Prospects of Institutional Repositories in Research Data Management Services with Special References to Shodhganga ETD

2021

A Thesis Submitted to the Vardhman Mahaveer Open University, Kota

For

THE AWARD OF THE DEGREE OF

DOCTOR OF PHILOSOPHY

In

LIBRARY AND INFORMATION SCIENCE

Supervisor	Submitted By
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DEPARTMENT OF LIBRARY & INFORMATION SCIENCE

VARDHMAN MAHAVEER OPEN UNIVERSITY

KOTA-320410 (INDIA)

DECLARATION

I hereby, declare that the thesis entitled, **"Prospects of Institutional Repositories in Research Data Management Services with Special Reference to Shodhganga ETD"** is submitted for the degree of Doctor of Philosophy (Ph.D.) in Library and Information Science, Vardhman Mahaveer Open University, Kota is a faithful record of the bonafide research work carried out by me. The work is original and has not been submitted previously to any other university for any other degree. I have carried out the present research under the able guidance and supervision of **Prof. (Dr) Dinesh K. Gupta, Professor,** Department of Library and Information Science, Central University of Haryana, Mahendragarh (Ex-Professor in Library and Information Science, Vardhaman Mahaveer Open University, Kota). The sources of material used and all assistance received during the course of research have been duly acknowledge. The thesis has been submitted in accordance with the UGC Ph.D. Regulations, 2009.

Place: **(Prashant Shrivastava)**
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VMOU/Research/Ph.D./LIS/2015/74

Date:

CERTIFICATE

This is to certify that the thesis entitled, "**Prospects of Institutional Repositories in Research Data Management Services with Special Reference to Shodhganga ETD",** submitted for **the degree of Ph.D. in the Library and Information Science, Vardhman Mahaveer Open University, Kota**, is a faithful record of the bonafide work carried out by **Mr. Prashant Shrivastava** under **my supervision and guidance.** The work is carried out by him and no part of the thesis has been submitted by him to this University or any other University for any degree.

He has fulfilled the requirements for the degree of Doctor of Philosophy in Library and Information Science at Vardhman Mahaveer Open University, Kota Rajasthan, regarding the nature and prescribed period of work as per UGC Ph.D. Regulations, 2009.

Place:
Date:

Prof. (Dr.) Dinesh K. Gupta,
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Acknowledgement

I would like to express my profound gratitude to my **Research Guide Prof. (Dr.) Dinesh K. Gupta,** Professor, Department of Library and Information Science, Central University of Haryana, Mahendragarh, former Professor, Department of Library and Information Science, Vardhman Mahaveer Open University, Kota for providing his valuable guidance, advice and specialised teaching aptitude for my deep understanding of research work. Completion of my research work would not have been possible without my research guide regular direction.

I am highly great full to **Hon'ble Vice Chancellor, Director (Research), Faculty members and research division staff** of VMOU, Kota for their complete support in my research work.

I am obliged to **Prof. (Dr.) H.K. Prasad, Department of Biotechnology, All India Institute of Medical Sciences, New Delhi** for providing his valuable suggestions during initial phase of my research work.

The guidance and support provided by research data registry, re3data.org authorities for assessment of various institutional data repositories as research data repository, have made the completion of this research work possible.

The present research work also owes its completion to **Ms. Sonia Barbosa, Manager of Data Curation, Harvard University, Cambridge, United States**, who provided support for Dataverse implementation.

I place my sincere and humble gratitude to my parents **Mother Smt. Pushpa Shrivastava, Father Sh. R.K. Shrivastava and my wife Mrs. Arunima Shrivastava** who provided best support and time in spite of various family responsibilities and take care of my two **kids Samarth and Sarthak** also assisted and inspired me during various stages of my research work. I am also thankful to all family members who have given their support to fulfil my goal.

Last but not the least, I would like to thank all the people who have directly and indirectly helped me in all these years.

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Pre-Ph.D. Course Work Completion Certificate

This is to certify that **Prashant Shrivastava**, a Research Scholar in School of Continuing Education at the **Department of Library and Information Sciences, Vardhman Mahaveer Open University Kota, Rajasthan**, India has successfully completed the **Pre Ph.D. course work and passed the Exam.** of the same subsequently as a part and requirement of Ph.D. Programme as per the UGC Ph.D. Regulations, 2009, the thesis also complies with UGC Regulations, 2009.

Date: ……. **Director (Research)**

Place: …….

Pre-Ph.D. Submission Completion Certificate

This is to certify that **Prashant Shrivastava**, a Research Scholar in **School of Continuing Education at the Department of Library and Information Science**, Vardhman Mahaveer Open University Kota, Rajasthan, India, has **satisfactorily completed the Pre Ph.D. Seminar requirement, which** is a part of his Ph.D. Programme as per UGC Ph.D. Regulations, 2009. This thesis also complies with UGC Ph.D. Regulations, 2009.

Date: ……. **Director (Research)**

Place: …….

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Summary

Up to last century the research outputs and scientific data either in private laboratories or in public sector were stored on magnetic tapes. The accessibility of those records was become unreadable with time and change in technologies. Results of these records used to be stored in Academic Research Libraries for future references. Due to advancement of technology and lifetime of media, previously stored research data has been unreadable and inaccessible.

But during last one decade a new approach to research had started and which is based on data curation/capturing in the life cycle of research to be used by other researchers in both present and future times. A vast volume of research data is generated with the application of technology during the research life cycle. But due to invisibility or inaccessibility of data, data are not optimally used by the researchers. Therefore, management of research data becomes important. It will not only fast the process of research but also be helpful in getting data for further use without extra efforts for the new researches. It will also bring relevant data of many researches collective irrespective of subject and themes. The process of research, tools and data used by a researcher may also help in taking up new approach by the researcher for better results. Lifelong availability of research data and its sharing are the great tasks for libraries. Many libraries and institutions worldwide have come forward to make the research data available in open domain in order to facilitate in making uses of their data by other researchers to avoid repeated/duplication in efforts in the ongoing or future researches. Presently Indian libraries don't employ such approach in managing data for the researchers carried out in the country.

The present research work deals with the prospects of Institutional Repositories in Research Data Management Services with special references to shodhganga ETD. An Institutional repository is a showcase of digital scholarly outputs within institute. While ETD repository has stored thesis and dissertations of researchers from various institutions/universities. ETD repository has a number of advantages for institutes and researchers. It works like a research index of the institute. Well maintained ETD repository represents the strength of the research community within institute. ETD has various benefits for authors. It provides a platform to visualise better citation. ETD repository provides tools to disseminate scholarly communication in various formats in minimum time. While in recent times research data is getting prominence and value over research outputs. Also

research data is designated as essential entity for verification of research outputs. In this environment it is mandatory to move on futuristic approach for Institutional Repositories.

The present research work aims to study the status of research data within academic communities and status of readiness for research data management within universities globally. These objectives are analysed through intensive literature review and website investigation of various universities for research data management. The review of literature is analysed using various keywords related to area of research from print, digital and online resources of information. The leading trends in international literature has been observed as emphasis on increasing significance of research data preservation for long time. There are also indication of major research data management practices in foreign universities through institute library. Indian scenario is observed through various Indian government policies and initiatives. It is realised by the researcher that present emphasis is on the digitization of contents in Indian academic community while emphasis on research data preservation is very limited but needs much importance.

The objective of study is also to explore prospects of Institutional Repositories to accommodate research data management services has been analysed by various ETDs repositories implementation in various universities of India and collecting data from the ETDs administrators and faculties of universities through online questionnaire. India has large numbers of Institutional Repositories as reported in DOAR and the Shodhganga is the leading repository with large number of stakeholders. Research data management possibilities have been explored for Shodhganga ETD repository resources through implementation of a research data repository prototype for all Indian universities with the help of open source software. Putting all the resources on the new platform, would require huge infra-structure and time. As such for the present study Library and Information Science resources is taken up and after putting up these resources on the new platform, these resources are made available for the library and information science researchers, practitioners and teachers to have their opinion on the improvements. List of universities registered in Shodhganga was compiled using Shodhganga website. Only those universities were considered where Library and Information Science theses had been submitted for preservation.

A model of unified national research data repository has been configured and offered to the researcher, ETD administrators, librarians and faculties for observation and

suggestions collected through feedback service. The Feedback data has been analysed for the conclusion and suggestions.

Chapter 1: Introduction

1.1 Introduction

Present human lives have information as a fundamental requirement as we are living in information age. Information is key element of the progress in all human, industrial, social and cultural, educational and technological developments. We can have information access from anywhere anytime. While information requirement for academic purposes is specific, academic libraries act as the information and knowledge centres for academic organizations. Current age libraries are specially benefitted with the developments taking place in Information and Communication Technologies (ICT) in order to make library and services user-centred offered anytime, anywhere in the preferred mode by the users. Digitization of information resources have changed the art of access and management of information and information resources.

Now the institutions are getting pace in conversion of information resources in digital forms in different ways. Creation and maintaining of institutional repository are common now. While digitization of information resources is almost a complete phase for academic libraries. It is a transformation process of analogue items into digital format for objectives of ease of access, sharing, preservation and management. The term digitization consists acquiring, converting, storing and retaining information in structured manner. The fair objectives of digitization are: one, to cater readers with rare materials; two, to provide swift search automatically; three, digitization also helps in promotion and marketing of resources; and the four, to maximise utilization of resources and promote return on investment.

Therefore outcomes of digitisation is to maximise visibility of knowledge resources within reader's community and enhance the use of the available resources. Institutional Repository (I.R) concept helps to accumulate, manage, disseminate and preservation of scholar outputs in digital form. As I.R is realised as a library, an archive, a digital records warehouse for an institution. During last two decades the IR developments have taken much evolved role for their respective organizations to store and preserve digital information and knowledge.

Institutional repositories offer a set of services to their users for stewardship of scholarly digital publication. It is a system to preserve, arrange and manage digital outputs of faculties, researches and staff members for a long time. The scholars of various disciplines require availability of specific scholarly literature for future research as well.

During last decade, the emphasis on management of research data gained momentum. The universities that came forward for the active institutional repositories (IRs) quickly assessed the emerging need raised not only of the publications/patents/researches of the faculty and researchers but also the data they created, assembled, used for creating final outcomes by the academic and research communities. As libraries are presumed to be perform as a trusted archivist of knowledge resources in human society. Care of research data is also a part of responsibility for libraries. Curation for research data is an active process throughout the life cycle of research data. A transformed structure of Institutional repository of an academic institution may be an excellent tool for research data organization. The requirement of new configuration and content specific services for Institutional Repositories enrols new frontiers for data repositories as Research Data Repositories.

1.2 Definition of Institutional Repositories

The concept of 'Institutional Repositories' is commonly understood as the digital container of the publications both digitally born or digitised supported with searching and retrieval facility for the researches again both published or not by the academic and research community of the institution. There are many definitions of the term Institutional Repository available in the literature however few important ones are presented hereunder:

In words of Raym Crow's (2002), an Institutional Rrepository (I.R) may be considered as a digital archive collection for academic productivity generated through academic community of the institution and accessible to scholars within or out of the campus with authorized access.

Clifford Lynch (2003) defines I.R as a University wide specific Institutional Repository with a union of facilities which is provided to the scholars of the community for the better organization of digital contents created within academic community. Further it advice to maintain Institutional Repository for electronic thesis preservation.

Chang (2003) identified an Institutional Repository as a latest practice for curation, accumulation, organization and sharing and preserving academic digital output by the members of institution.

Foster and Gibbons (2004) identified Institutional Repository as an electronic infrastructure for preservation of digital works produced by their community.

On the basis of above definitions and understanding Institutional Repositories may be visualize as a tool, system or infrastructure, utilized by the institutions for the management of

preservation, sharing and showcasing of digitals contents of various formats. Institutional Repositories may have open or closed access.

1.3 Need of Institutional Repository in electronic research environment

The need of an Institutional Repository are as follows:

a. Maximise global visibility of academic productivity of an academic institution.

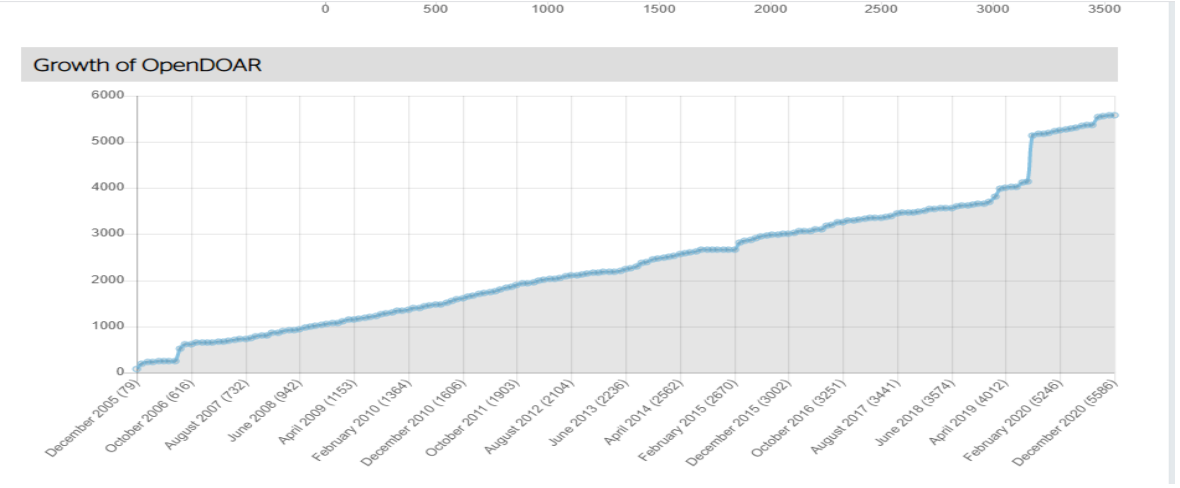
b. Establishment of single archives of digital contents.

c. User friendly access and sharing environment of digital contents.

d. Curation of various digital assets available from various institutions.

There is a rise in number of Institutional Repositories is around the globe as reported in figure: 1.1 which is substantiated through the increasing number of Institutional Repositories available on Registry of Open Access Repositories.

Figure 1.1: Growth of OpenDOAR around the world

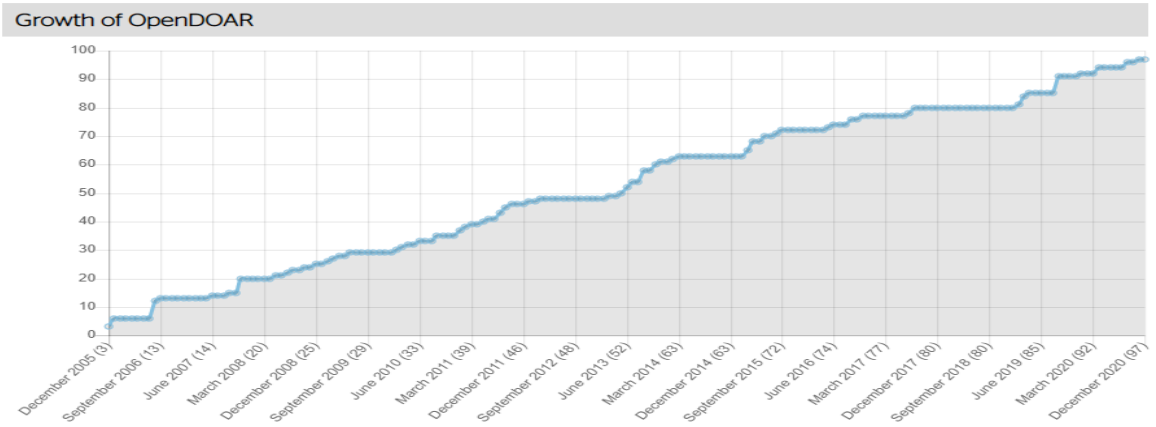


Source: https://v2.sherpa.ac.uk/view/repository_visualisations/1.html date: 12-12-2020

The data in the graph clearly reflects the consistent growth in number of Institutional Repositories is slow but steady these repositories are progressing towards provisions of research data preservations.

In Indian perspective, the growth of Institutional Repositories data is shown in figure: 1.2 which shows increase in number of Institutional Repositories registered in OpenDOAR.

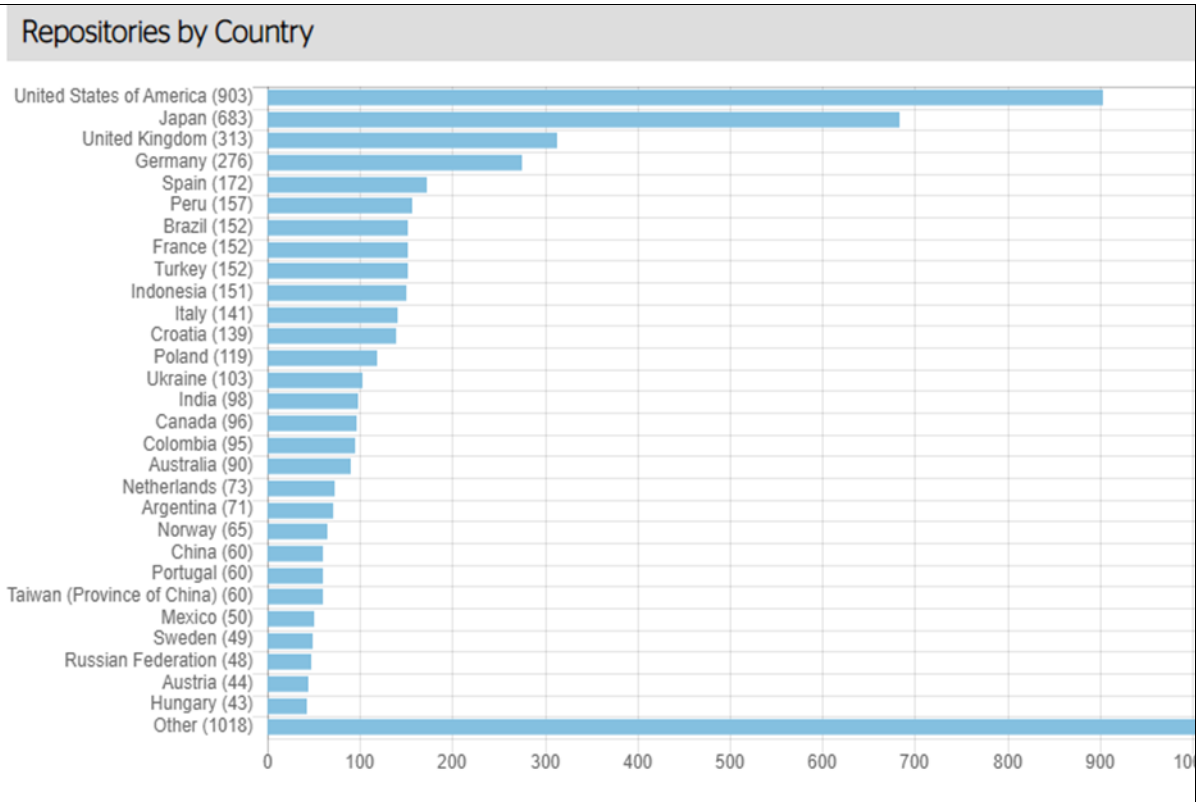
Figure 1.2: Growth of OpenDOAR around India



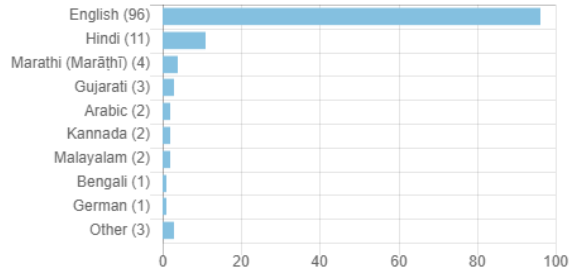
Source: https://v2.sherpa.ac.uk/view/repository_by_country/India.default.html date: 12-12-2020

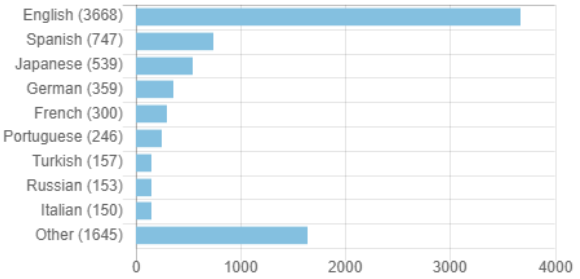
When relating the progress of the Indian Institutional Repositories with the international progress in terms of number of Institutional Repositories in OpenDOAR the figure 1.3 emerges as:

Figure1.3: Growth of I.R in India and other countries around the world.

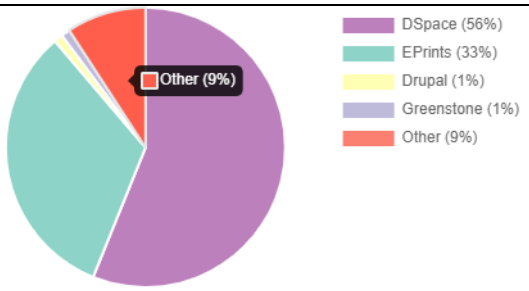


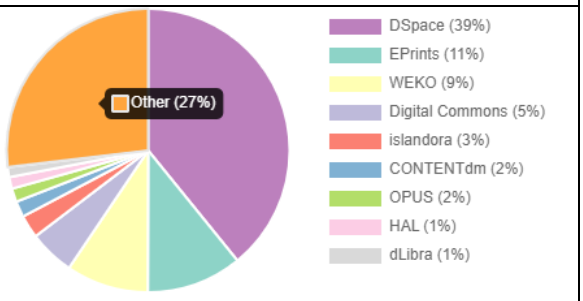
India	Around the World
Language of Content	



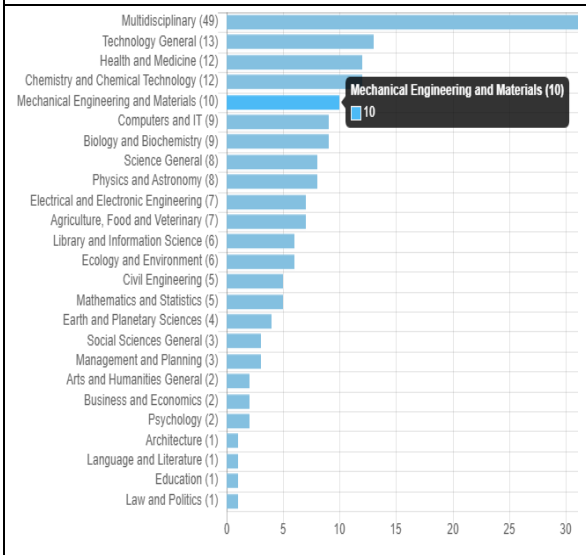


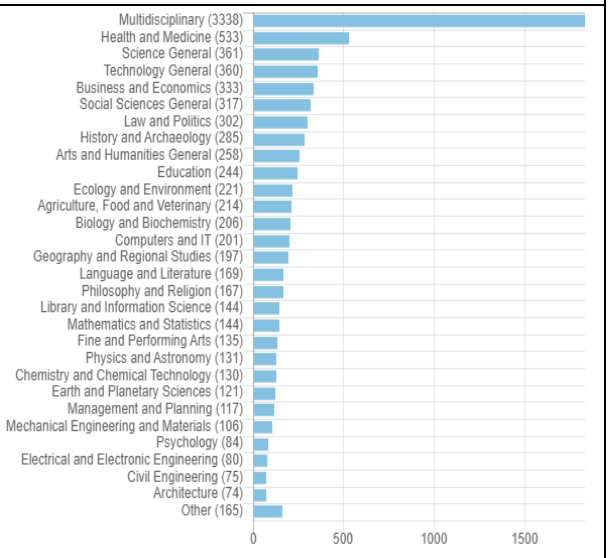
Software Platforms Overview



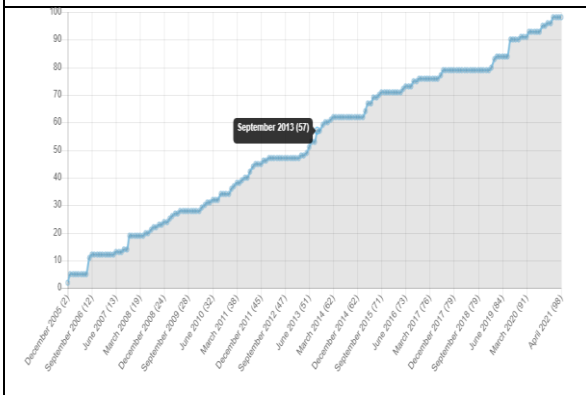


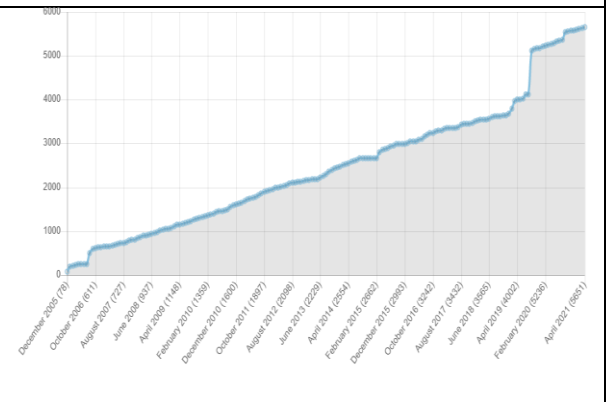
Content Subjects Overview





Growth of OpenDOAR





While looking at the country-wise progress of the growth of the IRs, reflect that USA is having biggest number of IRs almost ten times from India and India stands on the number 15 in terms of number of IRs country-wise.

1.4 Definition of Research Data

Research data is a newer field of work for libraries and institutions and its meaning is emerging with the passage of time. Presently no single accepted description of research data is available and each definition is largely based on the experience gained by the research data expert or institutions. Some of the definitions given by different expert / institution are given below:

Beitz et. al (2012) at Monash University explained that

> "the work developed by researchers with datasets and data, but exact definition of data will qualify by specific discipline descriptions. Primary sources of information or texts-based data may qualify data definition for humanities scholars. While social science field may define data in forms of statistics, survey results, interviews. Exactly in opinion of a scientists' data may be in terms of experiments and observations". Research data may be defined as qualitative or quantitative, in forms of analogue, digital or physical formats. Occasionally data may also refer as existing one or new one.

Elsevier support services has defined that

> "The particular concept for the body of research data always shifts from various disciplines but grossly it may be explained as data that comprises with outputs of investigations and results without involving any analytics or scholarly input. Data may also in forms of facts and statistics collected, references, analysis, and reading of devices for measurement. Social surveys statistics, digital graphs etc. Research data do not include preliminary analyses, nor do they include text in manuscript or final published article form".

Engineering and Physical Sciences Research Council (EPSRC) defined that

> "Definition of research data can be as noted factual substantial normally reserved by and acknowledged in the scientific community as essential to authenticate research results; while the common of similar data is formed in digital arrangement, all research data is encompassed regardless of the arrangement in which it is produced."

The Queensland University of Technology Management of research data policy states that:

> "Research data means data in the form of facts, observations, images, computer program results, recordings, measurements or experiences on which an argument, theory, test or hypothesis, or another research output is based. Data may be numerical, descriptive, visual or tactile. It may be raw, cleaned or processed, and may be held in any format or media".

