians.

5.4.2 Conclusion

Though the library professionals see themselves as major stakeholders of RDM support unit. However it seems that, in Norway; most of the academic institutions do not have a formalised structure and policy to back the activities and responsibilities of the stakeholders. This stems from the fact that, on the national level, the research council policy did not spell out clearly the roles and involvement of the libraries nor any policy drafted or found in the institutional level. However, a few academic libraries in Norway have proactively taken the steps to initiate some RD projects with the intent that "if the Library is not actively involved in providing these services, some other unit is likely to be pressed into service, which can diminish the image of the library as an important partner in the research process"(Brown et al., 2015 p.226).

Chapter 6: Conclusions and recommendation

This thesis has explored academic librarians' perception on roles and involvement in research data management support services in Norway. This chapter provides a concluding section, which put into context the research questions, the aims, and objectives of the study. The chapter also provides further suggestions and recommendations. Lastly, the key findings and contributions are presented.

6.1Summary of findings

One of the major aims of the study was to find out the awareness of the RDM mandate of the RCN among academic librarians in the study. The findings of the study shows that the academic librarians involved in the study are well informed of policies regarding open access to research data in Norway. There is common knowledge and understanding on the research data management mandate as required in the RCN guidelines. The participants are already engaged and familiar with the RCN guidelines since they already play major roles in advocating for open access to research publication on the institutional level. However, their familiarity with the mandate from the RCN has not yielded much result yet, though a few academic libraries have initiated RDM services in their respective academic institutions. Examples of such initiatives is the "trolling" project at the Arctic University of Norway, a pilot research data project "BIRD" at the Norwegian Business School Library and the Arctic University library's "TORD."

The study also investigated into the perceived roles of librarians in RDM. The results of the study indicate that these roles may be technical or non-technical. However viewed differently these roles are three-fold: namely, advocacy and support role; role of providing access to data; and role of managing data collections.

On advocacy and support, it was obvious that librarians involved in the study had prior extensive experience in promoting open access to research publications through institutional repositories and other open access options. Other related advocacy and support roles they identified in a potential RDM role included the provision of specialized advice on data storage services,

documentation, and intellectual property rights. They often promote the use of open source software to optimize resources and ensure sustainability. Finally as part of their roles in advocacy and support, librarians also promote and engender collaboration in an effort to ensure shared knowledge and expertise on various aspects of RDM.

In respect of the role of providing access to data, the findings show that librarians have some level of expertise in providing access to data collections, just as in their role in the traditional library. Many librarians expressed their experience with institutional repositories, which they had used previously to provide relevant information objects to supports library users. It can therefore be concluded from the statements of the respondents that they perceive the role of providing access to data as a very plausible role that they can play with a high level of comfort.

Lastly on the role of managing data collections, the findings of the study reveal that the participating librarians perceive a potential role in managing data collections. This finding came to light as the librarians demonstrated their skills in using discovery tools such as BibSysOria to enhance data access and sharing. Furthermore most of the librarians' awareness of what constitutes data storage infrastructures and their purposes, application and description of metadata standards and schemas for efficient storage and retrieval of data sets, as well as other expertise points to the fact that they understand their potential role in managing data collections within the framework of RDM.

The last major objective of the study was to identify the factors that hinder librarians from providing RDM services. Firstly, the lack of RDM policy to back them in in the institutional level was viewed as very challenging. Secondly, the academic librarians perceived RDM support as highly resource demanding. In their case, since most of the institutions are small, the academic libraries are constrained with skilled personnel who have an in-depth experience in research. They also indicated that inadequate storage infrastructure to store the research datasets restricts them from uploading the researchers' datasets into their repository. Additionally they mentioned that RDM services sometimes were very time-consuming. This is particular true where the librarian spends long hours of time to prepare each data set for processing.

Thirdly, the libraries themselves often fear of completion for recognition of professional duties and roles, that researchers might find the support they need elsewhere.

6.2 Recommendations

Based on the findings and discussions of the study, the following recommendations are proposed for the development of RDM in the institutions under study:

6.2.1 Academic librarians' awareness of RDM mandate

- Academic libraries should liaise with national agencies such as Norwegian research archive (Norstore) and Norwegian Social Science Data Services-Archive (NSD) to facilitate RDM promotional programme activities through workshops.
- There should not only be deeper cooperation between researchers and academic libraries but also both between the RCN, Norstore, and NSD so that good integration and clear interpretation of roles in the policies are maintained to ensure a complete compliance of the mandate of RCN.