According to Boston University Libraries,

> "The terms data consists of different fragments of information formally arranged in a predefined manner. Basically, data is the plural of *datum*, a single piece of information. In practice, however, people use *data* as both the singular and plural form of the word. In database management systems, data files are the files that store the database information". Research data is data that is collected, observed, or created, for purposes of analysis to produce original research results.

University of Edinburg has described

> "Research data, unlike other types of information, is collected, observed, or created, for purposes of analysis to produce original research results".

Based on the above definitions, the salient features of research data definitions are:

1. Research Data is the primary data generated during the course of various investigations or queries.

2. Research Data does not has any defined format, its type depends on the specific discipline or subject.

3. Research Data may be identified among existing data or new generated data.

4. Body of Research Data may be any data utilized to produce research analysis and outputs.

5. Any analysis, analytics or investigation may not qualify set of research data.

1.5 Classification of Research Data

The researcher has found classification of research data vividly, however the following table gives a broad understanding of categories of research data provided by different Institutions and Universities:

Table 1.1 : Categories of research data: provided by different Institutions and Universities

Institution/ University	University of Edinburg	Massachusetts Institute of Technology (MIT)
Types	**Observational**: Data-captured in real-time, usually-irreplaceable. For example, sensor-data, survey-data, sample-data, neuro-images. **Experimental**: Data from lab-equipment, often reproducible, but can be expensive. For example, gene sequences-, chromatograms-, toroid -magnetic field data. • Simulation: Data generated from test models- where model and metadata are more important than output data. For example, climate-models, economic-models. **Derived or compiled**: Data is reproducible but expensive. For example, text- and data--mining, compiled-database, 3D models. **Reference or canonical**: A (static- or organic-) conglomeration- or collection of smaller (peer-reviewed) datasets-, most probably published and curated. For example, gene sequence databanks-, chemical-structures, or spatial data portals.	**Observational:** Data-captured in real-time, usually-irreplaceable, examples include-neuro-images, survey-data, sensor-data, and sample-data. **Experimental:** Data from laboratory equipment, often reproducible, examples include gene- sequences, and chromatograms-. **Simulation:** Data generated from test models where model and metadata (inputs) are more important than output-data, examples include climate-models and economic-models. **Derived or compiled:** Data that is reproducible, examples includes compiled-database, 3D-models, text and data-mining.
Formats	Text-flat text files, Word-Portable Document Format (PDF), Rich-Text Format (RTF), and Extensible Mark-up Language (XML).	Sketchbooks- Video-recordings Correspondence Log-books

	Numerical - Statistical Package for the Social Sciences (SPSS), Strata-, Excel-. • Multimedia- - jpeg, tiff-, dicom, mpeg, quicktime. Models - 3D, statistical. • Software – Java-, C. Discipline- specific - Flexible Image Transport System (FITS) in astronomy-, Crystallographic-Information File (CIF) in chemistry. Instrument specific – Olympus-Confocal Microscope Data-Format, Carl-Zeiss Digital-Microscopic Image-Format (ZVI).	Test responses Slides-, artefacts, specimens, Samples Audiotapes-, photographs-, films Models-, algorithms-, scripts Questionnaires-, transcripts-, Codebooks Methodologies and workflows standard operating procedures and protocols

1.6 Need for Management of Research Data

Amos et. al. (2010) explained that the life cycle of e-Research is responsible for generation of vast amount of research data. Various studies identify emerging data usage and needs of research data management within the e-research life cycle of different research groups. Salo (2010) discussed the scope and size of research data not only demands its management but various data formats, non-standard data and variability are the key points to plan proper management of research data. Rotman et. al (2014) observed that in various studies demand for urgent preservation of research data and its organization with core idea of sharing and lifelong availability. Research data management is a complete set of activities which support research data handling in active research life cycle and after that for lifelong preservation and practice.

Research Data Management (RDM) consists steps like planning, documenting data, metadata management, storage, anonymizing data, sharing and permission control. The emergent necessity of RDM is due to requirement of researchers for discovery, interpretation and reusability of research data.

1.7 Research Data Management Components

The life cycle of research data involves various steps of research data management. Humphrey(2014) emphasised and explained that RDM is a cyclic process around research life cycle that includes “design, production, processing, documentation, analysis, preservation,

discovery and reuse" Educause (2009), Michigan State University encapsulated RDM planning document as the components of RDM related to complete process of caring of data before and after creation. Research Data Management : Briefing for Library Directors (2015) The Society of College, National and University Libraries (SCONUL) identifies the RDM components as the organisation of data throughout life cycle of research. University of Lowa expressed that research data organization consists creating, using, analysing, cleaning, storing and sharing data.

The process of research data management now designs in various modules as under:

Discovery: This is first stage of RDM to determine if a project will produce a new dataset, combine existing datasets or analyse existing datasets; identify privacy, confidentiality, and other ethical issues;

Planning: This part considers documentation format and content and the metadata standards to use to describe the data; identify potential users of project data; identify an appropriate data repository to archive the data; and determine data management costs. These details should be included in the data management plan.

Initial Data Collection: This is the stage during which to determine workflows and procedures for organizing files, backups and storage, performing quality assurance protocols, and setting appropriate access controls and security measures.

Preparation & Data Analysis: Researchers may need to clean, manipulate, or process the raw data. This part deals with analysis, hardware and software specifications.

Publication and Sharing: This is the stage to consult with the archive or repository to determine file formats, clean and further document data.

Long-term Management: This is the stage during which researchers share their data and findings through publications, submit reports, and deposit data and supplementary materials into the archive or repository.

1.8 Research Data Management Services

Based on use of research data management tools and techniques various services may be offered by the libraries to the users. Jones. et. al (2013) encoded in his words that increased support of Information and Computer Technologies in scientific research inclined science methods to data intensive research. Various research projects are largely funded by public resources which have motivated authorities for data sharing within public domain. Research data sharing mandate urgently prompted for research data management and services. Tenopir et. al (2014) discussed

that Research data management is the complete picture for life cycle of research data. It includes appropriate data management plans, datasets design, preservation strategies, versioning, policies for sharing, back and recovery. On the basis of research data life cycle, research data management services may be classified as consultative services provided before generation of research data and technological services provided after generation of research data.

Consultative research data management services include discussions and direction to readers about data management plans and datasets.

Technological research data management services include appropriate repository options, datasets configuration, data management policies, discovery options,

1.9 Prospects of Institutional Repositories in Research Data Management Services as Research Data Repositories (RDR)

Institutional Repositories are the showcases of institutional research outputs which provides wider displays and recognition of contents. Availability of voluminous digital contents in institutions develop an urgent need of a centralized system for management and sharing of contents. The expectations of institutions and scholars' community are enhanced to consider role of Institutional Repositories after increased significance of research data. Present form of Institutional Repositories are the solutions of these demands. Digital revolution of research methods with involvement of big data made it mandatory to transform Institutional Repositories into Research Data Repositories.

1.10 Status of RDRs around the world

Pampel et. al (2013) said that due to distinguished nature of research data in various disciplines, re3data.org has been configured to accommodate various Research Data Repositories as a contributor of research data as well as user of it. Table 1.2 enlist top 20 countries which is registered with re3data.org with maximum Research Data Repositories.

Table1.2: List of Top 20 countries, registered with re3data.org with maximum RDRs

Sl.no	**Country**	**No of Research data Repositories**
1	United States	1067
2	Germany	413

3	United Kingdom	282
4	European Union	267
5	Canada	256
6	France	106
7	Australia	90
8	Switzerland	70
9	Japan	59
10	Netherlands	56
11	India	51
12	China	44
13	Italy	37
14	Austria	35
15	Spain	29
16	Norway	26
17	Belgium	24
18	Russian Federation	22
19	Denmark	22
20	Sweden	22

Source: https://www.re3data.org/browse/by-country/data accessed on 09/05/2020

1.11 Shodhganga ETD in India

Shodhganga is a digital repository for Indian intellectual output hosted and configured by INFLIBNET Centre. It has been setup by the UGC act and notification of minimum standards and procedure for award of M.Phil and Ph.D degree. It is mandatory to submit electronic version of theses and dissertations by the researchers in universities with and aim to provide open access to the academic community. It has been configured by Inflibnet through DSpace software with the support of Massachusetts Institute of Technology and Hewlet Packard partnership.

Shodhganga repository status on the following parameters is as under upto Oct 2020:

Parameters	Statistics status
Universities Signed MOU	538
Universities Contributing	471
Full Text Thesis Available	298978
Synopses / MRPs/ PDFs/ Fellowships	7940

1.12 Statement of Problem

Crow (2002) depicted that an Institutional Repository is a digital archive of the intellectual output generated through academic community of the institution and accessible to scholars within or out of the campus with authorized access. While with the passing of time the nature of services and responsibilities of Institutional Repositories have been transformed. Earlier where organization of a large number of digital resources was the challenge for the institutions but now a days creation of pool of research data is a big challenge for the institutions. In this context Institutional Repositories have a versatile prospect to manage research data and offer its services. On the basis of available studies and literature related to Institutional Repositories and Research Data it is observed by the researcher that not much research has been done on research data services prospects of Institutional Repositories. Simultaneously in the development of I.R the primary emphasis has been given on digitization process while in current situation related to digital research data mandate directions for I.R configuration needs to be updated consistently.

Though there were many studies which critically examine the role, operation outcome resources of these I.Rs but there was no study found which deals with services of research data management through Institutional Repositories in India. This inspired the researcher to take the study entitled “Prospects of Institutional Repositories in Research Data Management Services with special reference to Shodhganga ETD” for undertaking a theme of the present research.

1.13 Objectives of the Study

Present study will be efforts to do the following

a. To find out the possible role of Institutional Repositories in Research Data Management.

b. To explore current practices in terms of Research Data Management Services (RDMS) in International and Indian universities.

c. To evaluate resources available on Shodhganga repository in the light of better Research Data Management solution by using Open Source Software.

d. To suggest appropriate measures to make effective development of Skills and management of research data.

1.14 Research Methodology

In view of the objectives of the study, an effort is made to evolve suitable research methodology for the research.

First objective has been covered by intensive literature review. Second objective has been derived by websites investigation of various world universities and Indian Universities. Third objective is related with Research Data Management possibilities with Shodhganga resources, for this purpose the researcher selected all the library and Information Science theses available in this (Shodhganga) repository and used for analysing using another open sources software for possibilities of services to the users/ researchers.

An analysis of the changes in research data search patterns and results have been conducted through offering access to the newly designed research data repository to the researcher/ practitioner/ teachers in LIS for their opinion and further improvement. Based on the outcomes and conclusions appropriate suggestion has been made as part of last objective. The detailed discussion on the research methodology is covered in the chapter-three of the thesis.

1.15 Scope and Limitations

As mentioned in table: 1.2, India has 51 Research Data Repositories while the Shodhganga repository is the biggest thesis repository of India with large number of stakeholders. Out of the existing Indian Research Data Repositories, none represents research data management services for Indian researchers. So with the available landscape of resources of Shodhganga Electronic Thesis Depository, an effort is made to configure a prototype of unified Research Data Repository for all registered Ph.d Scholars and researchers in Shodhganga.

As per consideration, if researcher puts all the available subject and discipline available in Shodhganga ETD on the new platform to provide single research data management services data repository, it would require huge infrastructure and time. As such for the present study Library and Information Science theses information are taken up and after putting up these

resources on the new platform, this research data repository is made available to the Library and Information Science researchers, practitioners and teachers to have their opinion for the improvements.

1.15 Chapterization

Present study has been conducted into following six chapters:

Chapter 1- Introduction: This chapter consists preface of the study, definitions, categorization, statement of the problem, objectives, scope of study.

Chapter 2- Review of Literature: This chapter comprises within depth study of available literature and different related topics to the I.R and Research Data Repositories.

Chapter 3- Research Methodology: This chapter includes various methods utilized to fulfil objectives of the study. This research work is based on questionnaire, survey and interviews techniques. It also consists survey population selection, pilot study, and details of style for bibliographical references.

Chapter 4- Profiles of Institutes providing Research Data Management Services: This chapter includes study of Institutions around the world and in India.

Chapter 5- Data Analysis and Interpretation- This chapter includes analysis of collected data through various techniques and their interpretations.

Chapter 6- Findings, Suggestions and Conclusions: This chapter includes results of the findings of the study based on analysis of data. Conclusions have been drawn on the basis of data analysis, suggestions received by feedback and interviews.

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Chapter 2: Review of Literature

2.1 Introduction

Review of literature is a very important part of all research works. It provides an intense insight of the topic and related areas. A researcher can easily know the available source and resources on the topic related knowledge concepts through systematic search of literature discovery. But searching is not enough, s/he has to identify the useful literature and find and collect the full text of the sources identified items. When the researcher further studies these full text, scholarly communications understand the area of study in a cohesive manner. Further, it helps to generate an orientation that what is already known and what are the gaps in the existing literature that supports to undertake the present research.

Review of literature also provides an assessment of objectives, scope and appropriate research approach used by the researcher and results and conclusions of the study.

While starting of the present study, the area of Research Data Management was at a nascent stage which can be evidently proved from the data retrieved on publications on this area through various Library and Information Science abstracting and indexing databases. The researcher used the LISTA to find the growth of researches in this particular area of research. The researcher searched in this database using various combination of terms like keywords as Institutional Repository, Research Data, Research data management, Research Data Management Services etc. and the results received are demonstrated in the following table/diagram:

Table 2.1: Lista search results used for various keywords in last five years

Sl.no	Keywords	2016	2017	2018	2019	2020	2021
1.	Institutional Repositories	119	121	146	144	105	36
2.	Research Data	181	169	191	201	102	59
3.	Research Data Management	56	78	58	83	62	19
4.	Research Data Services	17	16	12	11	7	6
5.	Research Data Management Services	2	7	6	3	5	4
6.	Research Data Repository	7	4	1	0	2	2

Date of updation: June 2021

Table 2.1 dipicts, the growth of literature found on keyword "Institutional Repositories" is almost stable during years while the literature results growth during the present study on keywords as research data, research data management, research data services and research data repository have found very slow.

Literature on prospects of Institutional Repository in Research Data Management Services could be grossly divided in to scholarly communication as Institutional Repositories, Research Data, Research Data Repositories, Research Data Management Services, Shodhganga Electronic Thesis and Dissertation repository.

2.2 Institutional Repository (I.R)

In general, an Institutional Repository is considered as an archive for collecting, preserving, and disseminating electronic copies of the intellectual output of an institution, may it be an academic institution or a research institution. There was a speedy growth of the Institutional Repositories from the beginning of the 21st century. There were numerous Institutional Repositories were started during the first decade. When this area started getting matured a focus of researchers started on finding solutions for creating and aligning data with the IR as the research data to a large extent remained unused during above period. While looking at the existing literature on the Institutional Repositories and their interest in the research data the researcher came across some important studies and those studies are tabulated in the following table 2.2:

Table 2.2: List of Literature review on the Institutional Repositories

S.N.	Information About the Work(s)	Key area of work which addresses the problem under investigation
1	Witt (2008)	Identified lack of available infrastructure for research data curation in long terms. Author observed roles of librarians and Institutional Repositories in research data

		curation with recommendations for distributed Institutional Repository.
2	Amos et. al (2010)	Investigated requirements of researchers for research data management in earlier science research and new e-science environment. Author identified that earlier research data had been recorded at end of research in research outputs while now researchers required continuous research data preservation support.
3	Shorish (2012)	Explored and identified fundamental challenge of research data preservation in smaller institutions and quality efforts to engage researchers in research data preservation on Institutional repositories.
4	Castagne (2013)	Provided the comparison of research datasets management software that may support Institutional Repositories for better research data organization.
5	O'Malley(2014)	Investigated requirement of researcher for research data management during implementation of Institutional Repository.
6	Palumbo et. al (2015)	Investigated requirement of Institutional Research Data Policy in Institutional Repositories.
7	Giusti et. al (2016)	Explored digital repositories collaboration to minimise accidental loss of research data.
8.	Renwick et. al (2017)	Authors investigated that why repositories do not considered first place for preservation of research data. Authors evaluated the problems as lack of orientation, unexplored possibilities of research data services within Institutional Repositories.
9.	Kipper et. al (2018)	Authors Investigated the role of research data management in decision making education concepts. Also observed that data literacy may help researchers to organize significant research data within Institutional Repositories.

10.	Wang and Wang (2019)	Identified and discussed that what are the critical differences between research data based organization of knowledge and library & Information science present digital knowledge setup.

The literature on I.R has been developed from evaluation of I.R systems in the United Systems. Crow (2002) presented an article to provide emphasis on proper space for the implementation issues of digital libraries and consortia. This paper identified I.R as an important parameter to reconfigures the system of Scholarly communications. I.R system have capability to serve as basic a sensor of university's research quality and to visualise the scientific, social and economic depth of its research systems and comparative status within academic society. Johnson (2002) has described benefits of I.R in depth. Lynch (2003) explained the respective developments in I.R and elaborate why do I.R are deeply related to strategically development of the organizations scholarly outputs. Lynch highlights in reference of I.Rs that it may be in practice for organizational control for smooth authorized scholarly outputs. Branin (2003) described in his paper for conceptual model and standards for Institutional Repositories. Yeates (2003) tabled the benefits of I.R as a resource sharing method for academic community. Publisher and Library / Learning Solutions (PALS)(2004) reported information on all dimensions of IRs as policy issues to establish I.Rs, issues related to academicians for self-archiving practice and related to intellectual property rights.

Shearer (2004) had discussed about his survey to gauge status of I.R at Canadian Association of Research Libraries (CARL). Author observed that a large number of CARL libraries prefer Dspace as I.R software. She also identified initially minimum staff deployed for I.R management as part time basis with some specific contents. This survey also include another survey to evaluate content, policies, software platforms and activities in CARL I.Rs. Gibbons (2004) observed the actual facts for adoption of I.R and as an appropriate tool for digital content preservation. Cullen et al. (2004) proposed the critical problems to setup Institutional Repositories. Authors discussed librarians and Information professionals' roles in I.R practices. Hayes (2005) identified the I.R support for research activities, as a learning and administrative tool. Pickton (2005) advised to use I.R as a tool to promote appropriate material to the readers' community. Lynch and Lippincott (2005) have conducted a survey to evaluate present status of I.Rs in United States Libraries. Authors identified in his studies that a large number universities are planning to adopt I.R as a tool to maintain doctoral outputs. While I.Rs in U.S also contains

various digital materials of respective organizations. One of the strong outputs of this survey is that library professionals have higher preference for I.R administrators. Westrienen and Lynch (2005) evaluated efforts of I.R developments in thirteen countries. This study highlights the bottlenecks of implementations. Arora (2006) described that digital preservation is depending upon various aspects of data types, situations and institutions. His study enlightened that short life of digital preservation techniques and media is a real challenge for long lasting life of preserved resources. Chattopadhyay (2006) studied the concept of preservation and digital preservation. The conversion of paper to digital era has been analysed. Various types of digital material preservation and formats are discussed.

The core outcome of this study is to emphasise content selection for I.R. Davis and Connolly (2007) observed that I.R development at Cornell University. They identified I.R usage best practice in university and recommended key point to improve usage of I.R in Cornell University. Yiotis (2008) expressed their concern as the electronic thesis and dissertation repository as a topic of native digital repository. "This study discussed interoperability among repositories and open archives initiative protocol for Metadata Harvesting". Various concerns regarding intellectual property rights, point of views of publishers, anti-plagiarism concerns and overall cost with long life preservation discussed.

Rodgers et al. (2013) discussed historical background on Institutional Repositories. Authors observed various organizational and professional transformation for I.R programs within universities. Tosaka et. al (2013) described the some very practical approaches for creation of I.Rs in small institutions with local digital resources. Authors explored all possible aspects and problems for small intuitions I.Rs development process. Also some proposed guidelines have been recommended. Bhat (2014) explored identification of various research data materials in Indian Institutional Repositories. Cayabyab (2015) studied and represented the picture of ETD in research data management era. Extensive literature review has been done to identify ETD projects and data integration requirements. The literature review for Institutional Repositories in light of research data studies reflects that digital transformation through Institutional Repositories are considering research data an important factor to deal futuristic services demand.

2.3 Shodhganga Electronic Thesis and Dissertation Repository

Shrivastava & Gupta (2016) described the Shodhgang as a national level open access ETD repository of Indian electronic thesis and dissertation. Authors observed that National Knowledge Network has been constituted to regulate various dimensions of national digital contents. Also observed that national ETD service may be the best practice and tool to disseminate national research outputs. Shodhganga: Indian national ETD repository service has been started in 2010 by INFLIBNET Centre. Submissions of research outputs in Shodhganga has been regulated by a regulation named as eligibility criteria for the award of MPhil and Ph.D. programs. Panda (2016) observed that Shodhganga has become a trusted digital repository having a large collection of research output. Still Shodhganga repository has not covered all universities in India. Sinha et. al (2018) expressed their concern about least awareness of national repository service within researchers. Also it has been observed that researchers are using national ETD repository service tools at very low level. There is a requirement of researchers' awareness programs. Available literature review about Shodhganga: national ETD repository shows that it is a very useful service to get transformation print research outputs to digital research outputs throughout the Indian universities. But still there is an emergent requirement of a national research data service for researchers with appropriate national research data policy.

A large number of research studies addressed the issues and status of Library and Information Science ETDs in Shodhganga as given below in table: 2.3:

Table 2.3: LIS ETDs research studies in Shodhganga

S.N.	Information About the Work(s)	Key area of work which addresses the problem under investigation
1	Kumbhar, R. M. (2002)	Author presented a Construction of vocabulary control tool thesaurus for library and information science.
2	Phuritsabam, B. (2008)	Presented a study for Library and information science education in Indian universities.
3	Jayanna, R. (2009)	Investigated Information technology components in library and information science curriculum in universities in India.

4	Ananda Ramesh, A. (2013)	Author analysed on 'Shodhganga- a Reservoir of India Theses' with Special Reference to Library and Information Science Theses.
5	Ghatol, S. K. (2014)	Presented a critical study on doctoral research in library and information science in India.
6	Sawant, S. (2014)	Investigated case study of Shodhganga about LIS Research and its Availability in Archives/Repositories
7	Jeyapragash, B., Rajkumar, T., & Muthuraj, A. (2016)	Investigated a research output analysis of electronic theses and dissertations with special reference to Shodhganga.
8.	Gogoi, M. (2018)	Presented a bibliometric study through Inflibnet Shodhganga about Library And Information Science Research (Doctoral Theses) In India.
9.	Lamba, M. M. (2018)	Investigated for Topic Mining and Prediction Modelling of Library and Information Science Theses Submitted to Shodhganga during 2013 to 2017.
10.	Lamba, M., & Madhusudhan, M. (2018).	Studied metadata tagging of library and information science theses: Shodhganga (2013-2017).
11.	Singh, R. K., Singh, A., & Singh, A. K. (2018).	Investigated A Case Study of DLIS Aligarh Muslim University for Research Trends in Field of Library and Information Science through Shodhganga Repository.
12.	Babu, H. R. (2019).	Presented a Case Study of Shodhganga ETD Database through Citation False Practices in the Library and Information Science Theses.

2.4 Research Data and its Management

Allcock et. al (2001) focused attention on a fundamental Data Grid Service which has been equipped with secure, reliable, efficient data transfer and compliant with data migration in multiple dataset replicas. Gray et al. (2002) described preparedness fordata publication, access, curation and preservation. Ross et. al (2005) concluded in their study that digital research data curation process must include researcher with close partnerships.

Beagrie (2006) explores digital curation practice as a field of cross discipline research. During the process of explorations of digital curation various drivers of curation related to publishing, sharing and reusing of research data analysed. Author emphasized to develop persistent digital information environment for digital contents management. Gurria, A. (2007). Science and Technology Ministers (European communities) called on the Organisation for Economic Co-operation and Development in 2004 has developed a set of guidelines based on commonly agreed principles to facilitate cost-effective access to digital research data from public funding. King (2007) introduced a latest collection of integrated developments in web equipped application solutions for data citations methods, numerical methods, scholarly recognition of data providers. Author proposed a united solution for various need of research data management and sharing environment. Various concerns of citation and data rights has been analysed. Beagrie et. al (2008) explored research data preservation assessment for a defined environment and created feasibility study for infrastructure dependencies.

Green et al. (2009) recommended guidelines of policy making for research data. Authors identified research data guidelines as a tool for decision making and planning for institutions digital research data mandate. Hey & Stewart (2009) had discussed about fourth paradigm for Science based on data Intensive computing. In the articles of this book the readers requested to consider the several prospects and contests for data-Intensive science comprising interdisciplinary cooperation and training, inter-organizational data sharing for scientific data mash ups. Cheong et al. (2007) explored quality of data has accuracy as indicator while availability on time, its relevance, reliability and domain specific increase features. His study strongly supports better research data management for better quality.

Amos, Frances & Ruthven (2010) presented a research study of data usage, creation and sharing within different research communities at University of New South Wales. This study has identified that developing data use and organization required in e-research life circle of different research societies. Comparative study has developed with results of other studies that investigated e-researcher work done in continuation of their data. The study investigated the results to identify what work type researches wants from libraries. Also it discussed that what may be the framework of library support for research data management and services throughout the various disciplines. Borgman (2010) encapsulated the prime purpose of data driven research for the point of view of researchers about research data sharing. Also author included role of libraries for management of research data. Higgins (2011) explored critical issues planning and

strategies concord with digital preservation of research data. Author discussed urgent need of wakeup, re-union, proper organization and engaged collaboration.

Wolski & Richardson (2011) presented a research data planning framework which fundamentally proposed according to life cycle of research. "Data discovery and collection, cleansing and processing, analysis and computation, and finally publishing and preservation for re-use." The framework arrangement evaluates various key indicators governance, applications, content management, delivery services, storage and network. Strasser(2012) This primer describes a few fundamental data management practices that will enable you to develop a data management plan, as well as how to effectively create, organize, manage, describe, preserve and share data.

Napier et. al (2012) discussed in his study about very important parts of research data management. Authors emphasised on involvement of multiple experts of various technical disciplines so that research data preservation infrastructure may be designed as an international level. Shorish (2012) describes the hardships to data curation. This study highlights the point of small organizations for data curation and management. It provides the steps to start discussion on research data curation and with the contribution of Institutional Repositories or the same. Boulton (2012) draws attention on an open approach is the best way to maximize the benefits of research for both scientists and the public. Asher et al. (2013) represented a comprehensive study of significance for research data in U.S higher education system. Book presented a collaborative effort to draw sketch of Research Data Management in U.S higher education. Authors also analysed about requirements and services allowed by stake holders for research data. Winn (2013) expressed his concern as research data management is one of the much required need of the hour. The research data which has been generated by public funded projects should have their policy to share their research data publically. Research datasets available in public domain will promote reuse and best verification practices. It has been also considered that availability of research data should be a part of free to all information legislations.

Koulouris et al. (2013) presented a bibliographic study for repository policies. Best practices standards recommended by the authors. Martin (2014) highlighted requirement of practical and policy related availability of research data management course for the skill development for researchers and librarians. Willmes et al. (2014) discussed well-established free and open source software for research data management. Authors recommended that open source software implementation for research data management will be best useful to generate confidence within researchers to develop research data management practices.

Akers et al. (2014) measured libraries contributions regarding research data management. Authors also advocated that libraries may have a prominent role in educating researcher and academicians for best research data management services.

Pinfield et al. (2014) have presented a study which was related to profession of the librarians. It was a conclusion of studies of various interviews of UK institutions library staff. Results reflect that library professionals can play a significant role in research data management. While an established library setup provides a good infrastructure to make a blueprint of RDM implementation. Planning for research data mandate within university considers check points as include storage, security, quality, compliance, preservation and sharing. The study also emphasise on a model development for an institutional RDM programme. Proposed model will be helpful to clarify various issues involve in RDM strategies. Also Institutions can compare direction and pace of RDM process with the proposed model. Cilip (2014) has drafted a report for better implementation of research data and its management. His attempt was to briefly explain roles of library professionals and retooling the profession. Rotman and Mike (2014) has presented an article which was a sketch of various aspects of research data life cycle. The numerous features involved in managing, describing, preserving and making research data included. Childs (2014) represented technical aspects of open research data initiatives for RDM. The authors advocate the need of skill development for research data management which may promote sharing and reuse of research data.

Vellucci (2015) in his book tested many aspects of research data from the perspectives of researchers and librarians. He minutely observes events where library is a crucial part of development of research data. His study recommends the fundamental data skills of librarians can promote better management of research data. Barskey et al. (2015) presented a book with various modules with discussion on how researchers can manage better their research data. While Cannon (2015) proposed an idea to explore and discover research data more easily for researchers. Dora and Kumar (2015) explored significance of research data with its preservation, organization, dissemination and its value in research life cycle.

Flores et al. (2015) has evolved increasing importance of research data and its management around the world. This study has included the documentation, curation, and preservation of research data. Research data management ensures lifelong organization of data. It was observed that sharing of research data requires a number of requirements, policy, techniques and tools.

Kennan et at. (2015) has reported in his survey that universities have usage of wide variety of research data including analogue data. These practices have faced problems in managing

research data, secure and safe storage is always a challenge also sharing of data required a comprehensive policy.

Van Deventer & Pienaar (2015) explored research data management lessons and provides recommendations that every organization have their own parameters to implement research data management concepts. Shearer (2015) observed in his study a detailed summery of policy environment for research data management in Canada. This report included all major challenges for policy creation, adaptation and rectification with preparedness for RDM in Canada.Rocha et al. (2015) encapsulated various comparisons of research data management platforms. This study explored current practices in data management workflows. The conclusion of the report was the most suitable platform for the local research data program is depend on its suitability.

Bloom (2015) identified a data publishing reference model. The data publishing practices demands identified standards for data publishing and it took a wakeup to share data.

Carroll (2015) analysed the legal aspects for sharing of sensitive research datasets. The concerns are raised in terms of 1. Framing of legal rights of data 2. Qualifiers of data rights 3. The process of sharing of data with encouragement to reuse and verification. The security and licensing issues are also explored. Kratz et. at (2015) identified a wakeup and appreciation environment for the dataset contributor for various scholarly communications. It included developments within various projects for review of datasets before final data publication. Concerns regarding researchers' expectations for appropriate research data management discussed.

Palumbo et al. (2015) discussed the issues related to data ownership within institutional data policy. Authors included concerns for sensitive datasets and the process of their confidentiality with process of limited sharing. Specific parameters discussed related to a dedicated data curation team, storage capacity, financial constraints, proper work flow of research data and involvement of researcher with data librarians. Zhang et. al (2015) identified librarians and other informational professionals' engagement in assessment of needs of researchers about management of research data it's sharing and curation. Authors proposed a guidelines for the ease of data librarians. Swauger et. al (2015) proposed significant features for researchers to help stack holder for planning more reliable repositories for research.

Abbott (2015) identified the requirement of digital curation of research output with the amalgam of skill between researches and research supervisors which suited well for digital curation. Author recommend the responsibilities of institutions for digital preservations with limited contribution of researchers in digital curation process. Lagoze et. al (2015) described the difficulty of data status which has public and private both rights. Authors further described the

search, access and cite complexities with data have relationship with identities of people's data specific data sets. The core of sensitive datasets lies within their confidentially, so it's a challenge to manage its sharing and use.

Erawy et al. (2016) had prepared a report to realise practical approach of research data sharing at first part all aspects of data sharing service have been discussed from initial stages to finally delivery of data. In second stage all resources for research data preservation and sharing have been analyse. Shrivastava & Gupta (2018) discussed that research data management requires proper planning and technical framework for implementation. Authors emphasize on research data literacy for development and proper implementation of research data management concepts. Awasthiet. al (2019) observed the bottleneck for the librarians to implement RDM concepts. Authors recommended to coordinate stack holder and librarians on RDM policies issues. Cristina (2019) elaborated the phenomena of e-science which essentially demands proper management and preservation of research data. Author also emphasized on strong policy creation for research data management implementation.

Author analysed available literature review on research data and observed that in table 2.4, following studies are slowly sensing the rise of research data significance.

Table 2.4: List of Literature review on Research data

S.N.	Information About the Work(s)	Key area of work which addresses the problem under investigation
1.	Gray et al. (2002)	Considered the problems and possibilities for research data publishing in research projects.
2.	Ross et. al (2005)	Analysed research data curation bottlenecks.
3.	Beagrie et. al (2008)	Identified feasibility study of research data curation for infrastructural dependencies.
4.	Hey & Stewart (2009)	Said that problem for management of research data pool has been occurred due to paradigm shift from science to e-science.
5.	Higgins (2011)	Waked up the research domain leaders about research data prominence.
6.	Cilip (2014) & Mark (2014)	Identified situations for libraries and research data driven services.

7.	Carrol(2015) & Kratz et. at (2015)	Identified problems of legal aspects of research data contributors.
8.	Shrivastava & Gupta (2018) and Awasthi et. al (2019)	Observed the requirement of research data literacy and role of library professionals.

2.5 Research Data Repositories:

Baker et. al.(2009) analysed that storage in data repositories are full of premeasured connected metadata. While various disciplines generated big research data considered data repositories as central pool for data curation. The repositories types based on their dependencies of data have been also analysed. The parameters of analysis are considered as roles, activities and responsibilities. Research data curation explained as care of research data during various scientific communications and data curation briefed as "a set of repeated and repeatable activities focusing on tending data and creating data products within a particular arena".

Martinez et.al (2009) observed that involvement of data user and contributors of data is more beneficial to organize any research data repository program. Further it included that clear benefits are highlighted when researchers are involved in process of digital research data curation. While authors argued that open research data environment is not always fit for all disciplines.

Skinner et. al (2010) proposed a prototype for distributed digital preservation of data. The proposed guidelines were found beneficial for any resourceful user or stack holder.Walters (2011) explained process of digital curation as a continued process throughout lifecycle of research and all parts of processing and creating of digital contents. Author concluded that it is a set of activities related to confirm continued access of digital materials for life long. It included that digital curation must facilitate the curation of distributed digital pool.

Wolski et. al (2011) described the roles of information science professional at universities level to develop research data curation policies and integration of data repositories for collaborations. Park et. al (2011) presented a study to measure the metadata component groups of electronic theses and dissertations used in specific Institutional Repositories. Various issued related to diversion and contradictions in Dublin core data used by repositories have been studied.

Starr et. al (2011) elaborate the use of persistence identifier for shared research data elements. Authors argued that a large amount of research data has been generated during research while Ball (2012) provided suggestion for techniques, tools, and training resources on the Research Data Programme. Farnel et. al (2014) measured the metadata standards and formats within

various research data services like Datacite, Dataverse network, Dryad and Figshare service. The aim of authors study was to observe the number and nature of metadata elements, metadata elements specific to research data, obedience with interoperability and preservation standards. The study identified that a large numbers of metadata elements used by the research data services.

Evans et. at (2014) emphasized that Portable document format (PDF) has been recognised as one of the universal accepted format for documents exchange. Authors observed the strategies for long lasting archiving practices for PDF files. Also confirmed the use of PDF files in fieldwork and research. Various other version of PDF formats also explored to identify its reliability for archiving of data. Rucknagel et. al (2015) identified the value of research data universally. The uniform access rights of research data is a big challenge for all administrators within research community. While open access initiate demands complete access of research data to all. Authors informed that globally universities and research centres have in a practice to configure Research Data Repositories for their researchers. The picture of Research Data Repositories is very complex in nature due to discipline contrast. Selection of appropriate research data repository for researcher and stack holder is very difficult. While re3data.org provides a very good and useful tool to identify Research Data Repositories.

Austin (2015) et al. developed a comparative study to measure diversified features of various Research Data Repositories to measure treatment of research data on parameters of "persistent identifiers, citation of datasets, data reliability, version control, metadata, data sharing, privacy controls, long-term preservation of data and certification of data repositories".

Crowder et al (2015) identified various ground realities to deal digitization of data in discipline specific repositories. Authors suggested that to improve various activities of digitization file naming convention should be improved. That will make easy to find, use and shared digital data. Also authors supported to various skill development modules to enhance the best practices in this area.

Doty et. al (2015) observed the suitability of Dataverse programme for the archiving and access solution for research data repository solution in University ETD repository. Authors explored various possibilities of university vide research data curation through Dataverse, web application. The advantages and short coming of the implementation had been analysed in terms of research data management policies.

Assante et. al (2016) analysed arrangement of data repositories those are dedicated to research data. Authors considered that open ended typologies for data science and data repositories.

Present practices of data repositories are analysed to recognise data publishing as "dataset formatting, documentation, licensing, publications costs, validations, availability, discovery and access and citation". Shrivastava& Gupta (2019) expressed observations that present digital preservation policies should revise their mandate to not only limited up to digitization but beyond it should cover curation of research data and its management with a national policy for research data management.

Above literature, review about Research Data Repositories shows their significant role to resolve and to deal various aspects of research data preservation and organization.

2.6 Research Data Management Services

Lyon et. al (2009) projected an assessment for requisite for research data management service support in universities on the points as maturity, capacity and preparedness. Authors described the framework of "Community Capability Model Framework (CCMF)" to study research data and its support services requirements within an academic environment. Salo (2010) tried to explain their concerns to prove significance of libraries to support research data services. Also authors expressed that libraries should be vigilant about repurpose their preparedness for reshaping the service environment to deal various aspects of research data and various complexities. Shearer (2010) represented the research data services as a bunch of latest prospects for libraries. The observations have been expressed in five key factors as "awareness and advocacy; support and training; access and discovery; archiving and preservation and virtual research environments". Corrall et. al (2012) explored a combined study of research support services within various academic libraries on the scale of various concerns as what are the effective research support services are offered in academic libraries, which types of latest research support services are crafted to support specific research groups, Are library staff is self-conscious to support various research support services. Authors are also explored that if there is any requirement of specific training and practical support to staff for research support environment implementation. The outcomes of author's observations were that bibliographic support services were in greater demand while research support and data management services were more prominent for various environments. Lyon (2012) explored the libraries strategies to conceptualize the service requirements in new data significant environment. Authors observed that information transformation has been reshaped the libraries service environment as "re-position, re-profile and re-structure" for appropriate research data management services encounters. Authors recommended a collection of ten data support services to uplift research life cycle research data environment. Martin (2012) expressed the services collections of data librarians that can be offered in a research data support service environment. Author expressed

that research data support services may be a latest tool to engage specific and new group to the library readers base. In continuation author showed preparedness for new roles of data oriented librarianship which is not limited up to research support services but also educate researches about latest practices.

Also authors prepared a report to elaborate research data management services roles and responsibilities in a closed environment. Recommendations had been done for capacities and capabilities development for research data services support.

Jones et. al (2013) investigated responsibilities layout for research data management services within academic setup. Detailed component and process based analysis have been done for Research Data Management Services. Corrall et. al (2013) represented good analysis for research data management services as an innovation in service mandate of librarians and information professionals. The practice of bibliometric and research data management services have provided new service frontiers for librarians. Parsons (2013) advocated a sustainable research data management service environment. Some key factors included as research data management requirements are data collection and verification with research data management training on portals.

Cox et. al (2013) contributed his findings as research data management services as a new service model for librarians. The RDM developments are analysed in light of various service models and deeper insights are expressed in recommendations. Akers et. al (2013) observed the various academic librarians are intensively engaged with the curation of data practices also suggested that professional librarians are offered data management and support service for research data. Various efforts are made by authors to understood disciplinary specific research data management requirements. Authors suggested that various discipline specific arrangement of research data management services required tailor made solution on multiple points. Tenopir (2013) explained about libraries to equip and enable to deal changing landscape of e-science environment in universities to respond responsibly. Authors recommended library based research data services to support e-science transformation.

Anne et. al (2014) investigated the professional and educational effects on developing research support environment. Their concerns were related to various availability of research support services as bibliographic and citation analysis for research data and its management.

Nielsen et. al (2014) informed the complexities for research libraries to deal research data management services in curation of research data. Authors proposed specific qualifications and skill development for the librarians to be in confident situation to deal research data specific

services. Tennopir et. al (2014) expressed their concerns about status of research data services in academic libraries. Authors observed that research data management services are not defined in good enough extension to deal research data management needs. While various academic institutions have plan to include research data services in their university vide policies. Authors emphasized that research data services skills training programs for librarians can make a different in situation.

Si (2015) expressed his observations for research data services for academic libraries and designed some recommendations for university centric research data environment. The recommendations has been drawn from surveys done throughout various academic institutions and universities for research data services. Whitmire et. al (2015) discussed data services development for faculties in universities with collaboration of various college and departments. Author's recommendations were to develop research data services by modifications in current services setup through identification of research data types generated in specific academic environment.

Rambo (2015) done assessment for data management services in an academic health science environment. Authors tried to recognize the areas for librarians to support research data management services. Armstrong et. al (2015) studied the aspects of librarians for research data management services implementation in the campus. Various important issues discussed as nature of research data, its storage, discovery and access. On researcher point of view effective management of research data is also investigated. Johnson et. al (2016) examined the developments of research data services on the appropriateness of data management plans within a campus setup. Authors suggested to develop various programs to enhance research data services through faculty grant competitions and campus vide data management plans contests.

Koltay (2016) identified the academic libraries roles in implementation of Research 2.0 findings. Some of the recommendations for research data management services framed as need of information literacy, wakeup call for faculty members for research data management and services, availability of research data services within academic communities.

Bote et. al (2019) discussed detailed problems to deal technical and ethical aspects of research data in Research Data Repositories. Authors warned that lack of available standardization for some basic issues related to research data declining its interoperability and reuse. Harp et. al (2019) recommended that research data services should be developed in consultation with researchers and librarians to sketch all problematic issue and possible solutions. Howie et. al (2019) concord that librarians should be responsible to respond abilities for changing aspects of

e-science and practices. Wang et. al (2019) raised an alert for librarian and libraries to use the turning point of services in digital knowledge transformation to knowledge management services with up to date research data services.

2.7 Research Gaps and Significance of the Study

While summarizing the discussions undertaken in the various sub-headings of this chapter, it can be drawn that: Institutional Repositories are popular concept worldwide and there are many Institutional Repositories in India which have been working successfully. Institutional repositories like ShodhGanga, AIJR Preprints, KRISHI Publications and Data Repository, Knowledge Repository Open Network, KrishiKosh, Vidyanidhi etc. are popular IRs in India but the work of research data management is at very beginning stage where there is mere discussions exist rather than practices in the country.

On the contrary, in the western world there has been great emphasis on the management of research data and research data services. It is evident from the literature that this area emerged during last ten years and gaining momentum in the present time.

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Chapter: 3 Research Methodology

3.1. Introduction:

Selection of an appropriate methodology and tools for research work is highly recommended to obtain exact research goals. Research methodology demands proper work in terms of planning and careful identification of tools to gauge the research parameters.

Methodology is termed as a route of development to the research in any area. Selection of an appropriate methodology and tools for research work is highly recommended to obtain exact research goals. Research methodology demands proper work in terms of planning and careful identification of tools to gauge the research parameters. Every discipline has some suitable research methods. Repko (2008) stated that particular research methods supports and suitable for specific theories. Gorman & Clayton (2005) defined that research models may be classified in three approaches those are positivist or quantitative, constructivist or interpretive or qualitative and mixed methods or Mixed Method Research (MMR). Library and Information Science area suited with scientific research methods of quantitative methodology. But now in recent times mixed methods are also in practice.

This Chapter covers the research methodology adopted for the research work being undertaken. The present study also applied mixed methods of research to study prospects of Institutional Repositories in changing digital service environment. Evaluation and identification of basic professional ethos have been captured through survey method using questionnaire. Some specific objectives of study are more experimental in nature than real concept so qualitative methods of case study and action research have been considered for identification of its indications.

In view of the objectives of the study, an effort is made to evolve suitable research methodology for the research.

Present study has following objectives:

1- To find out the possible role of Institutional Repositories in Research Data Management.

2- To explore current practices in terms of Research Data Management Services (RDMS) in International and Indian universities.

3- To evaluate resources available on Shodhganga repository in the light of better Research Data Management solution by using Open Source Software.

4- To suggest appropriate measures to make effective development of Skills and management of research data.

3.2 First objective

It has covered by intensive literature review to drive present situation, need and roles. Appropriate primary and secondary resources were identified by the researcher and used. The concepts of Institutional Repository, Research Data, Research Data Management, Research Data Repositories and Shodhganga ETd analysed through taking various leading research papers under literature review. Research papers searched through LISTA database and Google Scholar through relevant keywords. Highly cited research papers explored through above mentioned related keywords. Further these papers reviewed with their references for more clear understanding of author's ideas and analyses. All related research papers collected.

3.3 Second objective

It derived by websites investigation of various world universities and Indian Universities. Some top ranked institutions selected for understanding of development taken place in Research Data Management services in India and worldwide. Also, Indian Institutional Repositories studied from the point of research data management. Research data are very significant and omnipresent. Research data availability for lifelong is a big challenge for the stockholders. Research Data Preservation and Management facilities and services within any research organization has two basic categories.

First category is related to consultation type and second related to technological type. A numerous efforts have been done by foreign universities, organizations and governments to establish a sustained research data management environment. The directions in terms of how an Institutional Repository may be dedicated for research data to perform as research data repository, are encompassed in policies of research data registry. The registry registered Research Data Repositories of multiple subjects and research areas.

Leading research data registry re3data is considered for the purpose. Re3data represents the Research Data Repositories on the qualifying parameters as permanent storage, sharing options of data sets to scientists, funding bodies, publishers and academic organizations.

The study of research data management profiles for world top ranked universities is done on the basis of QS world Universities Ranking Database 2020.

QS - Quacquarelli Symonds is a well-recognised name for services, analytics and in-depth analysis for global higher education sector. The QS world University Rankings collection was started in 2004. Ranking of first twenty top ranked world class universities listed in table -1. The research data management developments and services of leading twenty-five universities

further discussed in chapter-4 by deep website investigations and assessment through re3data parameters mentioned in Schema 3.0 for Research Data Repositories.

Research Data Management profiles of Indian universities and institutions assessed through re3data registry is dealt in chapter -4 and listed in table-2.

3.4 Third objective

It is related with Research Data Management possibilities with Shodhganga resources, for this purpose the researcher used the resources available with the Shodhganga ETD in the field of Library and Information Science and prepared a prototype design for a unified research data repository for Indian scholars.

3.4.1 Research Data Management Service for Shodhganga registered researchers

Shodhganga ETD is a national thesis repository of India. Thesis submission in Shodhganga is a mandatory requirement for Ph.D Degree in India. PDF formats are most preferable and permitted by Shodhganga repository. All the theses submitted in Shodhganga are classified in different chapters while document formats are permitted.

3.4.2 Limitation of Shodhganga in terms of research data management services.

Presently Shodhganga repository has following features and future requirements in comparison with National RDR as compiled in table 3.1.

Table 3.1: Features comparison between Shodhganga repository and National RDR Prototype design

Sl.No	Shodhganga Features	Future requirements	National RDR Prototype design.
1.	National ETD repository for Indian universities to facilitate ETD submissions and provides searching facility.	National Research Data Repository for India is required to initiate research data services for Indian researchers.	It may Provide comprehensive support to manage research data of research scholars, registered with various universities in India.
2.	Provides visibility of scholarly output after completion.	A large amount of data and analysis generated during research, which should be taken care.	Provides option for universities to grant permission for researchers for understanding and

			management of research data from first day of joining research.
3.	Avoid duplication of efforts to understand and solve same research problem by various research scholars.	Presently most of the research problems are interdisciplinary, so already collected research data and a part of analysis may be useful for new research problems of different discipline.	National RDR prototype design is configured in such a way where researchers have complete control over their research data. Also, they can publish particular part of research output under a dataset and share for open access to users. Various datasets of different disciplines are useful for new research problems.
4.	Research data management planning is not available.	Requirement of data management planning before starting of research.	It will provide a platform to researcher to practice management of their research data in easy steps.
5.	Persistence identifier method has not been used.	Persistence identification method of digital resources is highly recommended for repository systems.	Proposed research data repository design uses DOI to make its provided data persistent, unique and citable
6.	Versioning of research outputs is not supported. Only one research scholar from a university can submit registered research title one time.	Developments of research methods provides latest tools to analyse past research. Also, various scientific projects required versioning for development.	National RDR prototype design provides versioning facility to researchers. Versioning is crucial for long-term research data management where metadata and/or files are updated over time. It is

			used to track any metadata or file changes once you have published your dataset.
7.	Support ETDs submission for research scholars of Indian universities.	Requirement of support for research data management services to Indian researchers throughout life time to prepare an active unified directory on various parameters.	National RDR prototype design will provide research data management support to researchers throughout life time. It may serve as a unified active directory of Indian researchers on various parameters.
8.	Research data exploration, comparison and analysis tools not available.	Research data exploration, comparison and analysis tools provides extra edge to researches for accurate selection of research data.	National RDR prototype design has facility to integrate external research data analysis tools to support statistical, tabular, containerized interactive analysis and file previewers facility.

3.4.3 Most preferable Research Data Repositories software's in Re3data registry.

Re3data.org is a well-recognised research data registry dedicated to Research Data Repositories. Registry have repositories registration for commercial (131) and non-profit (2564). While further it filtered on types of software then statistics shows as software implementation on numbers of repositories as CKAN (72), DSpace (92), Dataverse (93), DigitalCommons (3), EPrints (34), Fedora (38), MySQL (79), Nesstar (21), Opus (2), dLibra (2), eSciDoc (3), other (508), unknown (1232). Most of the Research Data Repositories implementations for academic community has been done in CKAN (72), DSpace (92), Dataverse (93) and MySQL (79).

Selection of a research data management software for a prototype implementation on Shodhganga ETD resources was consideration of many important aspects. Resources integration within a software depends on stability, compatibility, updation and faulty resolution. While CKAN, DSpace and MySQL software required physical and static implementation with regular updation. In case of any fault, resolution may be possible by technical help only. So that for the implementation of Shodhganga ETD resources on a research data repository made possible through Dataverse web application suitably. Also re3data.org registry statistics shows research data registry implementation was dominated by dataverse implementations. Dspace and MYSQL were using to maintain repository or database solutions. CKAN and Dataverse both was found to be the leading and dedicated research data management support platform.

3.4.4 Comparison of Research Data Management Software: CKAN and Dataverse

Following table:3.2, shows comparison of two leading Research Data Management CKAN and Dataverse on various parameters.

Table 3.2: Comparison of Research Data Management Software

Parameters	Comprehensive Knowledge Archival Network(CKAN)	Harvard Dataverse
Establishment	Mostly Government supported	Harvard University
Options to create Open cloud container or sub container	NA	Yes
customization of the Research Data Repository	NA	Yes
Directory Structure	NA	Yes
Dropbox integration	NA	Yes
Robustness of metadata	NA	Yes
Data integration alerts.	NA	Yes
Permissions	NA	Yes
Data citation facility	No	Yes
Multiple authorization methods	No	Yes
Data versioning level	No	Yes
Automated metadata generation from files	Unknown	Yes

Preservation technology?	Unknown	LOCKSS method through Data-PASS

3.4.5 Dataverse: An overview

Dataverse is an open source web application to share, preserve, cite, explore, and analyse research data. It is an effort of Institute for Quantitative Social Science (IQSS) collaborates with the Harvard University Library and Harvard University Information Technology organization to provide a facility for researchers and data curators to deposit data in Dataverse. Dataverse provides availability of data showcase and incorporation. Data providers, contributors and institutions facilitate by due credit and visibility. A Dataverse repository is the software installation, which is further distributed and maintained on various virtual containers called Dataverses. Dataverse is a virtual entity which contain datasets, metadata and files. The configuration and implementation of Dataverse is very data curator friendly as various related tasks are getting it done automatically.

3.4.6 Prototype design for Research Data Repository Creation

The way research is being undertaken has changed dramatically in with the application of various IT tools, techniques and applications. With reference to the libraries, the Association of Research Libraries (ARL) defines eResearch as "computationally intensive, large-scale, net- worked 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).

A large volume of data is the basic output of a new research. When a research report contains references of the various analysis of data which have been used during the research. Also, the data produced and outcome in the form of data while progressing the research would be useful for others. Data so used by others would be properly cited and acknowledged. So, researchers have a stronger requirement of research data management. Research data management is a newer concept, which has been generated to support various dimensions of research data.

In Indian context presently various efforts are in progress to preserve research output in digital form. National theses repository Shodhganga is one of the best initiative of Govt. of India through INFLIBNET Centre in this direction. Since 2009 more than 298978 theses have been registered from various Indian universities in Shodhganga till Oct 2020. While at this point of

time Indian universities have requirement of a National Research Data Repository which may support research data management features for researchers of various disciplines.

Research data has been considered a much valuable resources by the research organizations and governments worldwide. Public funded research projects and developments in India are sharing data at open data government portal called www.opendata.gov.in.

A nation level research data repository is urgently needed for registered researchers of various universities in India. The concept of national research data repository will provide research data management services to researchers of India. Also, it will motivate research scholars to manage research data and share it in the public domain. This repository should be designed in such a way where researcher have complete control over their research data. It should be available to public use. is will enhance visibility and reliability of the research data. Research data literacy may also be promoted through freely available research data management services provided by national research data repository.