6.2.2 Academic librarians' perceived roles in RDM

- Regardless of how knowledgeable individual's librarians are in terms of RDM practices, academic libraries should rise to the occasion to pursuing its core responsibilities and begin initiating RDM services, which do not involve huge cost.
- Academic libraries should set up RDM community of practice groups to provide on-going skills and development for their subject librarians. Thus developing their expertise and improving their confidence to engaging with the researchers.

6.2.3 Challenges confronting academic librarians in providing RDM

- Academic libraries clearly need to collaborate and work for the drafting of institutional RDM policies to foster cooperation and collaboration among relevant partners such as the Universities research office, IT department, researchers.
- Academic libraries should learn and follow the successful efforts from other countries and adopt to provide solution to suit their challenges. Academic libraries' tardy response to RDM may be to their advantage.

6.3 Suggestions for Further Research

- There is more to explore in terms of precisely what skills academic librarians need, how the workforce will be developed to support roles in RDM and the implications for the identity of the academic librarian.
- It would be desirable to conduct a similar study on IT professionals' perception on their roles with regard to RDM management, to understand the similarities and the differences between the two groups with regards to skills and competences for RDM.
- There is scope for research into how researchers and the various research disciplines as social entities respond to the professional support services academic librarians wish to offer.

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Appendices

Appendix 1: Interview Guide

- Are you aware of the open Access to Research Data policy issued by the Research Council of Norway? Are the Library thinking of or planning to draw a policy or strategy to provide support for the policy of Open Access to Research Data in the research council of Norway?
- Do Libraries have responsibilities at all in RDM? Who else do you think also have roles to play in RDMS? Is there any expectation from the Library to provide any research Data service?
- What type of services are you thinking or planning to implement in your library?
    1. **Providing access to data (**Example, helping faculty and students find a place to deposit their research data or pointing to data management plan examples)
    2. **Advocacy services (**Example promoting the benefits of Open access to Research Data and RDM in research.
    3. **Managing data collections (**Example, running an institution housed data repository or helping researchers write data management plans)**.**
- What kind of competences do your employees have to perform RDM services?

- The Research Council of Norway (RCN) mandate that went into effect in September 2014; requiring Researchers, Research data must in "general be accessible to relevant users, on equal terms, and at the lowest possible cost. How do you feel its influence on academic library service?

- There has been some debate that Libraries should perform a leading role in Research data management work. Do you think Norwegian Academic Libraries will play a lead role in

assisting researchers to conform to the mandate of the research Council of Norway (RCN).

- Traditional Academic Libraries in a long time have been supporting researchers by selecting, organizing, and making information accessible to Researchers. If the Library were to move in the direction of Research data management, what will be the main challenges for Academic libraries and Librarians?

- There has been some statement that, managing research data management is not libraries job, research data management is technical and that the IT should be their job. How do you feel about the assertion?

Appendix 2: Letter Of Invitation For Interview Participation

Dear Sir/Madam,

Subject: invitation to participate in thesis study on research data management

I am a student of International Master in Digital Library Learning (DILL) at the University College of Oslo undertaking a study on "**Librarian and Libraries awareness about roles of Research data management: a case at Norwegian Academic Libraries.**

The study aims to explore Libraries awareness of and involvement in the research Data management support services. Among others, to reveal librarian preparedness to take up roles related to research data management and their opinions about which job skills are necessary for librarians involved in data management needs and data management work and data management gaps currently experienced by the various stakeholders.

The specific research question that the research seek to tackle are

- What responsibilities do Libraries have in research data management?
- What kinds of services are seen as a priority for the future
- What are the expectations challenges and concerning research data management services

It is hoped that the result from this research will benefit Norwegian Library directors to make policy on research data management services and Research council of Norway to begin planning for research data management support services to their respective institution thereby contributing to innovations and quality of research. This research study forms a core requirement for the fulfillment of the Masters in Dill and maybe a publication of an article.

In order to obtain the required information I would like to invite you to take part in a **half-hour face-to-face interview**. If you are able to take part, please could you suggest to me when you might be available? I am excited to meet you in March at any time or please indicate a date that suits you best.