3.4.7 National Research Data Repository Prototype design

It is a RDR which support researchers for research data during throughout their research life. Preliminary due to time and resources limitations this facility is started to the Library and Information Sciences researchers those are registered to Shodhganga. This RDR has the capacity to manage research data of all the registered researchers of Shodhgang, to host their thesis and research data on this repository automatically. Proposed Research Data Repository (RDR) is a prototype design which is planned to initiate free research data management services to Indian researchers. Research data management services under this facility will provide electronic research analysis. In Indian context this repository is designed and named as Sanskrit language words as Research Analysis to Shodh Manthan. In electronic environment it has been named uniquely as Electronic Shodh Manthan or “eshodhmanthan”

3.4.8 Policy

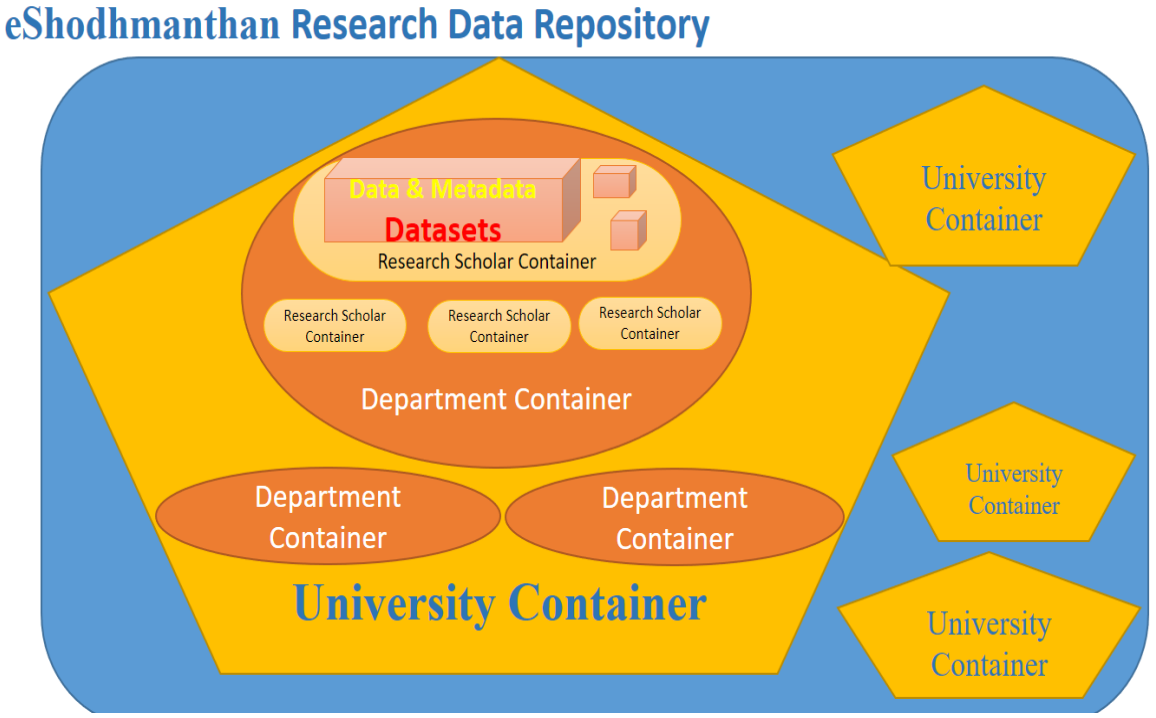
eShodhmanthan RDR configured with the CC0 option. CC0 option provides permission to others to use, rebuilt, distribute and develop on your work. In legal summary creative commons defines it as, "The person who associated a work with this deed has dedicated the work to the public domain by waiving all of his or her rights to the work worldwide under copyright law, including all related and neighbouring rights, to the extent allowed by law."

3.4.9 Design for Research Data Repository

eShodhmanthan RDR is developed as a repository dedicated for research data generated by the registered research scholars of Indian universities with published thesis on Shodhganga repository. Configuration diagram in figure: 3.1 of eShodhmanthan RDR planned as a container of universities registered with Shodhganga. Each university has its own container with facility to create separate container for each department. Various departments may register unique container for their research scholars. Finally, a research scholar will have a personal container. A researcher container has facility to create various containers and datasets with metadata. This container is under full control of research scholar with facility to set access and publishing permission of their research data.

Datasets and containers may be hosted by the research scholars till publishing. While after publishing it will available to eShodhmanthan RDR users for open use.

Figure 3.1: Configuration diagram for eShodhmanthan RDR



3.4.10 Crediting Research Data Contribution with Citations

eShodhmanthan RDR asks that all the users who download datasets from eShodhmanthan RDR follow fair use principle of research data. Any available data created that employ, reference, or otherwise utilize the data (in whole or in part) gathered from deposited datasets should credit

the source with the applicable data citation generated by eShodhmanthan RDR (found on the dataset page). These citations include the data authors, data identifier, and other information in accordance with the Joint Declaration of Data Citation Principles for all research data.

Features :

1. Research datasets citations will facilitate giving credits to all contributors of the research data.
2. It will provide persistent research data citation method for identification.
3. eShodhmanthan RDR will provide access to research data, associated metadata and other materials to make use by others.
4. Anonymity of human subject's research data will be maintained.

3.4.11 eShodhmanthan Research Data Repository for Shodhganga registered researchers.

The front page view for design of eShodhganga research data repository is displayed in figure: 3.2

Figure 3.2: Design for eShodhmanthan research data repository

URL: https://dataverse.harvard.edu/dataverse/RDR

eShodhmanthan RDR is developed as a repository dedicated for research data generated by the registered research scholars of Indian universities with published thesis on Shodhganga repository.

eSRDR is planned as a container of universities registered with shodhganga. Each university has its own container with facility to create separate container for each department. Various

departments may register unique container for their research scholars.

Finally, a research scholar will have a personal container. A researcher container has facility to create various containers and datasets with metadata. This container is under full control of research scholar with facility to set access and publishing permission of their research data. Datasets and containers may be hosted by the research scholars till publishing. While after publishing, it will available to eShodhmanthan RDR users for open use.
Figure 3.3 shows configuration of containers in eShodhmanthan RDR as sub dataverse, institutional dataverse.

Figure 3.3: Dataverse and sub dataverse design within eShodhmanthan RDR

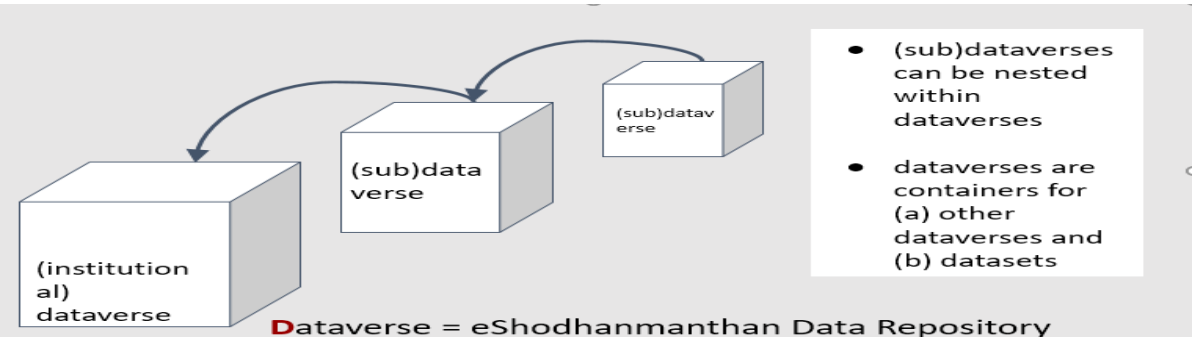
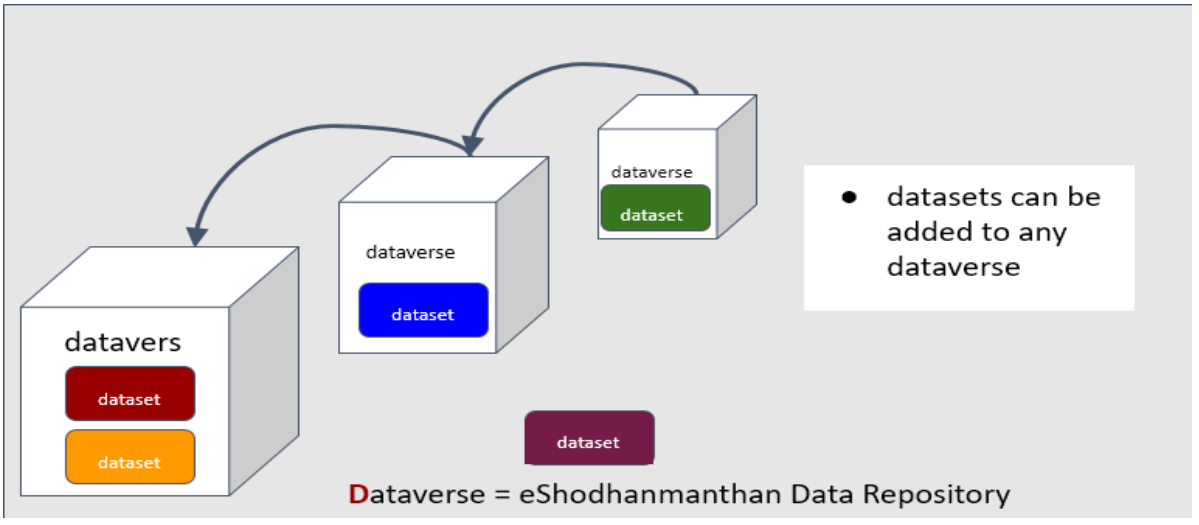


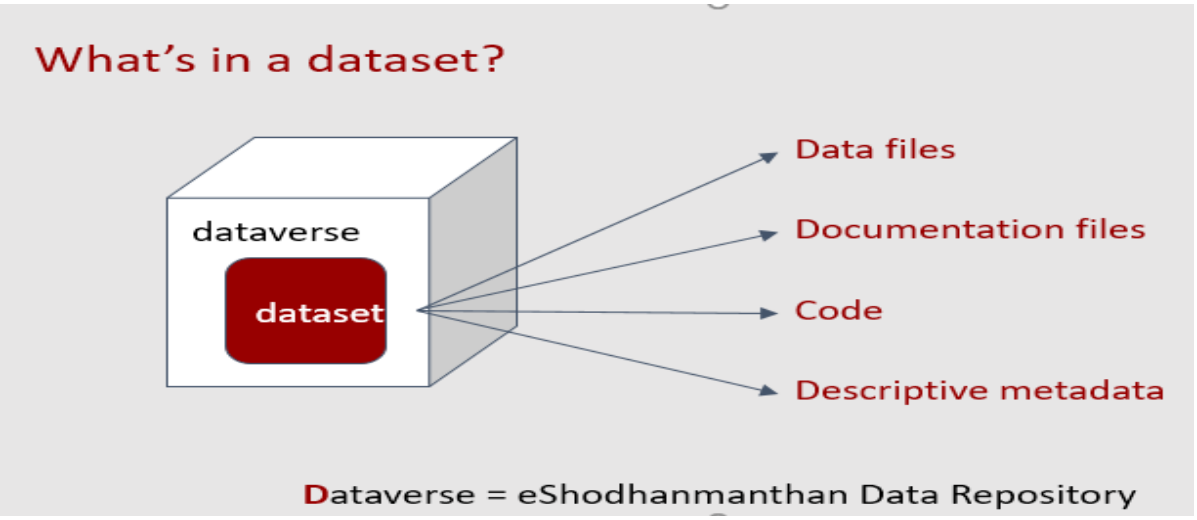
Figure: 3.4 visualise the creation of a dataverse and datasets in research data repository.

Figure 3.4: Dataverse design within eShodhmanthan RDR



It is clearly explained in figure: 3.5, how a dataset encompasses data file, documentation files, code, descriptive metadata etc.

Figure 3.5: Dataset design within eShodhmanthan RDR



3.4.12 Survey Method

The survey method is used for identification of present growth of Institutional Repositories, Research Data Mandate, Research Data Management concept adoption. Survey method is used for collecting experimental data of present time to fulfil research objectives requirements, it involves choice of sample from a population. Questionnaire and interview methods are mostly used as a tool for survey methods.

3.4.13 Population of the study

The population of the study consists Ph.d Scholars and experts in the field of Library and Information Science of various Indian Universities registered in Shodhganga ETD. A master list of Indian Universities is compiled with the information available on Shodhganga ETD. Out of the master list of 538 registered Indian universities, only 113 Universities have contributions of Library and Information Science Departments in Shodhganga ETD till October 2020. Detailed list of universities discussed in chapter 5.

3.4.14 Selection of sample criteria:

The Survey was conducted on the 113 universities through Department of Library and Information Science, librarians, ETD coordinators and research scholars. The selection was purposive. The purposive sampling technique is referred to a type of non-probability sampling that is preferred to conditions where certain population of sample has been under study.

3.4.14 Questionnaire

Kothari (2004) stated that "A questionnaire is a data collection instrument, which contains a series of questions presented in a particular order, desired for prompt replies from the population." This research tool has been used when population of survey is scattered on a wide geographical region. Sapsford (2006) stated that "The questionnaire is an entirely standardized measuring instrument as the questions are always phrased exactly in the same way for all respondents".

3.4.15 Designing of the questionnaires

Two Questionnaires were designed with the objectives to measure the ethos of the research scholars, librarians and ETD coordinators to understand preservation of research output and research data.

Questionnaire 1(Annexure:1) was designed to have understanding of Library and Information Science research scholars of various Indian Universities regarding preservation of research output and research data.

Questionnaire 2 (Annexure: 2) was designed to have understanding of librarians and ETD coordinators regarding preservation of research output and research data.

There were no specimen questionnaire available that could have been used collecting data to meet out the objective of the study. Therefore, questionnaires were designed to address the various concerns for preservation of research output and research data such as, preferences, general attitude, beliefs, awareness of preservation issues and new developments, dilemmas etc. Various parameters from multiple dimensions were adopted for identifications of core issues. The questions were included in the light of objectives of the study and scope of the research. Multiple type of questions ranging from simple dichotomous choice, exploratory, multiple choice and responses on the scale questions were used to get the required responses. All the questionnaire were designed to take care for simple comprehensible language while designing the questions.

3.4.16 Contents of the Questionnaire

The questionnaires were divided in various sections to address multiple issues in systematic order.

3.4.17 Research Data & Data Preservation

Salo (2010) keenly observed the changing trends of research data from print form to digital form. Author emphasised the preservation of digital research data. He identified libraries as pioneer to support researcher for research data management with the help of user-friendly technological solutions. While author visualise Institutional Repositories in new featured form to accommodate research data complexities.

Rotman & Lauruhn (2014) identified that a large number of studies have an idea for emergent preservation of research data and its management. While the core objectives of the efforts are preparation for the lifelong sharing of research data. Cannon (2015) proposed a user friendly frame work for easy learning of research data concepts. Author emphasis archival approach of data preservation to support research services. Author argue that the process of recruitment of contents for research data preservation may be very much helpful to understand research data discovery and its appropriate use.

3.4.18 Data Management

Borgman (2010) derived the objectives of data-driven research and its methods. Author deeply explored incites of researchers for sharing of their research data. Further he proposed research data sharing policies and enhanced roll of libraries in research data preservation.

Lin (2012) produced a frame of policies to visualise responsibilities of research data related preservation and management. The first sight observation of authors were that most of the research data within university, were stored in the personal devices of the researchers. Such types of practices for research data have invited data loss and less efficient use of research data resources. Due to limited sharing and absence of unified index, these research data resources may not be used for efficient decision making.

3.4.19 Data Storage and Archiving of Research Data

Green, Macdonald & Rice (2009) offered an approach which can be used as a decision making and policy making for organization to accommodate research data in their digital contents repositories.

Carroll, M. W. (2015) discussed about intellectual property rights of digital contents and research data. The perception of researchers regarding research data has been delivered by

authors. These questions were who will be the user of their data and what will be the legal rights in data usage.

Swauger, S., & Vision, T. J. (2015) observing the important services which may be helpful to researchers further directed to repositories for better policy and planning for services. Authors also evaluated researchers point of view and the parameter of their choice to consider particular repositories.

Assante (2016) proposed an analysis of data repositories on parameters of types of research data and its handling by Research Data Repositories. Further aspects of publishing of data, formats of data, configuration of datasets, discovery and sharing policies are also discussed.

3.4.20 Research Data Assistance

Bhat (2014) observe and explore various types of documents formats in Indian repositories. The research data available in various Indian repositories strongly demands a unified research data repository in India.

Austin, C., Et al (2015) has presented a ready reference list of available research data management platform. His study strongly recommended to develop research data management systems as per the users' needs. Research data repositories are developed in such a way so that they can manage services related to citation management, versioning control, compatibility of all types of data formats and various data compliance issues.

Questionnaire design and structure is addressed in table 3.3 as below:

Table 3.3: Questionnaire design and structure

Sections	**Questions**	**Questionnaires (Annexure – 1)**	**Questionnaires (Annexure – 2)**
I		Personal Information for recording the demographic information of the respondents.	
II		Questions to collect information about the knowledge of respondents in ETD development in their university/ institutions.	
	Q1 to QA1	Related to time line of ETD working in the university/ institution and respondent has the knowledge of ETD.	Related to time line of ETD working in the university/ institution and respondent has the knowledge of ETD.
	QA2	Relevant to repository access options.	Relevant to repository access options.

	QA3 to QA6	Related to content, its discovery, formats and choice of ETD.	Related to formats, number of contents and choice of ETD Software.
	QA7 to QA9		Related to ETD establishment and policy within University/Institution
III		Questions about ETD and Shodhganga ETD Repository Thesis Submission Information and experiences	
	Q2	Related to ETD exposure	Related to ETD exposure
	Q3 to Q6	Related to Shodhganga ETD usability	Related to ETD establishment financial assistant, training, anti-plagiarism practices.
	Q7 to Q10	Related to respondents practices for research data organization and retrieval.	Related to respondent experience about Shodhganga ETD usability and growth.
	Q11-Q12	Related to expectations of respondents for research data within shodhganga ETD.	
IV		Questions about Research Data Management requirement and understanding of the respondents	
	Q11 to Q13		Related to research data storage and practices.
	Q13 to Q14	Related to research data storage and practices.	Related to requirement of Research Data Repositories.
	Q15 to Q20	Related to respondent experience for requirement of research data management.	Related to respondent experience to fulfil demand of Research Data Management.
	Q21-Q25	Regarding National Research Data Policy and requirement of	

		Unified national repository for research data.	

3.4.21 Pilot Study for Testing the Questionnaire

A Pilot Study has been considered as a validity tool to access questionnaires. A pilot study was conducted to gather respondents' views about the suitability of questions and language with appropriate sequencing. The pilot study was conducted in October 2020 to pre-test the questionnaire designed for ten Library and Information Science experts' important suggestions were considered to redraft the questionnaire in terms of language and options.

3.4.22 Administering the Questionnaire

The final questionnaires were distributed among 113 universities librarians and ETD coordinators those are registered with shodhganga ETD. Questionnaires were distributed during Nov 2020 to Feb 2021 and were collected till March 2021. It was insisted to the respondents to fill questionnaire by themselves. The response rate was 58.40% and the cases wasted responses were few. The list of respondent universities is enclosed at Annexure: 5.

The response rate was good due to personal efforts made by researcher to track the responses. In most of the cases, the uncommon theme of the questionnaire, its briefness and directness appealed by the respondents. Only in 18% cases the respondents had to be contacted frequent times for submitting the responses.

3.5 Fourth Objective

Feedback form was designed and hosted on unified research data repository. Reviews received through feedback form have been analysed for the usability and appropriateness of repository. Reviews received in feedback form, from unified research data repository and Interview Schedule (Annexure –3) were designed to evaluate Library and Information Science experts' insights about the problem. Which contains two parts.

Section I has all interview questions related to personal and institutional information.

Section II has around 15 interview questions related to research data management mandate in India and abroad. First three questions (a) to (c) were related to Indian universities perception regarding research data management. Questions (d) to (f) were related to research data management development in abroad. Questions (g) to (l) were related to research data mandate in Indian universities, further national research data policy and shodhganga ETD like mandatory options were questioned to know the real insights. Last three questions (m) to (o) were related research data repository, implementation bottlenecks for India in RDM concept and finally it was asked about opportunities regarding LIS professionals.

3.5.1 Interview Technique

An interview is normally a qualitative research technique encompass open-ended questions to evaluate respondents' experiences and opinions about prompt answers about subject. Interviews marked as the best research tool to assess experiences of the population. Such personalise experiences makes easier understanding of the researcher to study the research problem within professional population. One of the measures advantages of the technique is that respondents express their own stories in responses of questions. However due to direct interactions there are chances of researcher's or respondent's personal biases to affect the responses.

Email interviews were conducted for qualitative research for this study. This method can be employed quickly and in a very easy manner and has capacity to create high quality data when observed carefully. The accessibility of emails interviews is very wide due to coverage of internet network throughout the academic institutions and universities. Carefully designed email interviews may be most effective and implementation of some techniques can avoid the factors that affects reliability.

3.5.2 Implementation and Outcomes

An analysis of the changes in research data search patterns and results were undertaken through offering access to the newly designed repository to the researcher/ practitioner/ teachers in LIS for their opinion and further improvement. Based on the outcomes and conclusions appropriate suggestions have been derived as part of last objective.

The prototype design of unified research data repository for Indian researchers further submitted to Library and Information Science researchers / practitioners / teachers. Assessment for the ease of use, metadata, research data search, persistent identifier scheme, DOI, data exploration and visualisations options have been collected through feedback form.

Feedback form is enclosed as Questionnaire 3 (Annexure: 4) which was designed to evaluate understanding of users for new prototype design related to research data repository for Indian researchers.

3.6 Summary

The data collected by quantitative research techniques are general considered. Findings of qualitative research may be applied in terms of creation of concepts, drawing of implications. So for this research study mix of quantitative and qualitative techniques methods has been used to create complete picture of facts for analysis. In this chapter, responses received through questionnaires, interviews and feedback. It is prominently discovered through responses that most of the Indian researchers are aware about ETDs repositories. But Indian researchers are getting certain difficulties to preserve their research output in ETDs.

Responses received supports that concept of research data has very low impact in Indian Library Science research domain. While Indian library science experts relies that research data management is a versatile concept and will take long way to come in Indian research domain.

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Table 3.4: World universities rank wise

Sl.No	Universities rake wise
1	Massachusetts- Institute of Technology- (MIT)
2	Stanford -University
3	Harvard -University
4	University- of Oxford
5	California-Institute of Technology-(Caltech)
6	ETH-Zurich – Swiss-Federal-Institute of Technology
7	University- of-Cambridge
8	U-C-L
9	Imperial-College-London
10	University-of-Chicago
11	Nanyang-Technological-University, Singapore-(NTU)
12	National-University-of-Singapore (NUS)
13	Princeton-University
14	Cornell-University
15	University-of-Pennsylvania
16	Tsinghua-University
17	Yale-University
18	Columbia-University
19	E-P-F-L
20	The-University-of-Edinburgh

https://www.topuniversities.com/university-rankings/world-university-rankings/2020

Table 3.5: Indian Universities rank wise

Sl.No	Universities rake wise
1	Indian- Institute- of Technology -Bombay (IITB)
2	Indian- Institute- of -Science
3	Indian -Institute -of -Technology -Delhi (IITD)
4	Indian -Institute of -Technology -Madras (IITM)
5	Indian- Institute -of -Technology -Kharagpur (IIT-KGP)
6	Indian -Institute of -Technology -Kanpur (IITK)
7	University- of -Delhi
8	University- of -Hyderabad
9	Indian- Institute- of Technology -Roorkee (IITR)
10	Indian -Institute of -Technology -Guwahati (IITG)
11	University- of -Calcutta
12	Jadavpur- University
13	Indian -Institute of Technology- Indore
14	Savitribai- Phule- Pune- University
15	Indian- Institute- of Technology- Hyderabad
16	Anna- University
17	University- of- Mumbai
18	Birla- Institute- of Technology- and Science, Pilani
19	Banaras- Hindu- University
20	Indian- Institute- of Technology- Bhubaneswar

https://www.topuniversities.com/university-rankings/rankings-by-location/india/2020

Chapter 4:

Profiles of Institutes providing Research Data Management Services

4.1 Profiles of Institutes offering Research Data Management Services

Research Data Management Services are the latest requirement in the service catalogue of research organizations and institutions due to global extension of Open Access movement. A large number of leading research organisations have a requisite grant sanction eligibility for submission of Data Management Plans and its accessibility to public domain.

Akers et al.(2014) observed the category of services provided by the library and information professional in light of Research Data Management. Tenopir et al. (2014) has represented a deep discussion on the classification of Research Data Management Services within libraries. Guss (2016) gauged Research Data Management Services on the scale of regular library services with extended orientation and training of researches. Tenopir et al. (2017) exercised a process of surveys to identify clear image of research data management services in European academic libraries. The report of surveys indicates that in present scenario most of the European academic libraries are involved in consultative research data management services rather than technological services.

International Federation of Library Associations approved a project of Library Theory and Research with objectives to outline services fields of data librarians in international and cross disciplines contexts.

Authors observed that two measure categories of Research Data Management Services have been identified. Both the categories have a significant part in research data life cycle. Universities libraries have a prominent role to support Research Data Management Services at various stages. Types of research data management service provided to the researchers by the libraries are differ in nature. In primary stages of research, researchers have requirement to understand the concepts of Research Data Management. At initial stages libraries mostly concentrate types of research data management services which relates to necessary measurement, training for Data Management Plans, sharing and access of research data. Most of these services are in consultative in nature. Data librarians provide guidance for data preservation infrastructures and collaborate with various sections of the university. At further

stages data librarians provide consultation regarding technological services. Technological services are related to organization of data, its metadata formats, appropriate repository selection, access rights, sharing permissions and other technological suggestions.

It derived by websites investigation of various world universities and Indian Universities. Some top ranked institutions selected for understanding of development taken place in Research Data Management services in India and worldwide. Also Indian Institutional Repositories studied for the point of research data management. Research data are very significant and omnipresent. Research data availability for lifelong is a big challenge for the stockholders. Research Data Preservation and Management facilities and services within any research organization has two basic categories. First category related to consultation type and second related to technological type. A numerous efforts have been done by universities, organizations and governments to establish a sustain research data management environment. The directions in terms of how an Institutional Repository may be dedicated for research data to perform as research data repository, are encompassed in policies of research data registry. The registry registered Research Data Repositories of multiple subjects and research areas.

Leading research data registry re3data has been considered for the purpose. Re3data represents the Research Data Repositories on the qualifying parameters as permanent storage, sharing options of data sets to scientists, funding authorities, publishers and academic organizations.

4.2 Research Data Management Profiles for World's Top Universities:

Ranking of Research data management profiles for world top universities have been done through Quacquarelli Symonds Universities Ranking Database 2020. Top ranked twenty universities have been explored for research data management services in table: 3.4 of chapter-3.

The research data management developments and services of leading twenty universities further discussed by deep website investigations and assessment through re3data parameters mentioned in Schema 3.0 for Research Data Repositories.

The website investigation for research data management services of universities have been done on the basis of respective policy, consultative and technological services. Websites of the various top ranked universities have been analysed for related parameters encompassed in template shown in table 4.1.

Table 4.1: Template for Research Data Management Profiles of Universities.

1.	Name of Repository
2.	URL
3.	Subjects
4.	Repository Type
5.	Language
6.	Country
7.	Policy Availability
8.	Type of access to RDR
9.	Type of access to data
10.	Data License
11.	Persistent identifier systems
12.	Software
13.	Consultative Services
14.	Technological Services
15.	Listed in research data registry

The research data management profiles of leading twenty universities have been analysed and discussed on the basis of designed template. Researcher analysed the template parameters by website investigation of universities websites.

4.2.1. Massachusetts Institute of Technology (MIT)

Table 4.2: Research Data Management Profile@MIT

1.	Name of Repository	DSpace@MIT
2.	URL	http://dspace.mit.edu/
3.	Subjects	Engineering Sciences Humanities and Social Sciences Life Sciences Natural Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open

9.	Type of access to data	Restricted
10.	Data License	CC
11.	Persistent identifier systems	HDL
12.	Software	Dpace
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

Consultative Services

Research data management consultative services are provided to faculties and researchers in terms of managing, storing, and sharing of research data. Individual consultation for researchers is also available in MIT for research labs. MIT arranges various research data workshops for researches to provide incite about best research data management practices. Data Management plans is essentially required for researchers, MIT has customized (Data Management Plans) DMP Tool for researchers. DMP Tool is utilized for creating Data management plans.

Technological Services

MIT provides a large number of technological research data management services for their researchers.

1. Data management check lists : MIT Data Management services provides project start and end checklists to support researchers configuration and manage well-arranged data management setups throughout life cycle of a project.
2. MIT provides ezDMP a free to use web toolkit for funding requirement and Data Management Plans funding requirements.
3. Massachusetts Green High-Performance Computing Center (MGHPCC) which is dedicated to provide high-performance processing to MIT researchers.
4. The Harvard-MIT Data Center Research Computing Environment provides Storage and processing capacity. Users have facility to access their datasets remotely and to special software to process datasets.
5. MIT also provide specialized storage options for research groups with the help of IS&T's community partnerships team.

6. MIT also provides electronic lab notes services with LabArchives , a cloud-based ELN system,

4.2.2. Stanford University

Table 4.3: Research Data Management Profile @ Standford University

1.	Name of Repository	Stanford Digital Repository
2.	URL	https://library.stanford.edu/research/stanford-digital-repository
3.	Subjects	Humanities and Social Sciences Life Sciences Natural Sciences Engineering Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open
10.	Data License	Copyrights
11.	Persistent identifier systems	DOI PURL other
12.	Software	Proprietary
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

Stanford University provides research data facilities to their researchers with organization, management and curation of research data. Stanford university researchers can plan for research with DMPTools. Further various collaborative approaches like Data Management Services workshops and events ,Stanford Geospatial Center workshops, Center for Interdisciplinary Digital Research workshops, Consulting for quantitative and qualitative data and software, Drop-in Research Consulting for the sciences, Lane Library classes and workshops, Stanford

Digital Repository Inter-university Consortium for Political and Social Research (ICPSR), Domain-specific data repositories, Data Management Services. University also support researchers with the organization, management and curation of research data to boost its preservation. Stanford university libraries has collaboration with the California digital library to provide data management planning tool service.

Consultative services.

Stanford University provides guidance to researchers about Long-term planning, research data documentation service, file naming support with expert guidance for better retrieval in future. Consultation about project or research experiment or acronym, coordinates about locations, type of data, conditions, versioning of files. Guidance about saving and backing up of research files. The use of file formats should be chosen based on impact on ability to operate these file formats at later stages. It is always recommended to select non-proprietary file formats while in special conditions it is considered to proprietary file formats. While selecting the file formats general guidelines are non-proprietary, unencrypted, uncompressed, conventionally used by community, interoperable amongst varied stages and presentations, completely circulated and royalty free layouts.

Technological Services: University also provide guidance about storage of research data with most preferably two options either google drive or Stanford box service. Version control options provided by git distributed version control systems.

A large numbers of tools support is also provided as DataONE tools, UK Data Archives, Open Science Framework support, OpenRefine, Tabula, UnScanIt, Protocols.io, Research Electronic Data Capture application for creating and organizing online databases, qualtrics online survey tool, 3D world studio modelling program for data.

4.2.3 Harvard University

Table 4.4: Research Data Management Profile @ Harvard University

1.	Name of Repository	Harvard Dataverse
2.	URL	https://dataverse.harvard.edu/
3.	Subjects	Social Sciences, Economics, Astrophysics and Astronomy, Basic Biological and Medical Research, Social and Behavioural Sciences, Humanities and Social Sciences, Physics Natural Sciences, Biology Life Sciences

4.	Repository Type	Disciplinary, institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open
10.	Data License	Apache License 2.0, CC0
11.	Persistent identifier systems	DOI
12.	Software	Dataverse
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

Harvard research data policy support long term and robust data management and documentation practices. It includes managing useful research data and provision for reuse.

Preservation of research data in Harvard University is managed to be available and participated in going on research projects.

Research data management at Harvard University has been planned through guidance of faculty advisory committee. This committee provides directions regarding distinguished set of researches sub topics, procedures and research data types. Various groups of researchers from several schools of university have been designed to focus on multiple aspects of management of research data. Researchers training for best practices in research data management. Organizational system has been developed in such a way to get collaboration from office of Vice provost for research, library of Harvard university and Harvard university information technology at one place.

Harvard university data policy comprises data ownership, fair use of data, enterprise information security, genomic data policy, intellectual property rights, Research data legal agreements, open access of research data, publishing rights, security of sensitive research data, and regulation of various schools regarding research data.

Harvard University also provides consultative research data services for various research programmes. It includes orientation of researches regarding best practices for research data.

Technological services for researchers are also provided through Dataverse research project.

4.2.4 University of Oxford

Table 4.5: Research Data Management Profile @ University of Oxford

1.	Name of Repository	ORA-Data
2.	URL	http://researchdata.ox.ac.uk/
3.	Subjects	Humanities and Social Sciences Life Sciences Natural Sciences Engineering Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United Kingdom
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Proprietary
11.	Persistent identifier systems	DOI
12.	Software	Proprietary
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

University of Oxford has planned a wonder full research data academic community policy with access and distribution of research data to the researchers. University supports open research data mandate those are based on research council common principles. It is also recognised by the university that best exercise in data management is the important aspect to a real research method. It is measured that requirement of readers to manage research data is increasing day by day. Various aspects of research data related to privacy, safely, security and commercial interests are considered important to manage preservation of research data.

Consultative services:

Oxford University provides various consultative support services to their researchers to manage various steps of research data management. University also have one of the appropriate infrastructure to support projects specific research data management plans. Special training programs designed for the users. University enabled the policy to involve researchers to fulfil the mutual activities regarding research data management services.

Technological Services:

In oxford university researchers are orientated to deposit their data aligned output in an appropriate data repository with necessary metadata. Oxford University have Institutional Repository of data as ORA-Data or Oxford Research Archive for Data.

4.2.5 California Institute of Technology (Caltech)

Table 4.6: Research Data Management Profile @ Caltech DATA

1.	Name of Repository	CaltechDATA
2.	URL	https://data.caltech.edu
3.	Subjects	Humanities and Social Sciences Geosciences (including Geography) Humanities and Social Sciences Life Sciences Natural Sciences Engineering Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open
10.	Data License	Apache License 2.0
11.	Persistent identifier systems	DOI
12.	Software	Proprietary
13.	Consultative Services	Yes
14.	Technological Services	Yes

15.	Listed in research data registry	Yes

California institute of technology adopted institutional research data policy with reflection to Australian National Data Service and UK Data Archive. California institute of technology supports the best practice strategies and methods for creating, preparing and storing sharable datasets.

Consultative Services:

Institute have the provision of various research data support services. Identification of data type like text series, numerical data, pictorial data, modelling data. Available research data collaboration with new research projects. Consultative services also includes support for plans of data management. As per the precise requirements of the funding organizations data management plans are prepared according to fundamental data management principles those are mostly applied to all disciplines, formats and projects. Institute has the facility to educate the researcher about to note project description, collected data, plan for small period storing and data management, lawful and principled issues, necessities for lengthy term archiving and preservations.

Technological Services: Caltech library provides DMPTool online web interface service to make data organization plans that prepare to come across official and funder requirements. Institute also have templates service for various research data management processes as Caltech data management plan template, Research Sharing and Data Management template for a data organization plan, template for collaborated investigation, Research Data Management Plan Template etc. Information provided regarding various metadata standards, tailored metadata schemes for projects, data identifiers schemes as PURL- A persistent uniform resource locator. Digital Object Identifier, InChi – International Chemical Identifier, Uniform resource Identifier Caltech CODA repository solutions provided for digital research data solutions.

4.2.6 ETH Zurich - Swiss Federal Institute of Technology

Table 4.7: Research Data Management Profile @ ETH Zurich

1.	Name of Repository	**ETH Zürich Research Collection**
2.	URL	https://www.research-collection.ethz.ch

3.	Subjects	Natural Sciences Economics Social and Behavioural Sciences Humanities and Social Sciences Agriculture, Forestry, Horticulture and Veterinary Medicine Medicine Biology Life Sciences Geosciences (including Geography) Mathematics Physics Chemistry Construction Engineering and Architecture Computer Science, Electrical and System Engineering Materials Science and Engineering Engineering Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	Switzerland
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	closed
10.	Data License	Copyrights
11.	Persistent identifier systems	hdl DOI
12.	Software	Dspace
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

ETH Zurich research data policy is designed around recommendations of Swiss National Science Foundation (SNSF) named as Horizon 2020. The aim of the repository to support researchers at ETH Zurich with management of their research data by providing a set of steps and listing of available tools and resources. The repository has been prepared by research data management and digital curation at the ETH library and ETH Scientific IT Services.

SNSF approved the requirement of data management plan for funding schemes formats. It has been mandatory for the researches to provide public access of their data with no lawful, ethical, patented or additional topics. SNSF supports the open research data policy with mandate

"Research data are the evidence that underpins the answer to the research question, and can be used to validate findings regardless of its form (e.g. print, digital, or physical)."

Consultative and Technological Services are provide as a part of these services various check lists are provided to identify data repositories that comply with the FAIR data principles.

4.2.7 University of Cambridge

Table 4.8: Research Data Management Profile @ University of Cambridge

1.	Name of Repository	**Apollo**
2.	URL	https://www.repository.cam.ac.uk/
3.	Subjects	Natural Sciences Life Sciences Humanities and Social Sciences Engineering Sciences Geosciences (including Geography) Mathematics Physics Chemistry Agriculture, Forestry, Horticulture and Veterinary Medicine Medicine Biology Social and Behavioural Sciences Humanities
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United Kingdom
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open
10.	Data License	Copyrights
11.	Persistent identifier systems	hdl DOI
12.	Software	Dspace
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

The aim of university of Cambridge research data management strategy structure is to offer direction to all universities academics, staff and students on research data management. University under took various efforts to maintain best research data management services.

In terms of consultative and technological services university provides help to researchers to create data management plans with the help of Digital Curation Centre. User friendly online training modules are provided for research data management. Training modules are developed with the help of UK Data Archive, university of Edinburgh, Digital Curation Centre and Purdue University Libraries.

Data archiving help has been provided by five step guidance document. Help data for deposition, file naming convention by Queensland University of Technology, Information and Learning support.

Researchers are educated about research data management practices by available licenses, cloud computing by Jisc, Bad research data management video by NYU Health Sciences Library, guidance on metadata provided by Digital Curation Centre, ISA metadata tracking tools for life sciences. BioSharing web portal of interconnected data standards, databases and policies has been designed for curation of life science projects.

4.2.8 University College London

Table 4.9: Research Data Management Profile @ UCL

1.	Name of Repository	**UCL Research Data Repository**
2.	URL	https://rdr.ucl.ac.uk/
3.	Subjects	Physics Computer Science, Electrical and System Engineering Astrophysics and Astronomy Chemistry Medicine Medicine Engineering Sciences Natural Sciences Life Sciences Humanities and Social Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United Kingdom
7.	Policy Availability	Yes
8.	Type of access to RDR	Open

9.	Type of access to data	Open
10.	Data License	Open
11.	Persistent identifier systems	DOI
12.	Software	Other
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

UCL Research data repository policy is built up to maintain capability to store, preserve and access continuously increasing volume of research data also the protection and preservation of UCL's research data assets. Time and budget anticipating tool is provided to help about research data management costing guides can yet be created. Questionnaire evaluation tools are provided to weigh on project budget. As per policy of UCL Research Data may be facts, observations, experiences, basis of a theory or argument, may be numerical, descriptive or visual.

Consultative and technological services:

UCL provides various consultative research data services in form of orientation programs for researchers based on research data best practices. UCL repository provides various technological services to researchers for long lasting preservation.

4.2.9 Imperial College London

Table 4.10: Research Data Management Profile @ Imperial College London

1.	Name of Repository	**Spiral digital repository**
2.	URL	http://spiral.imperial.ac.uk/
3.	Subjects	Humanities and Social Sciences Life Sciences Natural Sciences Engineering Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United Kingdom
7.	Policy Availability	Yes

8.	Type of access to RDR	Open
9.	Type of access to data	Closed
10.	Data License	Open
11.	Persistent identifier systems	hdl DOI
12.	Software	Other
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

Imperial College London adopted high principles of educational investigation and research data management. ICL planned a strong digital preservation structure for exposed data access and defends private data. ICL research data policy concluded lawful, moral and commercial restrictions on data distribution. Imperial college is dedicated to upgrade the leading values of academic research, comprising brilliance in research data management. College provides evolving services and direction for researchers to substitute best exercise in data management by healthy digital curation organization.

4.2.10 University of Chicago

Table 4.11: Research Data Management Profile @ University of Chicago

1.	Name of Repository	**Federated Research Data Repository**
2.	URL	https://www.frdr-dfdr.ca/repo/
3.	Subjects	Humanities and Social Sciences Life Sciences Natural Sciences Engineering Sciences
4.	Repository Type	Institutional
5.	Language	English Francis
6.	Country	Canada
7.	Policy Availability	Yes

8.	Type of access to RDR	Open
9.	Type of access to data	Closed
10.	Data License	Open
11.	Persistent identifier systems	DOI
12.	Software	Other
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

University of Chicago developed research data policy for researcher's everyday strategies for managing research data. Various decisions support provided regarding file naming conventions, versioning, depositing data in a disciplinary data repository for long terms access and archiving.

Consultative and technological services in terms of effective data management plan and approach for the management of their data is provided. Researchers are sensitize regarding research data importance, research data fragility and loss, best data management benefits for research team. Preparation and training to write capable research data management plans, to get eligible for funders requirements. Training provided regarding identification of research data, how to manage datasets and expending data items. Importance of data management planning where and how to store active data.

University of Chicago provides faculty, students and staff with an archival storage box, it is a cloud based storage option that allows for file sharing and collaborative editing. It is known as UChigago Box. Its storage size is 15 GB for an individual files. Center for research informatics has data storage options that are secure, accessible and compliant with HIPAA.

4.2.11 Nanyang Technological University, Singapore (NTU)

Table 4.12: Research Data Management Profile @ NTU, Singapore

1.	Name of Repository	**DR-NTU (Data)**
2.	URL	https://researchdata.ntu.edu.sg/

3.	Subjects	Economics Engineering Sciences Social Sciences Humanities and Social Sciences Biology Chemistry Physics Chemistry Social and Behavioural Sciences Life Sciences Natural Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	Singapore
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Open
11.	Persistent identifier systems	DOI
12.	Software	Dataverse
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

NTU repository of research data DR-NTU (Data) cares NTU faculty affiliates, investigation staff and scholars in matching their funders, official, publishers and investigation groups' data distribution necessities. The NTU Research Data Policy needs concluding research data to be ready accessible in DR-NTU (Data) and/or an peripheral open access data repository. Institute has research data policy for an increasing emphasis on managing and sharing research data. DR-NTU Data is an official open access research data repository for Nanyang technological university supported by the library and CITS. The Repository is constructed on an open source web tool support called Dataverse. NTU researchers are encouraged to use DR-NTU (Data) to store, publish and preserve their ultimate research data to available their data sharable, accessible and use ready for other research.

4.2.12 National University of Singapore (NUS)

Table 4.13: Research Data Management Profile @ NUS

1.	Name of Repository	**ScholarBank@NUS**
2.	URL	http://scholarbank.nus.edu.sg/
3.	Subjects	Humanities and Social Sciences Humanities Engineering Sciences Life Sciences Fine Arts, Music, Theatre and Media Studies
4.	Repository Type	Institutional
5.	Language	English
6.	Country	Singapore
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Open
11.	Persistent identifier systems	DOI hdl
12.	Software	others
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

NUS repository policy applicable to all NUS academic members, staff, scholars and all the involved staffs engaged in research work. The structure of Data work at NUS implemented as a system which enable full retrospective assessment on requirement. Generated research data has been preserved for a minimal time of 10 years if there is not any ethical, expert or funding organisation direction needed. University employees and scholars have not any rights to delete any research data form NUS), or distribute research data through new parties deprived of prior permission of authorities. Scholars is required to maintain chronological order of their research data. While protected personal data or human data is required to use as per the University's Data Management Policy and further necessities of the NUS Institutional Evaluation Panel or additional controlling bodies.

Consultative and technological services are provided to safeguarding research truthfulness and regeneration, collective research competence, confirming research data and records for exact, whole, reliable and consistent storage and recovery. Securing time period and available assets in extended period, attractive data safety and minimal chance of data loss, stopping duplication of effort by allowing availability of research data, obeying with followed practices directed in trade and market, enabling the examination of modification, by giving availability of data with which data at different time can be compared.

4.2.13 Princeton University

Table 4.14: Research Data Management Profile @ Princeton University

1.	Name of Repository	**DataSpace**
2.	URL	https://dataspace.princeton.edu/jspui/
3.	Subjects	Humanities and Social Sciences Life Sciences Natural Sciences Engineering Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Open
11.	Persistent identifier systems	hdl ARK DOI
12.	Software	Dspace
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

Princeton university research data policy have impact of University of Virginia Libraries, DataONE, Smithsonian Institution, Digital Curation Centre (UK), UC Curation Center, California Digital Library, UC San Diego Libraries, University of Illinois, UCLA Library,.

Consultative and technological services are provides in Princeton University as university is a backing institution for the DMPTool (Data Management Plan Tool). DMP tool helps in systematic support in designing data management plans custom-made to the explicit necessities of chief U.S. funding agencies. To authorize in to the DMPTool as a Princeton scholar, prompt login in the portal page and select Princeton University from the institution available options. User will be oriented to the Princeton Central Authentication Service where you can authorize to use.

4.2.14 Cornell University

Table 4.15: Research Data Management Profile @ Cornell University

1.	Name of Repository	**eCommons - Cornell's digital repository**
2.	URL	https://ecommons.cornell.edu/
3.	Subjects	Humanities and Social Sciences Life Sciences Natural Sciences Engineering Sciences Biology Agriculture, Forestry, Horticulture and Veterinary Medicine
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open
10.	Data License	Open
11.	Persistent identifier systems	hdl DOI
12.	Software	Dspace
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

The Research Data Management Service Group (RDMSG) constituted as a collaborative campus wide body to connect Cornell University faculty, staff and students with data management services to cater required research needs. The governing body of RDMSG have group of professionals to support policy, technological aspects and information traits for the designing and expertize data management plans. It helps to scholars to discover and identified accurate data management services for their research at various stages of research. Provision of training programs for researchers to encourage sharing, reproducible research data within laid down rules and research constraints. The RDMSG provides consultative and technological services in general in funder organization specific guidance may be achieved on expert advice. Research data management services are offered in a collaborative system with steps of data collection and analysis, data distribution, highly efficient performance computation, intellectual property right, customized metadata, privacy protection, preservation and retrieval.

4.2.15 University of Pennsylvania

Table 4.16: Research Data Management Profile @ University of Pennsylvania

1.	Name of Repository	**Wharton Research Data Services**
2.	URL	https://wrds-web.wharton.upenn.edu/wrds/
3.	Subjects	Economics Statistics and Econometrics Social and Behavioural Sciences Humanities and Social Sciences
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Closed
11.	Persistent identifier systems	Unknown
12.	Software	Others
13.	Consultative Services	Yes
14.	Technological Services	Yes

15.	Listed in research data registry	Yes

University of Pennsylvania implemented Wharton Research Data Services (WRDS) dedicated to research data management and support. It is a leading data analytics and research platform. WRDS manages data permissions within distributed environment to provide maximum facility to researchers for discovery of relevant data sets. Associating globally, It manages widest storage of data on the supreme vigorous computing structure with provision to researchers the strength to analyse multifaceted data at speeds of up to 400 MB per second.

Consultative and technological services: WRDS support team of doctoral-level expert's response all questions relating to research data. Also provides access to customized training, sample programs and tutorials. All data validation by top tier academics and experts.

4.2.16 Tsinghua University

Table 4.17: Research Data Management Profile @ Tsinghua University

1.	Name of Repository	**Institutional Repository of Tsinghua University**
2.	URL	http://ir.lib.tsinghua.edu.cn/
3.	Subjects	Multidisciplinary
4.	Repository Type	Institutional
5.	Language	Chinese
6.	Country	China
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Closed
11.	Persistent identifier systems	Unknown
12.	Software	Dspace
13.	Consultative Services	Yes
14.	Technological Services	Yes

15.	Listed in research data registry	No

National Tsinghua University repository is designed to preserving NTHU academic research and expanding the sharing scope and influence of NTHU academic output. The library is responsible for planning, constructing, maintaining and executing the system and relative works. The library is responsible for planning, constructing, maintain and executing the system and relative works. The library also works with other school units to maintain the content of the system.

Consultative and technological services access are allowed at the following labels:

- Teachers and researchers: Allowed to upload document onto the system and can manage their own research.
- School unit representative: Has authority to manage and maintain the unit uploaded documents.
- Library staff: Has authority to manage, maintain all documents uploaded by different units. Assists different school units in uploading process of the documents.

4.2.17 Yale University

Table 4.18: Research Data Management Profile @ Yale University

1.	Name of Repository	**Yale Research Portal**
2.	URL	https://researchdata.yale.edu/
3.	Subjects	Multidisciplinary
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Closed

11.	Persistent identifier systems	Unknown
12.	Software	others
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	No

Research data support at Yale University is a collaboration between units across the university including Yale University Library, Yale center for research computing, information technology services and the poorvu center for teaching and learning. Staff collaborate with each scholars at every step of the data generation as to search others research work, use of self-data, find strategies to accomplish stock and define research data, analyse the data, reserve and share research data for upcoming researchers.

Consultative and technological services: The Library of Yale University manages research data management support with various tools, techniques and club of learning resources for RDM concepts. DMP tools for designing management plans for data, tailored made Meta data standards, enabling plans to funder's requirements. University research support group constitute with experts available in various departments of university, provides their consultation to researchers on requirement.

4.2.18 Columbia University

Table 4.19: Research Data Management Profile @ Columbia University

1.	Name of Repository	**Columbia University Academic Commons**
2.	URL	https://academiccommons.columbia.edu/
3.	Subjects	Social Sciences Economics Jurisprudence Biology Medicine Microbiology, Virology and Immunology Agriculture, Forestry, Horticulture and Veterinary Medicine Natural Sciences Engineering Sciences Social and Behavioural Sciences Humanities and

		Social Sciences Life Sciences Agriculture, Forestry, Horticulture and Veterinary Medicine
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Closed
11.	Persistent identifier systems	DOI
12.	Software	Fedora
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

Columbia University provides guidance on long term preservation of research data through overview in sustaining precise and proper records with respect to original research data essential component in any research project.

Research support services as consultative and technological categories are to protect intellectual property rights, to facilitate, empower data distribution and maintain proper university rules, policies and funder eligibilities. Good work practices to sustain and maintain research data requirement on the type of research work and defined subject constraints. The guidance provided through out the campus with support to various research specific labs. Ultimately these standards are works as guidance for preservation, distribution and management of research data.

4.2.19 EPFL: Ecole Polytechnique Federale de Lausanne institute

Table 4.20: Research Data Management Profile @ EPFL

1.	Name of Repository	**EPFL repository**
2.	URL	https://www.epfl.ch/

3.	Subjects	Multidisciplinary
4.	Repository Type	Institutional
5.	Language	English
6.	Country	United States
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Restricted
10.	Data License	Closed
11.	Persistent identifier systems	other
12.	Software	others
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	no

EPFL repository is maintained by Ecole Polytechnique Federale de Lausanne institute. A team at EPFL Library is there to support researchers with the organization and publication of their research data. Ethical clearance of the data management plans provided by EPFL research office and intellectual property guidance related to research data provided by EPFL technology transfer office. Consultative and technological services are provided in limited manner.

4.2.20 University of Edinburgh

Table 4.21: Research Data Management Profile @ University of Edinburgh

1.	Name of Repository	**Edinburgh DataShare**
2.	URL	https://datashare.is.ed.ac.uk/
3.	Subjects	Medicine Biology Basic Biological and Medical Research Physics Human Genetics Medicine Cell Biology Engineering Sciences Natural Sciences Life Sciences Humanities and Social Sciences
4.	Repository Type	Institutional
5.	Language	English

6.	Country	United Kingdom
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open
10.	Data License	Open
11.	Persistent identifier systems	hdl DOI
12.	Software	Dspace
13.	Consultative Services	Yes
14.	Technological Services	Yes
15.	Listed in research data registry	Yes

Digital repository of university of Edinburgh known as Edinburgh Datashare managed by department of Information sciences. Scholars within University of Edinburgh indulge in research programs and produced their research data within university are supported to preserve their research data here and maintain further research publications showcasing which may be use full for future researchers. Supports regarding various research data management services on author's credibility, various citation schemes are also provided. A good initiative about preparation of modules through check list is developed to prepare high level of acceptance of data plans and datasets and avoid rejections. Edinburgh Datashare repository is prepared on Dspace software solution with open source license. It has university friendly customization to provide convincing feel to their researchers. This repository is supported by various research data tools and google like search engine interface.

4.3 Ranking of Research data management profiles for Indian top universities

Research data management profiles for Indian top universities have been done through Quacquarelli Symonds Universities Ranking Database 2020. Top ranked twenty universities have been explored for research data management services in table: 3.5 of chapter 3.

In re3data research data registry none of the Indian universities have qualifies registration.

While 51 repositories have registered from India in re3data.org. Out of the 51 repositories 48 repositories are registered from non-profit organizations and 5 repositories are registered from commercial organizations.

4.3.1 Research Data Management efforts in Indian Institutions

National Data Sharing and Accessibility Policy (NDSAP) declared in year 2012 with the objectives of maximise public sharing of data, which is generated in public domain through public funds. It was recommended that accessibility of data should be maintain in a robust environment so that retrieval may continue with convenience. NDSAP has been implemented by a mandatory regulation for all government departments throughout India to provide data preservation.

Development of Research Data Repositories in India has been initiated with very slow pace from last decades. But Indian Research Data Repositories are not maintain all the necessary components or tools to deliver key consultative and technological research data management services.

Re3data.org has 51 registered RDR from India but data weighted RDR from government establishments are very limited.

4.3.1.1 Indian Genetic Disease Database

Table 4.22: Indian Genetic Disease Database

1.	Name of Repository	**Indian Genetic Disease Database**
2.	URL	http://www.igdd.iicb.res.in
3.	Subjects	Epidemiology, Medical Biometry, Medical Informatics Human Genetics Public Health, Health Services Research, Social Medicine Medicine Medicine Life Sciences
4.	Repository Type	Institutional, Disciplinary
5.	Language	English
6.	Country	India
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open

10.	Data License	Open
11.	Persistent identifier systems	None
12.	Software	Unknown
13.	Consultative Services	No
14.	Technological Services	No
15.	Listed in research data registry	Yes

Indian Genetic Disease Database has been established by CSIR institute and maintained by Institute of Chemical Biology. The database is related to genes and related disease and disorders.

4.3.1.2 Open Government Data Portal of Tamil Nadu

Table 4.23: Open Government Data Portal of Tamil Nadu

1.	Name of Repository	**Open Government Data Portal of Tamil Nadu**
2.	URL	https://tn.data.gov.in/
3.	Subjects	Medicine Statistics and Econometrics Economic and Social Policy Education Sciences Social and Behavioural Sciences Humanities and Social Sciences Natural Sciences Agriculture, Forestry, Horticulture and Veterinary Medicine Life Sciences Medicine Geosciences (including Geography) Agriculture, Forestry, Horticulture and Veterinary Medicine Social Sciences Public Health, Health Services Research, Social Medicine Economics Political Science
4.	Repository Type	Institutional, Disciplinary
5.	Language	English
6.	Country	India
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open

10.	Data License	Open
11.	Persistent identifier systems	None
12.	Software	Unknown
13.	Consultative Services	No
14.	Technological Services	No
15.	Listed in research data registry	Yes

National Informatics Centre of India established Open Government Data Portal of Tamil Nadu. The RDR has responsibilities to preserve datasets collected by government of Tamil Nadu for open public access and uses. RDR has formats as CSV, XLS, ODS / OTS, XML, RDF, KML, GML, etc.

4.3.1.3 KRISHI- Knowledge based Resources information systems Hub for Innovations

Table 4.24: KRISHI- Knowledge based Resources information systems Hub for Innovations

1.	Name of Repository	**KRISHI - Knowledge based Resources Information Systems Hub for Innovations in Agriculture**
2.	URL	https://krishi.icar.gov.in/
3.	Subjects	Life Sciences Agriculture, Forestry, Horticulture and Veterinary Medicine
4.	Repository Type	Disciplinary
5.	Language	English
6.	Country	India
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open
10.	Data License	Open
11.	Persistent identifier systems	hdl DOI

12.	Software	Unknown
13.	Consultative Services	No
14.	Technological Services	No
15.	Listed in research data registry	Yes

KRISH data portal is a centralised RDR effort of Indian Council of Agricultural Research to maintain generated research data within experiments, surveys, observational studies, Publications and various self-learn resources. This portal has access of six repositories and started in 2016.

4.3.1.4 National Data Repository

Table 4.25: National Data Repository

1.	Name of Repository	**National Data Repository**
2.	URL	https://www.ndrdgh.gov.in/NDR/
3.	Subjects	Natural Sciences Engineering Sciences Thermal Engineering/Process Engineering Heat Energy Technology, Thermal Machines, Fluid Mechanics Energy Process Engineering Geochemistry, Mineralogy and Crystallography Geology and Palaeontology Geosciences (including Geography)
4.	Repository Type	Disciplinary
5.	Language	English
6.	Country	India
7.	Policy Availability	Yes
8.	Type of access to RDR	Open
9.	Type of access to data	Open
10.	Data License	Open
11.	Persistent identifier systems	Unknown
12.	Software	Unknown
13.	Consultative Services	No

14.	Technological Services	Yes
15.	Listed in research data registry	Yes

National Data Repository is maintained by director general of hydrocarbons, Ministry of petroleum and natural gas, government of India. This RDR contains very useful data related to search and production of hydrocarbons. It works as a centralized portal for standardised and maintained datasets.

International Research Data Repository re3data.org statistics reflects that at present none of Indian universities repositories qualified as RDR on international standards. While most of Research Data Repositories registered under Indian locations are registered by core research specific institutions not by academic research universities or organizations.

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CHAPTER 5:

Data Analysis and Interpretations

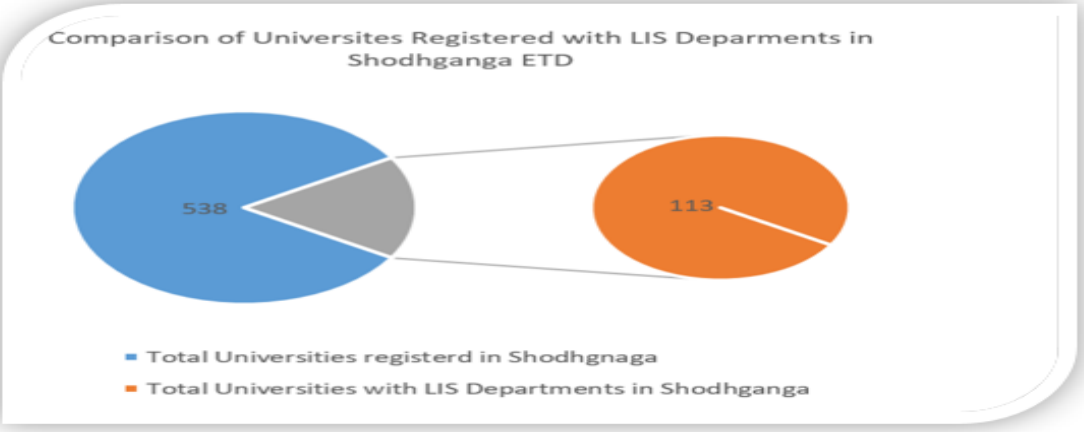
Surveys, interviews and feedback conducted to explore perceptions of library and information science researchers, faculties, librarians and experts regarding following concerns:

1. To identify research data apprehensions and sensitivities.
2. To evaluate research data storage practices among respondents.
3. To sense urgent requirement of a Research Data Management Service within Indian academia.
4. To measure requirement of national research data policy.

5.1 Data Analysis & Interpretation

The current chapter examines and deduces the replies acknowledged from the online survey questionnaires and interview. The questionnaires and interviews were prepared through google forms, one of the open and easy to use questionnaire tool. To administer each of the survey questionnaire, a web-link was e- mailed along with a covering letter to the research scholars, faculties, librarians and universities / institutions ETD managers. The Scope of the study has been decided up to library and Information Science thesis submitted to shodhganga ETD. So only those universities have been considered for questionnaire distribution who submitted LIS thesis to Shodhganga ETD After preparation of registered universities list available on shodhganga ETD in depth website investigation has been done to identify registered universities with LIS departments' thesis submissions.

Figure 5.1: Comparison of Universities registered with LIS Departments in Shodhganga ETD



As shown in figure: 5.1 records available on shodhganga portal only 113 universities have submitted LIS thesis to Shodhganga ETD as listed in Annexure: 6 & 7

First questionnaire was prepared for research scholars and the second questionnaire was prepared for Universities / Institutions librarians and ETD administrators. Both the questionnaires were sent to 113 universities which were identified as depositor of the eThesis in the field of Library and Information Science in the repository called ShodhGanga. On completion of surveys, the researcher compiled the data in Microsoft Excel. The collected data is further represented in graphs and charts which facilitated better analysis of results.

5.2 Questionnaires analysis

Questionnaires for research scholars and Faculty / Librarian / Universities or Institutions ETD coordinators for Sodhganaga ETD of universities were sent to 113 universities Library and Information Science departments and also directly to many research scholars / LIS faculties of the universities.

Responses received from 282 researchers and Faculty / Librarian / Universities or Institutions ETD coordinator from 66 Indian Universities. Universities or Institutions ETD coordinators of 66 universities responded for questionnaire about universitie's ETD facility.

Figure 5.2: Response received from Universities.

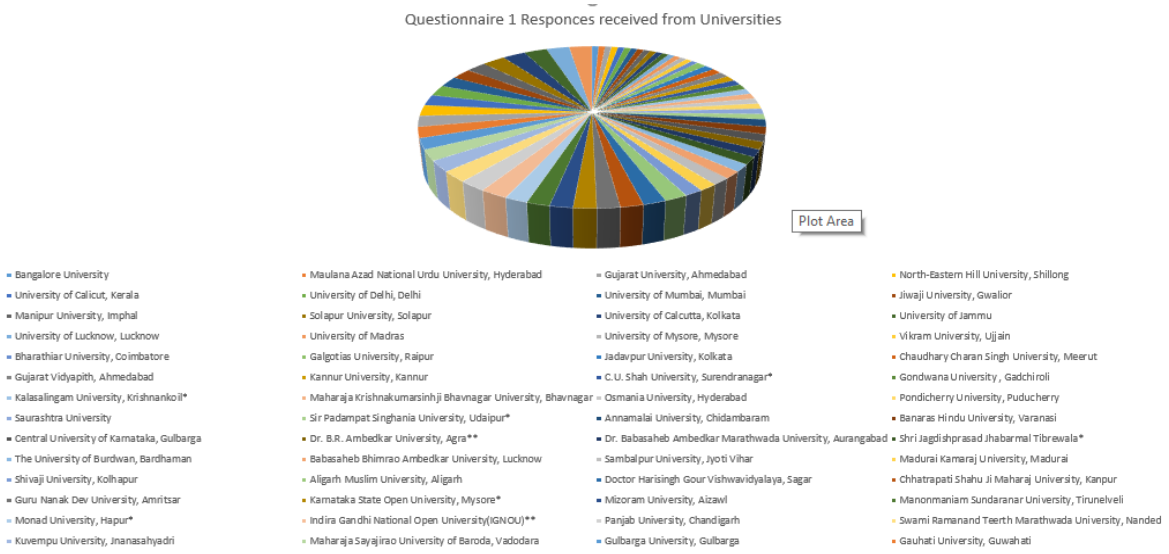


Figure: 5.2 shows out of the 113 selected universities responses received from 66 universities.

First questionnaire contained twenty five questions, divided into following four sections:

Section I - Personal & Institutional Information

This section contained six enquiries related to basic information about research scholars.

Section II- Information about your University / Institution ETD Repository

This section contained eight questions related to university thesis repository, ETD submission practices, Shodhganga repository support and experiences of research scholars.

Section III- Shodhganga ETD Repository thesis submission process

This section covered ten questions related to ETD related formats, utility, anti-plagiarism practices.

Section IV- Research Data Management (Understanding and Practices)

Most relevant section of the questionnaire contained enquiries related to research data preservation requirements of the researches. Thirteen questions were asked to observe the research scholars' perception for research data curation, sharing, benefits, problems, practices.

Section: 1 Related to personal and institutional information of the respondents. Responses received from 66 universities out of 113 universities list.

Question1 and A1 were responded very low by various research scholars only 19% researchers admitted to have knowledge about ETD repository of their respective university.

Question A2 was responded to 86.6% in regard to open access of ETD repository.

Figure 5.3: Open access policy of ETD repositories in universities.

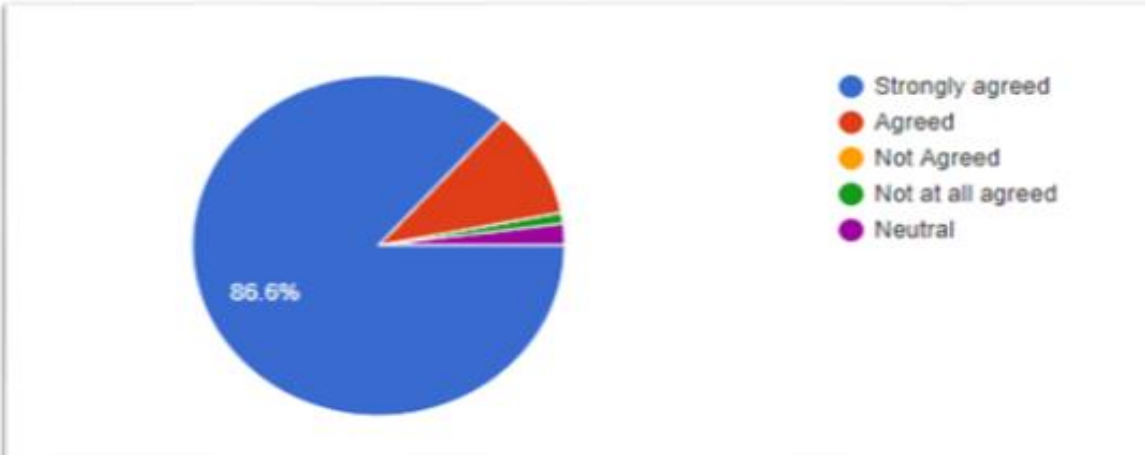


Figure 5.3 shows that 86.6% responses received in favor of open access policy of ETD repositories in universities.

Question A3 about the types of file formats are currently allowed to submit in university's ETD Repository has been responded as:

Figure 5.4: Formats of documents used in ETDs

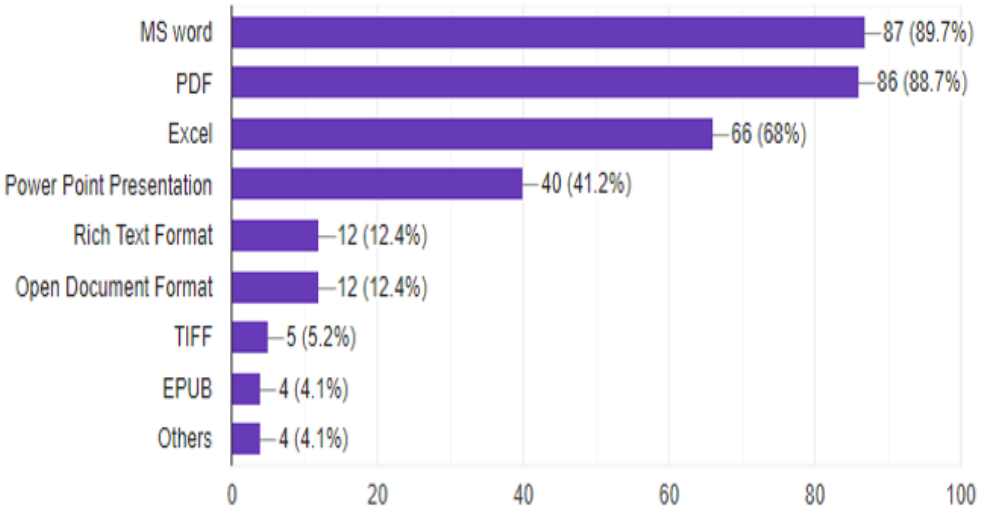
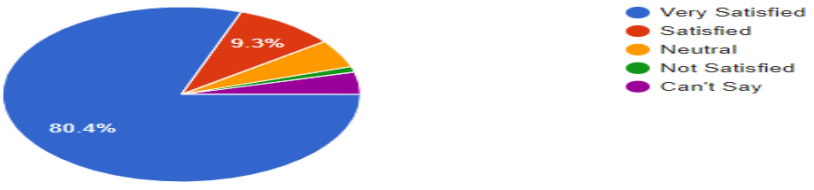


Figure 5.4, clearly shows that MS word, PDF and Excel formats have much responses in favor.

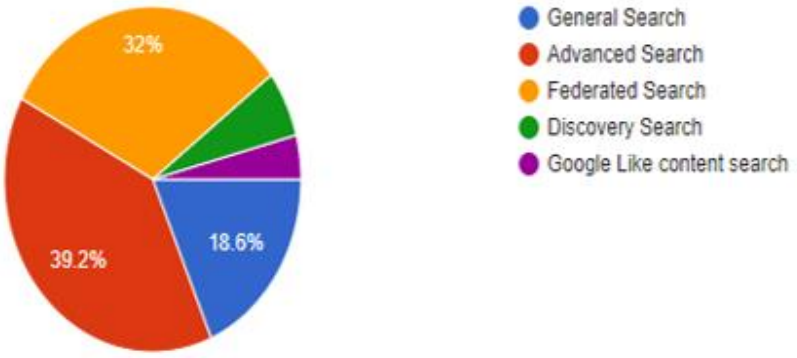
Question A4 asked about content discovery in University ETD repository and measured 80.4% in very satisfied category as figure 5.5.

Figure 5.5: Content Discovery in Universities ETDs



Question A5 has been asked about the search options preferred by research scholars. It has been responded in favor of advance search options. Figure-5.6 shows that 39.2% of responses were satisfied with advanced search options.

Figure 5.6: Search options in ETDs



Question A6 asked about most utilized open access ETD service, which was majorly responded for Networked Digital Library of Theses and Dissertations (NDLTD) service with 54.6% as shown in figure: 5.7.

Figure 5.7: Most utilized ETD service by Indian Scholars

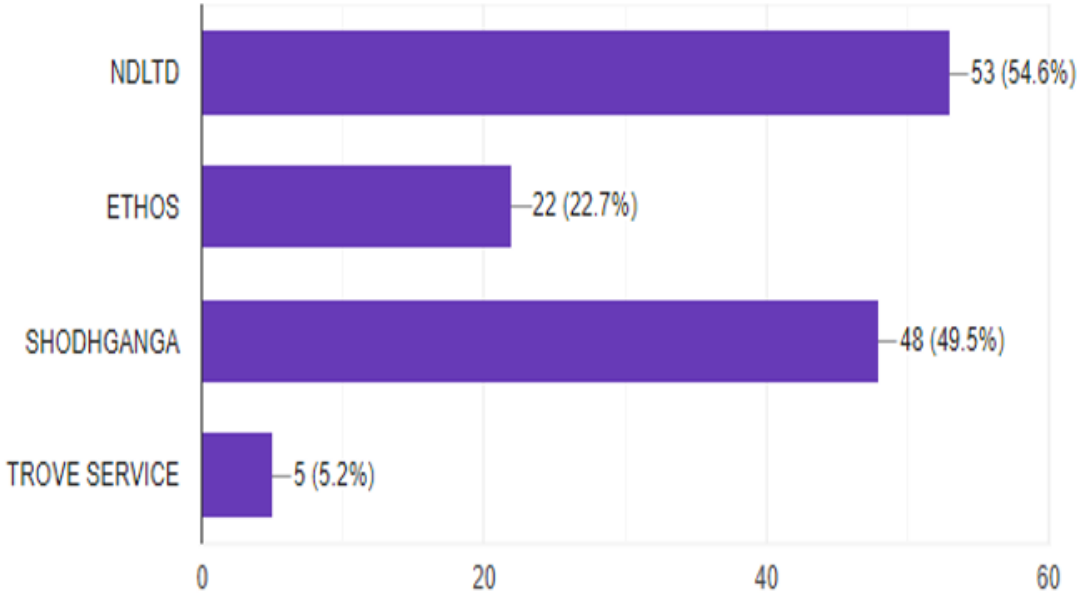
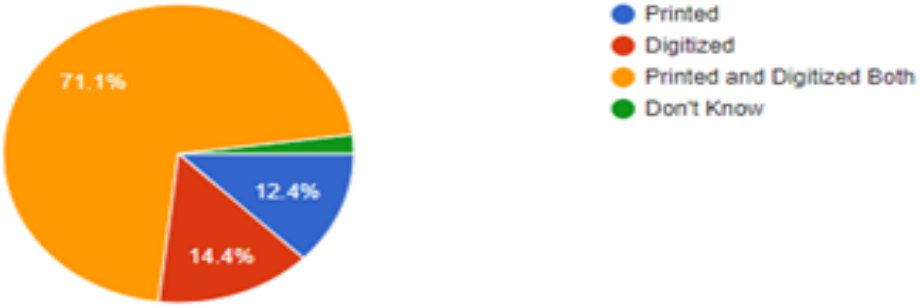


Figure 5.7, shows Indian ETD service has been responded by 49.5% of responses.

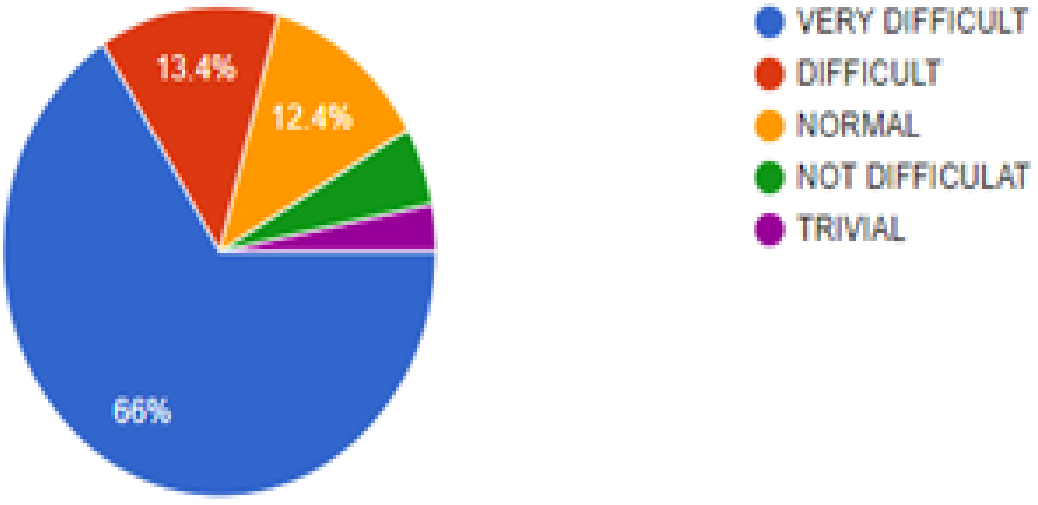
Question 2 has been asked for most easy format used by research scholars to consult thesis. Responses are found highest for printed and digitized both formats as shown in figure 5.8 with 71.1%.

Figure 5.8: ETD formats favoured by Scholars



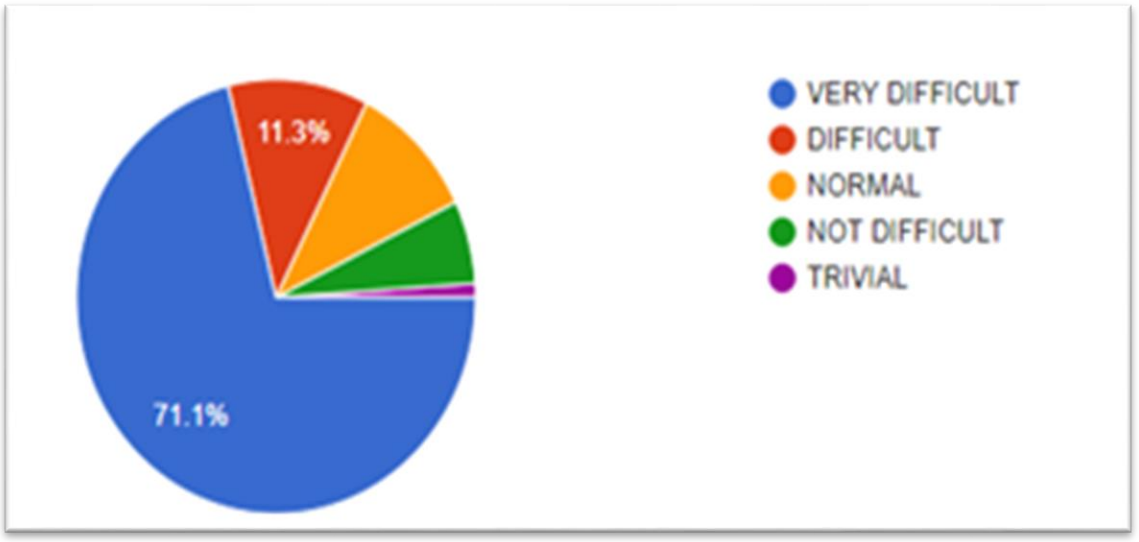
Question 3 has been marked for experiences to develop file naming convention according to shodhganga guidelines during submission of your Ph.D. and responses discovered as 66% as it was experience very difficult. Figure 5.9 shows file naming conventions have experienced very difficult.

Figure 5.9: File naming difficulties for scholars



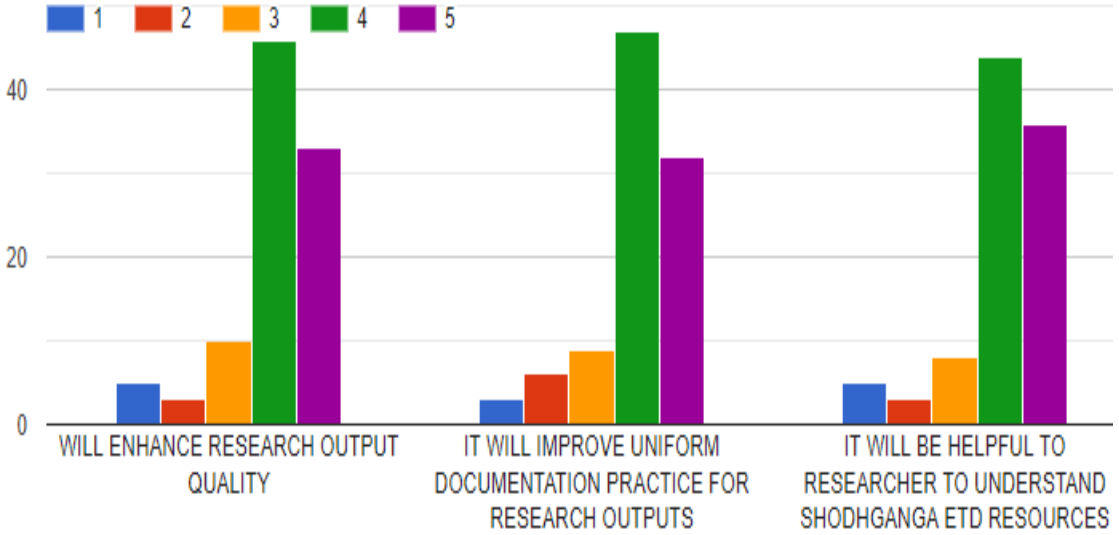
Question 4 and 5 were asked for experience to convert your theses files to PDF format for uploading purpose in to Shodhganga. Figure 5.10 shows that research scholars responded 71.1% majorly that it was very difficult. It discovered in responses that ETD repository should have format free submission options.

Figure 5.10: Scholars difficulties for PDF conversion



Question 6, 7 and 8 asked for usability of shodhganga ETD repository for research work. Responses received importantly as for proper and intensive training should be available to researchers for Shodhganga ETD submission as shown figure 5.11 with green indicator.

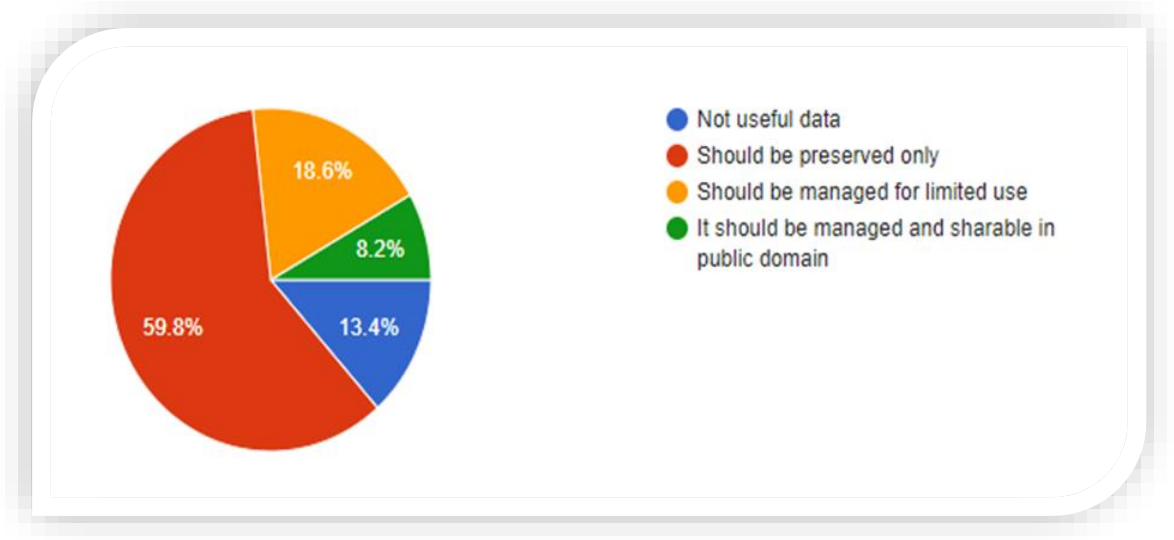
Figure 5.11: Scholars usages experience for submission of research output



Questions 9, 10, 11 and 12 were asked for usage of anti-plagiarism software, content discovery in shodhganga ETD, and overall service rating for same. Responses received as shodhganga ETD service as best in class.

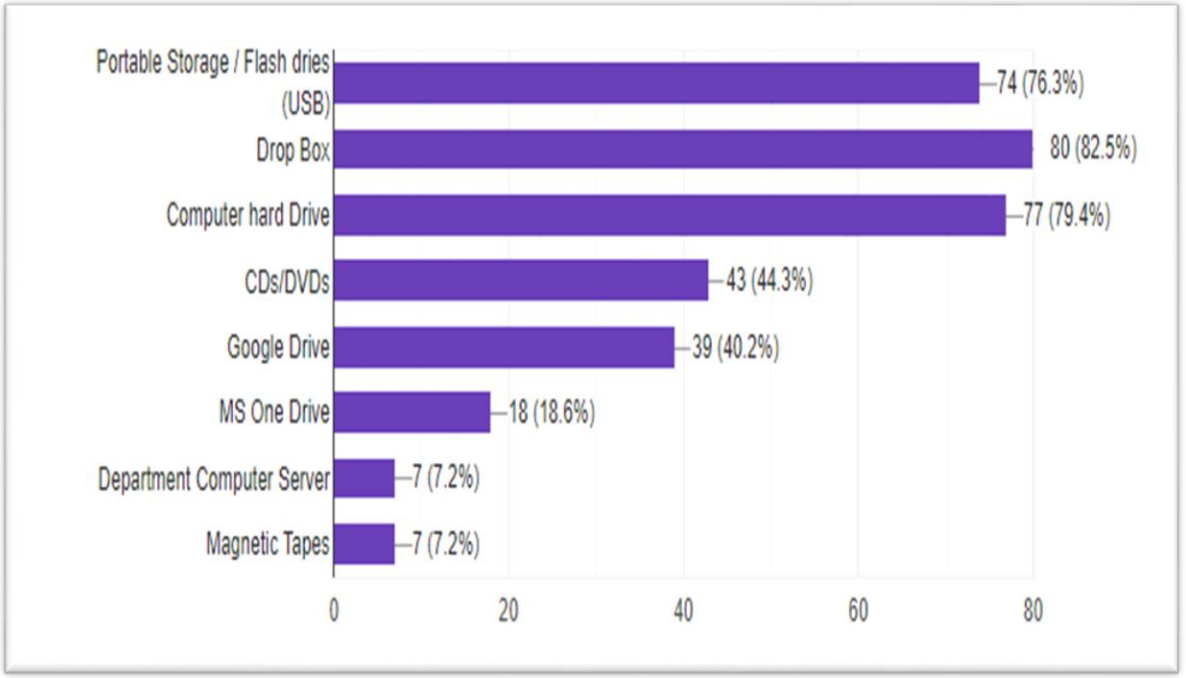
Questions 13 has been asked about significance of generated research data and as per figure 5.12 shows that responses received 59.8% as research data should preserve only.

Figure 5.12: Research data mandate in Indian Scholars



Question 14 asked about practices of research data preservation in library science Indian researchers and responses have been received as under and as per shown in figure 5.13 research data has been stored personally by Indian Library Science researchers.

Figure 5.13: Practices of research data preservation in Indian Library Science researchers



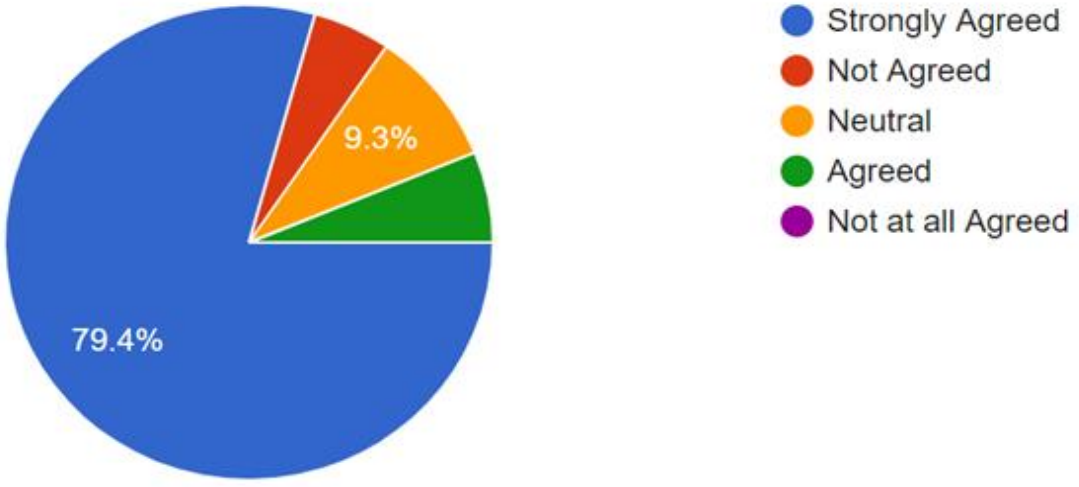
Question 15 to 20 have been asked about researchers' interest in research data organization in Research Data Repositories. Responses have been received in favor of research data

preservation in Research Data Repositories for lifelong sharing while research scholars are experiencing critical problems to deal with big amount of research data as shown in figure 5.14 with 70.1%.

Figure 5.14: Experience of researchers to manage Research Data

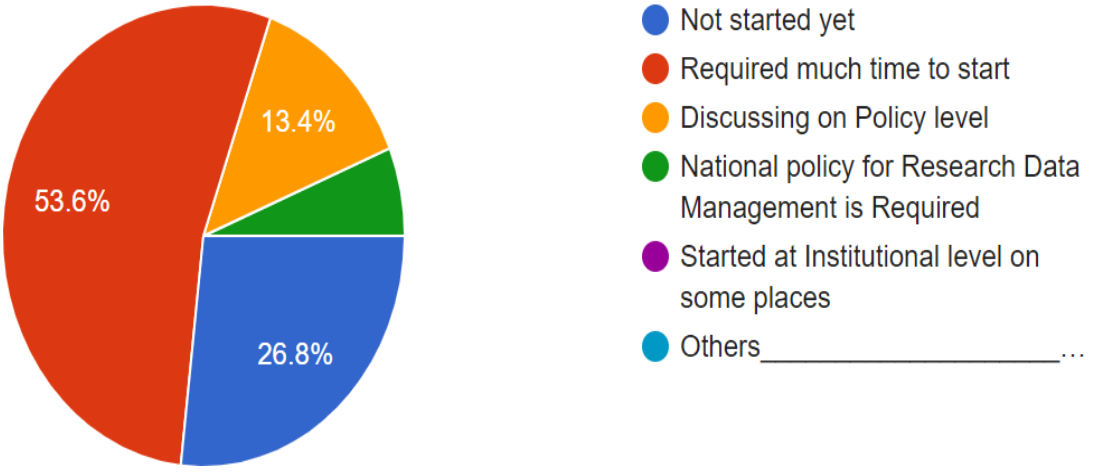
Question 21 and 22 are about requirement of one Unified Open Research Data Repository as a national research data repository to researchers in India, figure 5.15 depicted that has been responded in favor with response rate 79.4%.

Figure 5.15: Requirement of National Research Data Repository



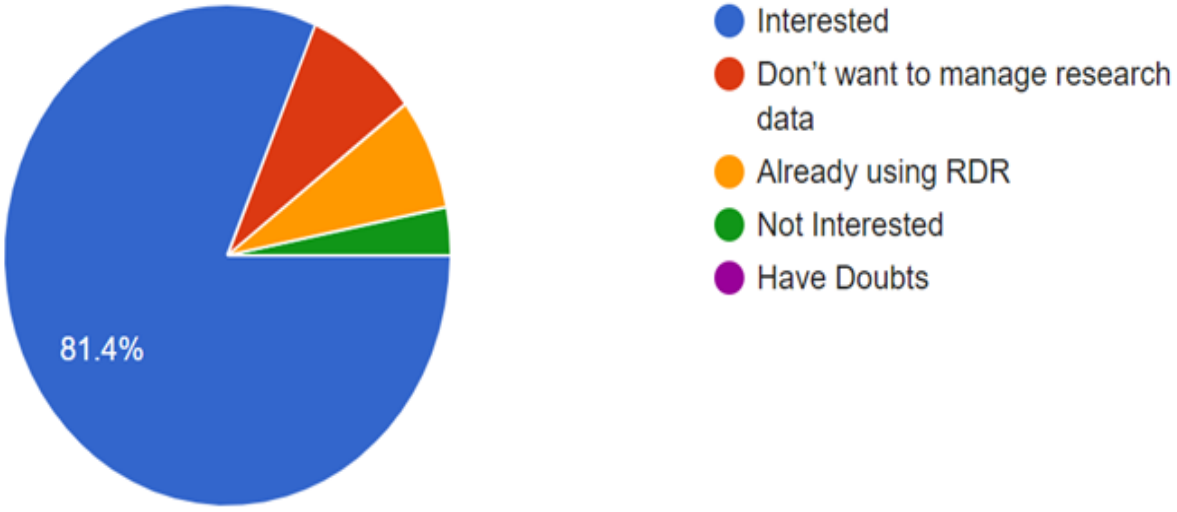
Question 23 is about status of research data management in Indian universities has been responded as it will take long time to start figure 5.16 shows responses 53.6% in favour.

Figure 5.16: Sensation of Research Data Management in Indian Academia



Question 24 and 25 are about to get free research data management service to researchers in India. The research data repository service eshodhmanthan has been offered to the researchers. Figure 5.17 shows responses have been received in favor of research data preservation as 81.4%.

Figure 5.17: Free research data management service for Indian Researchers



Second questionnaire contained twenty questions which were divided into following four sections:

Section I - Personal & Institutional Information,

This section contained seven enquires related to basic information about research scholars.

Section II- Information about your University / Institution ETD Repository.

The present section contain ten questions related to university thesis repository, ETD submission practice, Shodhganga repository support and experiences of librarians / ETD administrators.

Section III- Shodhganga ETD Repository thesis submission process.

This section covered nine questions related to ETD related formats, utility, anti-plagiarism practices

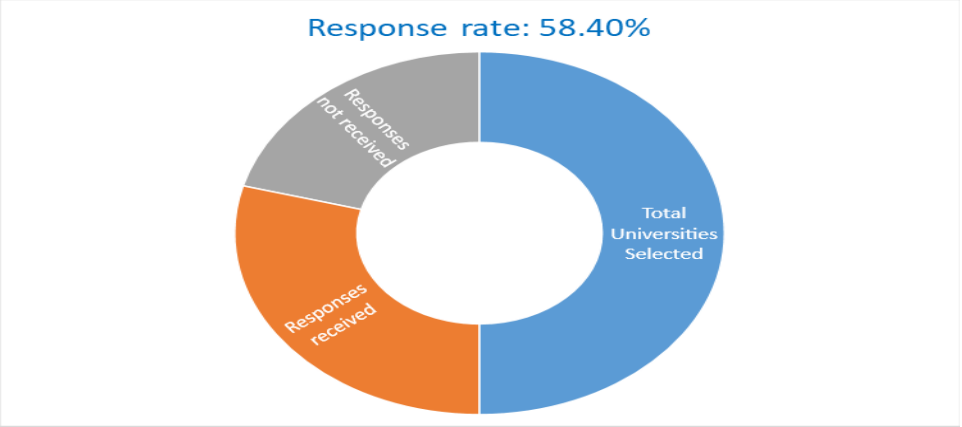
Section IV- Research Data Management

Most relevant section of the questionnaire contains enquires related to research data preservation requirements of the researches. Ten questions were asked to observe the librarians / ETD administrators' perception for research data curation, sharing, benefits, problems, practices.

Questionnaire for Faculty / Librarian / University or Institution coordinator for Sodhganaga ETD has also sent to 113 universities library science departments and also directly to many ETD administrators of the selected universities. Responses have been received from 66 universities.

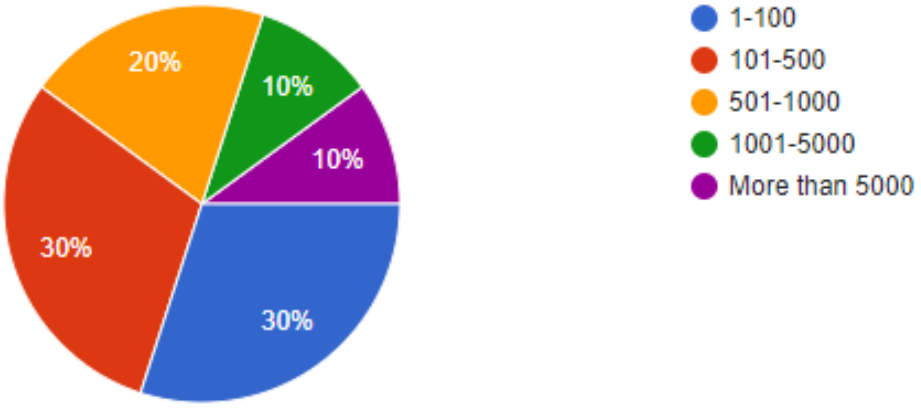
Section: 1 Related to personal and institutional information of the respondents. Responses have been received from 66 universities out of 113 universities list as per Annexure 5 & 7. Figure 5.18 shows response rate 58.40%.

Figure 5.18: Response received from selected universities and total universities



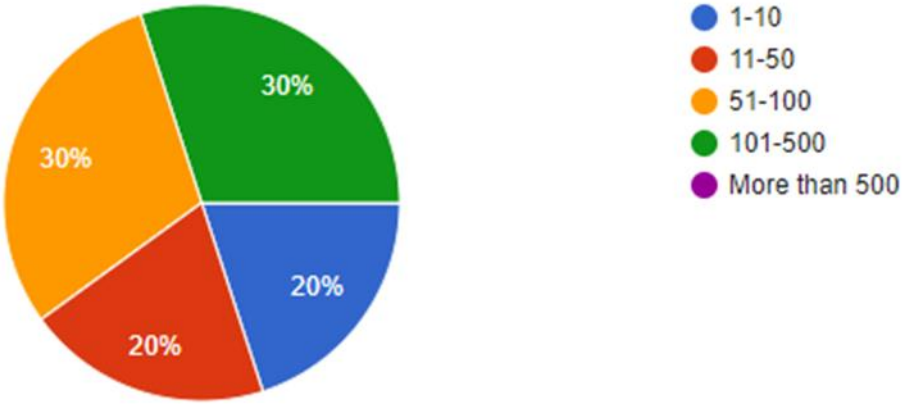
Section 2, question 1, A1, A2 and A3 were asked about general enquiries for ETD service of respected universities. The responses rate were low. Question A4 was asked about present records status of repositories and responses are as follows:

Figure 5.19: Status of repositories establishments



Question A5 was asked for approximate numbers of items uploaded to respective repositories of the universities during 2019 and responses were received as follows:

Figure 5.20: Status of records updation in repositories



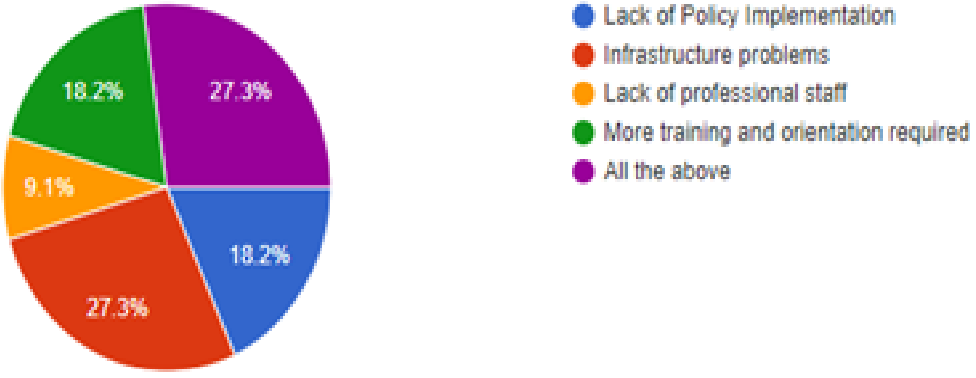
QA6, A7, A8 and A9 were asked about establishment of ETD service in the universities. Responses were received for findings as Dspace was most favorable platform for Indian universities. The visibility of universities research output was found the key driving force for their establishment. Most of the responses about separate cell for ETD were in favor while research section was observed as authority for most of the universities.

Question 2 to 10 were asked about Shodhganga ETD submission process, training for research scholar and teachers, usage and content discovery.

Responses were as follows most of the universities were observed that financial assistance have been received for Shodhganga ETD repository. Most of the ETD administrator admitted that proper training for Shodhganga ETD submission will enhance uniform documentation practice for research outputs within Indian academic community. On the basis of content discovery, usage of content by researchers and management of research outputs in Shodhganga ETD various responses remarked Shodhganga ETD as a very good initiative.

One of the very interesting observation about implementation of Shodhganga ETD service did not covered all Indian universities till date, was responded as figure 5.21 as follows:

Figure 5.21: Reasons for slow growth of Shodhganga ETD



Section 4 has covered ten questions about research data management aspects of Indian research. Question 11 was responded as presently no Indian universities have any policy for research data. Question 12 was replied that most of the researchers have practice to store their research data in their personal devices. Question 13 and 14 were responded that in Indian research environment there is urgently need of Research Data Repositories. Question 15 and 16 were replied as low responses about Indian researcher's interest in research data management conferences / Seminars/ workshops / Most favorable software for RDM.

Question 17 and 18 were asked about national research data policy and unified research data repository for Indian researchers. The responses were received very much in favour. Question 19 was asked about over all observation for level of Research Data Management process in Indian universities and it was responded with 45.5% by option that It will required much time to start figure 5.22 as follows:

Figure 5.22: Level of Research Data Management process in Indian universities

In question 20 unified research data repository prototype service "eShodhmanthan" was offered to the Universities librarians and ETD administrators. Responses were marked very much in favor to use this service.

5.3 Interview Schedule Analysis

Further interview Schedule (Annexure –3) was designed to evaluate library and Information science experts' insights about status of research data management in Indian academic community. Interview schedule which contained two parts,

Section I has all interview questions related to personal and institutional information were responded by various eminent library science experts and professionals of universities / institutes of national importance.

Section II has around 15 interview questions related to research data management mandate in India and abroad.

(a) What are your views about the status of Research Data Preservation in Indian Universities?

(b) In your opinion what are the most prevalent practices to store research data within Indian Universities / Institutions?

(c) What is your opinion about present policies for research data sharing around the world?

First three questions (a) to (c) were related to Indian universities perception regarding research data management and prevalent policies of Research Data Sharing around the world. The Responses were received that status of Indian Research Data Management is not up to the mark or have long time to start. While responses supported that research data sharing polices are strongly designed and implemented at universities or institutions situated out of India.

(d) What do you think about roles of libraries in managing research data?
(e) How do you observe pace of Research Data Management (RDM) in foreign universities?
(f) What is your overall observation for level of Research Data Management process in Indian universities?

Questions (d) to (f) were related to roles of libraries on research data management development. Various experts responded that libraries have a good opportunity to serve at various stages of research data management. While pace of Research Data Management at foreign universities responded and marked as good. Large number of responses observed that Research Data Management process at Indian universities will take long time.

(g) What is your opinion regarding impact of rules by regulatory authorities for mandatory submission of thesis / dissertation in Shodhganga repository?
(h) Do you think similar to Shodhganga repository concept, One Unified Open Research Data Repository should be available to researchers in India? If so, how it can be possible in your opinion?

Questions (g) and (h) were related to concepts of national level effort for preservation of research outputs and data. Most of the responses supported that if any effort taken at national level it will surely generate impact at status of research data preservation in India. Further national research data policy and shodhganga ETD like mandatory options of submission of research data were questioned to know the real insights. Various eminent library sciences professionals and experts responded it as a very good options to start the research data preservation within Indian universities. Also remarked status of research data mandate in Indian universities as very low.

(i) How to you recognize need of National Research Data Policy for a countries?
(j) Do you feel requirement of National Research Data Repository for researchers in India? How would it be beneficial?
(k) What is your opinion about the need to host or manage research data at institutional level in India?

Questions (i) to (k) were asked about National Research Data policy and Repository. Responses received by well support for both the concepts.

(l) As you are familiar with Research Data Repositories (RDR). In your opinion which research data repository software is best for RDM?

Question (l) were asked about Research Data Repositories exposure of respondents. The responses were low replied with limited knowledge about software of Research Data Management. Most of the responses were received with not any clear answer.

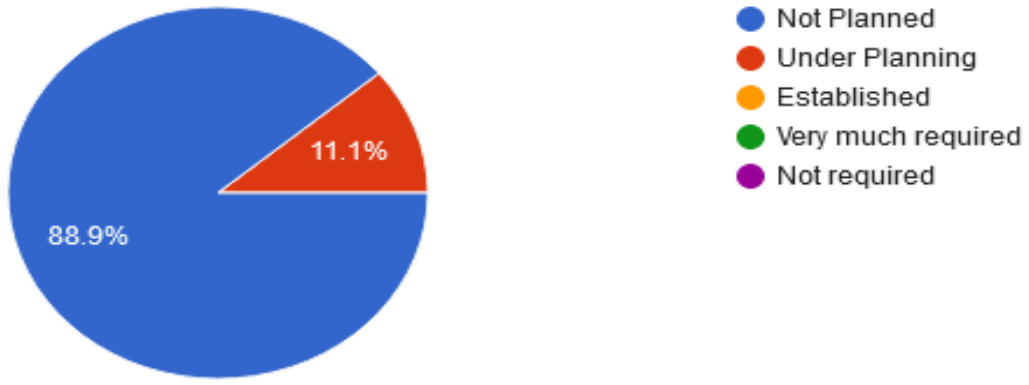
(m) What are the bottlenecks you fell in implementation of Research Data Management in Indian conditions?
(n) What are your views about Research Data Management (RDM), as a best opportunity for library science professionals in India?

Last two questions (m) to (n) were related research data repository, implementation bottlenecks for India in RDM concept and finally it was asked about opportunities regarding LIS professionals. While the major bottleneck was identified by the experts in interview as lack of research data literacy.
Finally very good responses were received in favor of research data management as a vital opportunity for Library and Information professionals in India.

5.4 eShodhmanthan RDR Feedback analysis

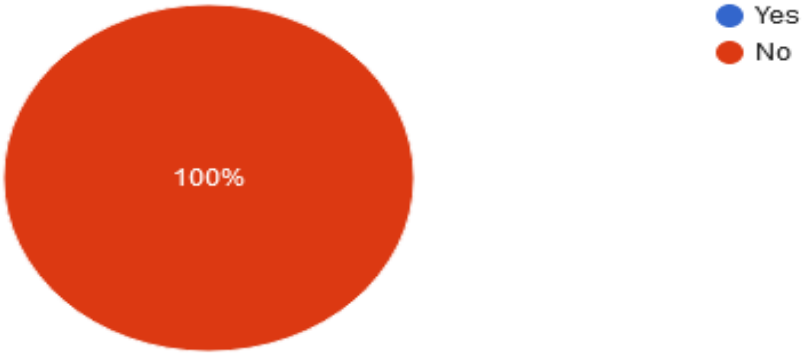
In responses of question, has your university / organization / Institution any policy for preservation of digital research data? Around 88.9% users of eShodhmanthan RDR responded no. Only 11.1% responses are supporting that such policy related development is under planning in some academic institutions / Universities as shown in figure 5.23.

Figure 5.23: Planning for preservation of digital research data in Indian Universities / Institutions



Question asked as, has your university / organization / Institution any research data management services? All the responses replied no, which indicate till date no academic research data management service is running in various Indian universities as figure 5.24.

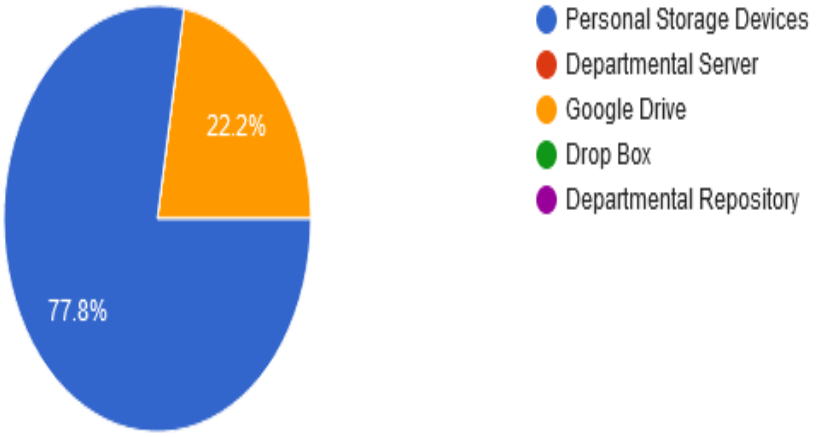
Figure 5.24: Responses for research data management services in Indian Universities/ Institutions



The question related to research data storing practices asked as where do teachers / research scholars within your university / institution / organization store their research data?

As shown in figure 5.25 around 77.8% of the responses received in favour of personal storage devices. It summarized that most of the Indian researchers have personal device research data storing practices.

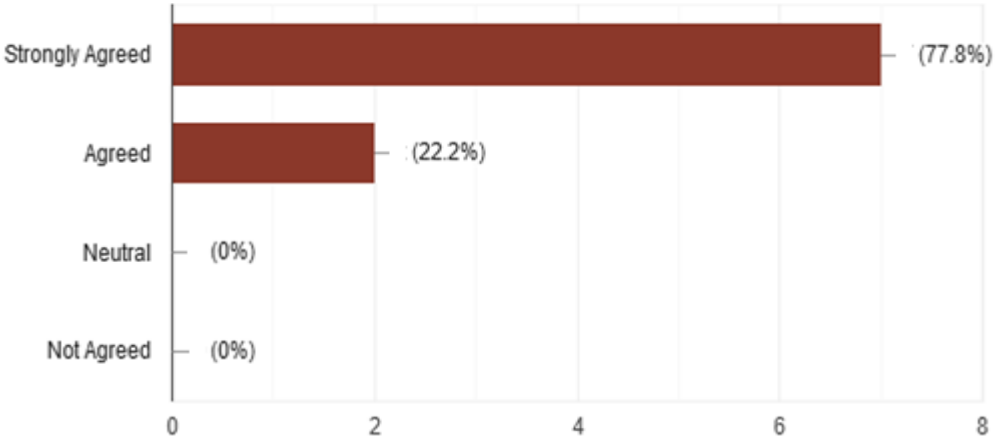
Figure 5.25: Research data storage practices in Indian Universities



The question related to perception of research data management as, what is your opinion about the need to host or manage research data?

Around 77.8% responses received with strongly agreed for the requirement of research data management as shown in figure 5.26.

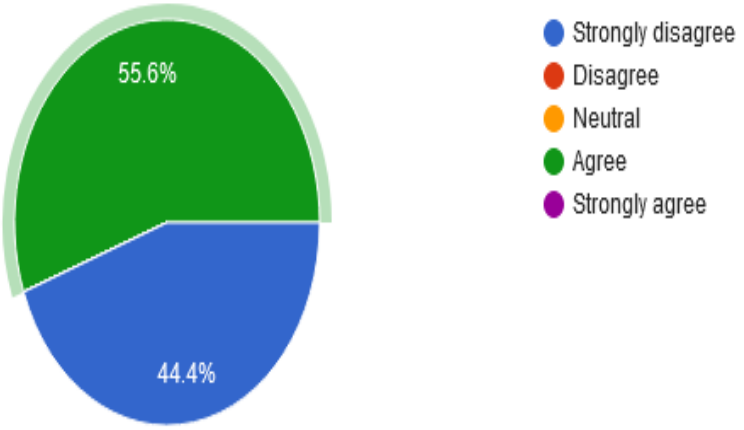
Figure 5.26: eShodhmanthan users responded for requirement of Research Data Management



Question related to free Research Data Management Service to Indian Scholars may be fruitful to develop Research Data Literacy within Indian academic communities.

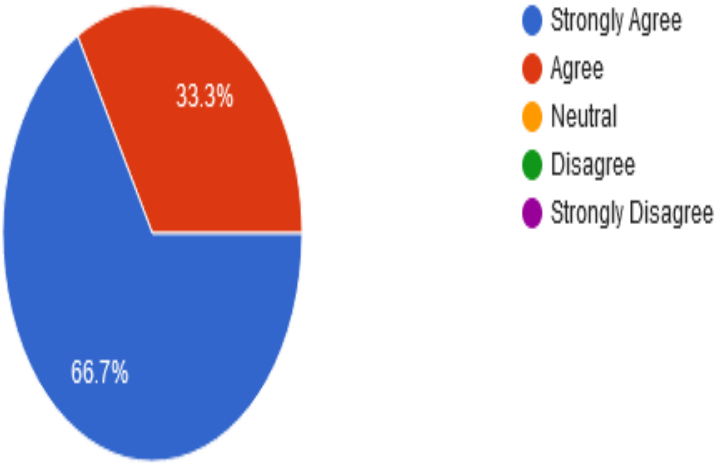
Responses received majorly around 55.6% in favour of service. While 44.4% responses received as disagree as figure 5.27.

Figure 5.27: Responses for free Research Data Management Service may fruitful to develop Research Data Literacy within Indian academic communities.



While question asked about eShodhmanthan Research Data Repository may be a prototype design for National Research Data Management Service dedicated to Indian Research Scholars. Most of the users agreed to consider eShodhmanthan as a good service with 66.7% response rate as shown in figure 5.28.

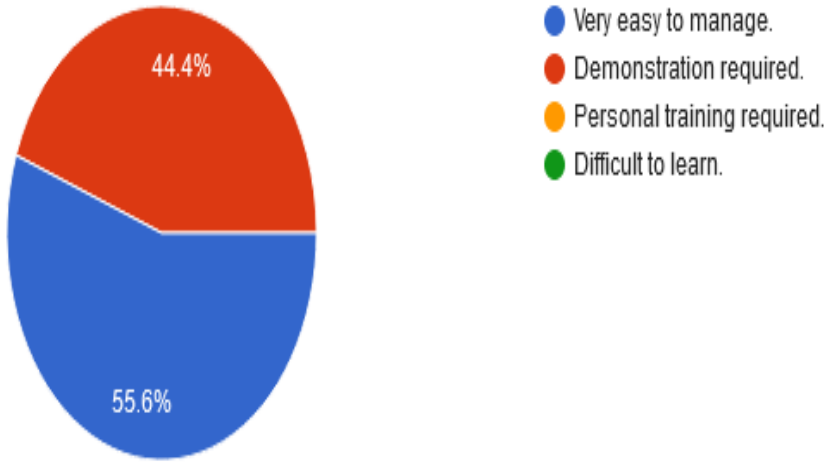
Figure 5.28: Responses for eShodhmanthan Research Data Repository may be a prototype design for National Research Data Management Service.



Question related to eShodhmanthan Research Data Management Service is very user friendly for researcher. What do you observe?

Around 55.6% responses revert with answer very easy to manage while 44.4% considered for required demonstration.

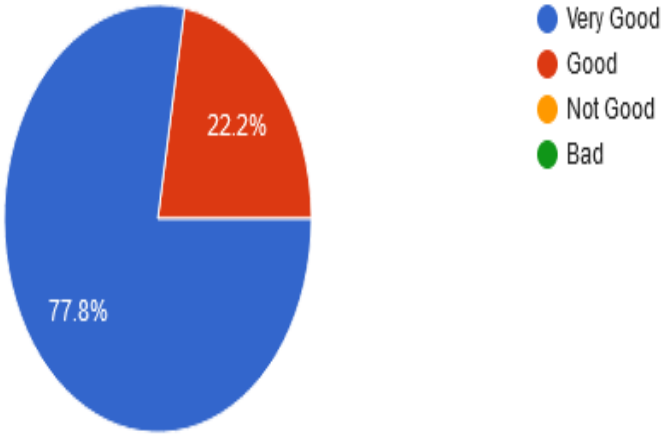
Figure 5.29: Responses for ease of eShodhmanthan Research Data Management Service.



Question asked as eShodhmanthan RDR provides open access to its published research data. Before publishing only authors of research data may manage it. How do you observe this feature?

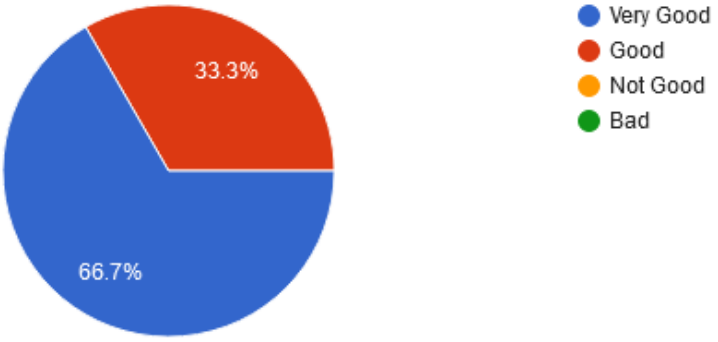
Around 77.8% replies considered is very good.

Figure 5.30: Responses for data privacy feature of eShodhmanthan RDR service.



eShodhmanthan research data repository uses DOI to make its provided research data persistent, unique and citable. How do you observe it? Around 66.7% responses favoured it.

Figure 5.31 : Responses for DOI feature of data in eShodhmanthan RDR.



Question asked about "eShodhmanthan is an initial free of cost Research Data Management Service for Indian Research. How will you rate it on the scale?"

Most of the responses received on higher side of scale with consideration of eShodhmanthan as a good initiative.

After analysing surveys, interviews and feedback of various responses it may be drawn that concerns regarding:

1. Research data apprehensions and sensitives are not clear and enough, it requires more efforts.
2. Research data storage practices among respondents is not up to the recommended best practices.
3. Sensation for urgent requirement of a Research Data Management Service within Indian academia is very low. Various experts responded in this direction.
4. National Research Data Policy requirement has been felt by various LIS faculties / experts.

CHAPTER 6:

Findings, Conclusions and Suggestions

6.1 Findings, Conclusions and Suggestions

The present research on " Prospects of Institutional Repositories in Research Data Management Services with special reference to Shodhaganga" focused and few lights on various crucial issues and unexplored aspects those have relevance to research data policies, planning, growth, implementation, pre-requisites, technology, metadata issues, versioning, sharing, access control, long term preservation, innovative services, research data management, training and best practices.

In present chapter all objectives are established through the results of the gathered data, summaries are concluded and suitable recommendations are encoded. The web questionnaires surveys were created as per the research aims and separated in units. The conclusions and findings are also conferred one by one.

The chapter summarise with recommendations on future research titles related to research data management services and role of I.Rs.

6.1.1 First Objective: To find out the possible role of Institutional Repositories in Research Data Management.

Finding and conclusions: Earlier Institutional Repositories are used to showcase the digital outputs of the institutions and organizations. But in current Scenario digital contents of an institution have a big part of generated research data. Also in recent time research data has a high prominence. So it's obvious to be a part of Institutional Repositories services. Current study finds that Institutional Repositories dedicated to research data are getting growth on higher rate in universities and Institutions.

Evaluation of intensive literature review shows that Institutional Repositories are getting shapes from last two decades. But due to advent of research data in digital content sphere of institutions, responsibilities and prospects of I.R are redefining. Large number of authors discussed already incorporated in this study about bottlenecks, general view and practices of Institutional

Repositories. Universities and Institutions libraries are trustworthy archival manager of knowledge of society. Institutional Repositories of Institutions and universities have been established as a tool for libraries to showcase and authenticated sharing of resources.

Suggestions: Due to great value of research data, its responsibilities and faith may only be maintained by libraries. Further multidimensional prospects of Institutional Repositories have been unveiled in western world in the form of Research Data Repositories services for research society. Now Research Data Repositories on leading standards may provide vast ranges of research data management services to the researchers.

6.1.2 Second Objective: To explore current practices in terms of Research Data Management Services (RDMS) in International and Indian universities.

Finding and conclusions: Globally institutional repositories are getting transformational change to deal research data needs. Leading registry of Research Data Repositories, re3data.org reported that Institutional Repositories or data repositories are converting in Research Data Repositories with latest standardised configuration of registries. Various good initiatives have been taken to support new avatar of Institutional Repositories as Research Data Repositories like Dspace@MIT, Standford digital repository, ORA-Data U.K data archives, Harward Dataverse Project, Caltech Data repository, TROVE repository, ETH Zürich Research Collection etc.

While in Indian environment, Institutional Repositories are still in developing phase. Registry of Research Data Repositories reported that none of the research data repository of Indian universities are configured for research data to take consideration. Presently ardent efforts are concentrating only on fully digitization of contents. Sensation about new form of Institutional Repositories are not even started. Understanding of research data prominence in Indian academia is very much required so that development of Institutional Repositories may takes place on global standards.

While globaly, Research data management services are provided to researches in two major categories.

Consultative Services: These are the services related to educate the researchers about various concepts of Research Data Management and prepare them to apply tools and practices for research data. Most of the services includes consultation regarding research data before generation.

Technological Services: These are the services related to deal after generation of research data. It includes the storage, preservation, sharing and analytical services.

Suggestions: Globally mutual initiative like NDLTD (Network Digital Library for Thesis and Dissertations) is very much required to develop repositories for research data to sustain growth of Research Data Repositories at universities level. It will not only provide guidance to new efforts but also enable Research Data Repositories to deal latest research data management requirements.

6.1.3 Third Objective: To evaluate resources available on Shodhganga repository in the light of better Research Data Management solution by using Open Source Software.

Finding and conclusions: Evaluation of researchers experiences for shodhganga ETDs have been done in chapter 5 and for further requirements, surveys have been conducted through 113 Indian universities those are already registered in shodhganga ETD. Around 282 researchers responded from 66 Indian Universities and 86.6% responses favoured open access of repositories. Researchers and ETD administrators responded with urgent requirement to deal research data preservation for lifelong sharing. One of the prominent opinion with 79.4 % responses has been highlighted in favour of Unified Open Research Data Repository as a National research data repository for researchers in India. A large numbers of responses have been received to concur the fact that research data management in Indian universities will take long time to go.

Resources available with Shodhganga ETD have been utilized and one unified research data repository as eShodmanthan RDR has been configured with help of open source software Dataverse. The eShodhmanthan RDR access has been offered to various library science faculties, researchers, experts and scholars.

Responses received were very much encouraging and advised to sensitize research data literacy within Indian research community. Registered users of eShodmanthan RDR expected in feedback to provide more tutorial and learning resources for research data management skills to Indian researchers.

Suggestions: There is an urgent requirement of research data literacy for Indian researchers to educate and equip them regarding research data utility, management and value. While theoretical conceptual knowledge may not fulfil the target. Presently Indian academic and research communities have support of good initiative of Inflibnet Center as research support

services like Shodhgangotri-Repository service for research proposals and Shodhganga-Repository service for thesis and dissertations.

But at the same time to initiate sensation and understanding for research data in Indian environment, there is an emergent requirement to develop an ICT integrated Research Life Cycle Platform with Research Data Management Services at National level.

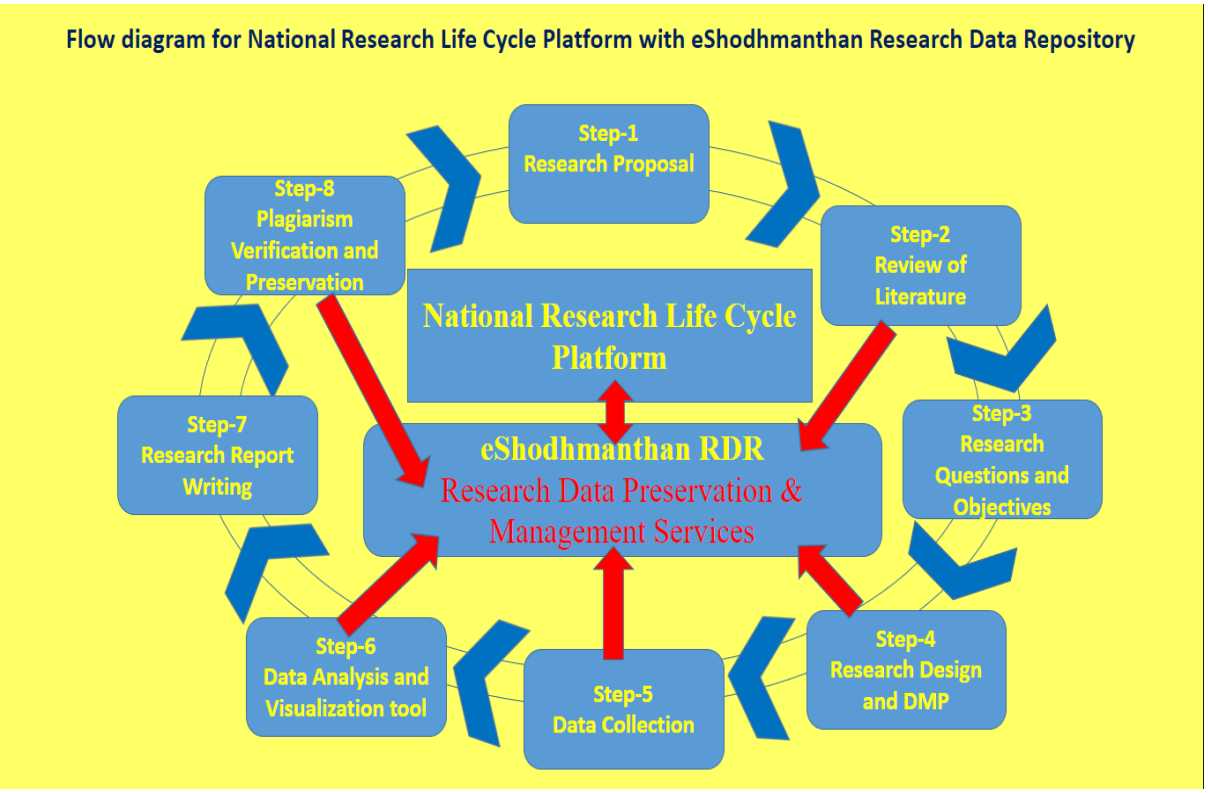
As visualised research life cycle in figure 6.1, ICT integrated Research Life Cycle Platform with Research Data Management Services may support researchers at various steps of research life cycle, to identify research data, its reusability, management and preservation for future use.

Research cycle has different phases while ICT integrated platform may support researchers to work at one place as a single solution for research cycle which will efficiently improve research performance.

At initial level on identification of problem for research, researchers required availability of unified research repository of various disciplines like Shodhgangotri repository. On second step vital reviews of literature are required which demands connectivity of various databases, information sources and reference management softwares with the research cycle platform. At third step researchers required to setup research questions and objectives which also required verification in light of present research outputs with the help of unified research repository. Fourth step is to prepare a research design and data management plan for research which required Data Management Planning tools on the research cycle platform. Fifth step is related to collection of data which required data collection facility and tools with research life cycle platform. Sixth step is related to processing and analysing of research data which demands data analysis and visualization tools on the integrated research life cycle platform. Seventh step is related to creation of research report, which required research report writing capabilities at the same platform.

Further on eighth step Research Life Cycle Platform should also have facility to preverification of plagiarism through anti-plagiarism software at same platform. At this stage approved research reports and research data may archives on Shodhganga like National repository systems through ICT integrated Reseach Life Cycle Platform. National Research Life Cycle Platform should be integrated with eShodhmanthan like Research Data Repository, Which may provide research data management services further throughout the research life cycle.

Figure 6.1: Flow diagram for National Research Life Cycle Platform with eShodhmanthan Research Data Repository



Nationwide free of cost ICT integrated Research Life Cycle Platform with Research Data Preservation and Management Services should be provided to all researchers. It should be governed by the mandatory acts so that universities and researchers do adopt it. **National Research Life Cycle Platform** may be a possible solution to provide a practical approach of efficient research practices with research data management skills in Indian research domain.

6.1.4 Fourth Objective: To suggest appropriate measures to make effective development of Skills and management of research data.

Finding and conclusions: This objective has been resolved by email interview of library and Information science experts and received feedback of eShodhmanthan RDR.

Good number of expert's advice and feedback have been received in favour of India's National Research Data Policy. In comparison to western world, Indian research community has requirement of multidimensional efforts to maintain world class service environment for research data.

Responses support that presently Indian research community is behind decades in comparison to world class research data management systems.

Suggestions: National research data policy for India is urgently recommended. It should be implemented throughout the curriculums of higher education in India. So that research data literacy may develop from early stages. National research data repository should be configured with the contribution of all universities. Indian researchers should have an environment where they can use open research data, use it fairly and preserve it in public domain for future researchers.

6.2 Prospective areas of research:

a) Explore bottleneck to identify slow growth of research data management.

b) Evolution of Research Data Management software solution.

c) Criteria for implementation of RDM.

d) Dimensions of Information professional rolls to deal RDM.

e) Impact of Research Data Literacy on RDM Skills.

f) Case study of specific RDM implementation to discover various concepts involved.

g) Comparative analysis of RDM repositories in a specific geographic reason.

h) Research Data Management learning tools and techniques.

6.3 Conclusion:

The inclusive inference that may be resultant from the present research work is that concept of Institutional Repositories was born in single dimension but with time it has been evolved in multidimensions and prospects are open to deal research data management services.

Highly efficient Research Data Repositories are required to extract ultimate value of research data. But it can be possible only through development of a research data skilled research society. Research data literacy may not be achieved in a year. It required continuous efforts on all aspects. The development has still a lengthy way to go.

Research Data Policy at national level may be a landmark to start the transformation of Institutional Repositories in Research Data oriented Repositories. NKC - National –

Knowledge-Commission already declared polices to encourage open access and ETD. Systems like National Research Life Cycle Platform should be designed with comprehensive Research Data Repository support.

As per resolution it was reported by the working team on open access and educational available resources 2007 output that most of the research work performed by the 3rd world regions is not reported to the academic and research domain because of economic reasons and laid down rules.

Now Indian and global research societies should come forward to develop a forum to identify, classify and standardised a mutual system where research data management issues may discussed.

Once again, it is required to start a moment to achieve high percentage of research data literacy around the world to deal critical threats for humankind like COVID and others.

In my words, research data is like energy, which can change its interpretations but may not be destroyed or insignificant.

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(APA 7th Ed)

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Annexure 1- Questionnaire for Research Scholars of University

Respected Sir / Madam,

I am pursuing Ph.D on "Prospects of Institutional Repositories in Research Data Management Services with Special References to Shodhganga ETD" under the guidance of Prof. Dinesh K. Gupta, Professor, Department of Library Science, Vardhman Mahaveer Open University, Kota, Rajasthan (Presently working in CUH, Mahendergarh).

With reference UGC Notification dated 1 June 2009 which mandated the submission of electronic version of theses and dissertations at Shodhganga ETD. I am sending this questionnaire seeking your valuable views and comments regarding your theses / dissertation submission in Shodhganga and research data. I request you sir/madam kindly to give your valuable views for which act of kindness, I will remain grateful to you. The Information will be treated as confidential.

Thanking you,
sincerely,
Prashant Shrivastava

* Required

Section: 1 Personal and Institutional Information

Please provide the following information:

Salutation

Mark only one.

Prof. Dr. Mr. Mrs. Ms.

Name

Job Position

Name of University / Institution / Organization *

Area of Specialization

University / Institution has ETD service (Y/N)

Mark only one

Yes

No

URL of ETD

Section – II Information about your University / Institution ETD Repository

Q1. Does Your University presently maintain an ETD Repository for research outputs? *

Part A- If Yes

Mark only one

Planned and Created and tested, Established and not updated, Configured and Active, Others.

QA.1. How long you are aware of ETD Repository of your University.

Mention Year

QA.2. Do you think ETD Repositories, should be publicly accessible for research scholars? *

Mark only one

Strongly agreed

Agreed

Not Agreed

Not at all agreed

Neutral

QA.3. What are the types of file formats are currently allowed to submit in your university's ETD Repository? *
Select all those apply

Check all that apply.

MS word PDF Excel

Power Point Presentation

Rich Text Format

Open Document Format

TIFF EPUB Others

QA.4. What is your experience about content discovery in your University ETD? *

Mark only one oval.

Very Satisfied Satisfied Neutral
Not Satisfied

Can't Say

QA.5 Please mention your choice of search you like most for an ETD service. *

Mark only one oval.

General Search
Advanced Search
Federated Search
Discovery Search

Google Like content search

QA.6 Please mention your choice of ETD service which you like most. *

Select all those apply

Check all that apply.

NDLTD
ETHOS
SHODHGANGA
TROVE SERVICE

Part B-If No:

What is your opinion about benefits of ETD repository for research scholars please specify?

Section-III: Shodhganga ETD Repository Thesis Submission Information

Q2: As a research scholar which is the most easy file format to access earlier Thesis and Dissertations during Ph.D. *

Mark only one oval.

Printed

Digitized

Printed and Digitized Both

Don't Know

Q3. How was/is your experience to develop file naming convention according to shodhganga guidelines during submission of your Ph.D.? *

Mark only one oval.

VERY DIFFICULT
DIFFICULT
NORMAL
NOT DIFFICULAT
TRIVIAL

Q4. How was your experience to convert your theses files to PDF format for uploading purpose in to Shodhganga. *

Mark only one oval.

VERY DIFFICULT
DIFFICULT
NORMAL
NOT DIFFICULT
TRIVIAL

Q5. What's your opinion about various types of file formats not allowed to upload for theses in Shodhganga repository? *

Mark only one oval.

All formats should be available single format maintain uniformity format conversion is critical it's technical limitations not required.

Q6. Do you access shodhganga repository for your post Ph.D. research work? *

[5= Very frequent, 4= Normally, 3=Neutral, 2= Not very frequent and 1= Not at all used]

Mark only one oval.

1 2 3 4 5

Q7. Did you saved copy of your Ph.D. research data, like questionnaires, Bibliographies, data analysis, etc.? *

Mark only one oval.

NOT SAVED
SAVED
IT HAS BEEN SUMMARIZED IN PH.D REPORT.
SAVED IN PRINTED FORMAT

Q8. What's your opinion about the need of training for research scholars about electronic submission of theses and dissertations to Shodhganga. *
[5= Very important, 4= Important, 3=Neutral, 2= Not very important and 1= Not at all important]

Mark only one oval per row.

1 2 3 4 5

Will enhance research output quality.
It will improve uniform documentation practice for research outputs.
It will be helpful to researcher to understand shodhganga ETD resources.

Q9. Which anti-plagiarism software is used by research scholars in your university? *

Check all that apply.

URKUND
TURNITIN
iTHENETICATE
OTHERS

Q10. Did you ever use Shodhganga ETD for your Ph.D research work? *

[5= Very frequent, 4= Normally, 3=Neutral, 2= Not very frequent and 1= Not at all used]

Mark only one oval.

1 2 3 4 5

Q11. What is your opinion about content search facilities in shodhganga ETD? *

[5= Strongly agreed, 4= Agreed, 3=Neutral, 2= Not agreed and 1= Can't Say]

Mark only one oval per row.

1 2 3 4 5

Search Options are good enough in Shodhganga

Single search box should be available for tittle,, authors,, university and departments search..

Discovery search should be available for all fields.

Content search in Shodhganga PDF files cannot provide metadata.

Q 12. What is your opinion about over all access options of research outputs in Shodhganga ETD? *

Mark only one oval.

Very good

Good
Normal
Not Good
Required Improvement

Section IV Research Data Management

Q13. What is your opinion about significance of generated data during research? *

Mark only one oval.

Not useful data

Should be preserved only

Should be managed for limited use

It should be managed and sharable in public domain

Q14. Where do you store your research data during research? *

Select all those apply

Check all that apply.

Portable Storage / Flash dries (USB) Drop Box
Computer hard Drive

CDs/DVDs Google Drive MS One Drive

Department Computer Server

Magnetic Tapes

Other:

Q15. What is your opinion about to host or manage your research data on Repository? *

Mark only one oval.

Strongly Agreed Not Agreed Neutral
Agreed

Not at all Agreed

Q16. Did you find any problem to organize your research work data and files for future use? *
Mark only one oval.

Yes, it's critical to manage research data for long time.
I personally manage my research data.
We have departmental facility.
Not required
Don't know how to manage research data.

Q17. Please share your opinion about your preserved research data usage. *

Mark only one oval per row.

- Agreed
- Strongly
- Agreed
- I don't think so

- Did you face any problem to access research data obsolete file formats during your research work?
- Did you felt any complexity to manage improvement on same research project?
- Do you know about versioning control of files applying this researcher can manage various improvement in research projects?
- Do you think all verified data generated during research work may be useful for other research projects?

- Do you think literature review for a particular research work may be useful for any cross discipline research work?

- Knew lot about this Knew little about this don’t know

If Yes ---- Please write some names of Research Data Repository:

Part A:

Q18. If yes, how did you learnt about Research Data Repository (RDR)? *

Source of learning about RDR

Check all that apply.

Through Internet
Through Journals
Faculty
Friends
Library
Others

Part b:

Q19 If no--- Do you interested to know more about RDR ?

Yes, I agree for sharing.

No, I will not support for research files and data sharing. Sharing should be within controlled access.

I required time to think about it.

Q20. Have you attend any Conference / Seminar / Workshop related to Research Data Management. (Please mark your level of interest): *

Mark only one per row.

INTERESTED VERY INTERESTED NOT INTERESTED

Research data
Research data management
Research data visualization resources.
Research data documentation and Metadata.
Research data archiving.

Digitization off records.
Research data sharing and access..
Confidentiality off research data on human participants.

Q21. Research Data Repository should be available to researchers in India? *
Mark only one

Strongly Agreed
Not Agreed
Neutral
Agreed
Not at all Agreed

Q22. What are your views about National Research Data Repository for all research Scholars in India? *

Mark only one

Strongly Agreed
Not Agreed
Neutral
Agreed
Not at all Agreed

Q23. What is your overall observation for level of Research Data Management in Indian universities? *

Mark only one

Not started yet
Required much time to start
Discussing on Policy level

National policy for Research Data Management is Required Started at Institutional level on some places Others_____

Q24. If your university set up a Research Data Repository, What will be your choice to manage your future research data on it? *

Mark only one

Interested
Don’t want to manage research data
Already using third party RDR Not Interested
Have Doubts

Q25. Would you like to get an experience to manage your research data and files On a free Research Data Repository (RDR) for Indian research scholars? *

Mark only one

Interested
Don’t want to manage research data
Already using RDR Not Interested Have Doubts

If yes, please mail to eshodhmanthan@gmail.com to get personalize login details For academic research data repository.

Annexure 2- Questionnaire for Faculty / Librarian / University or Institution coordinator for Sodhganaga ETD

Respected Sir / Madam,

I am pursuing Ph.D on "Prospects of Institutional Repositories in Research Data Management Services with Special References to Shodhganga ETD" under the guidance of Prof. Dinesh K. Gupta, Professor, Department of Library Science, Vardhman Mahaveer Open University, Kota, Rajasthan (Presently working in CUH, Mahendergarh).
With reference UGC Notification dated 1 June 2009 which mandated the submission of electronic version of theses and dissertations at Shodhganga repository. Here I want to observe the experiences of Faculty/ Librarian / University or Institution coordinator for Sodhganaga, Electronic Thesis and Dissertations (ETD) repository at the University for Thesis Submission Process. May I request you to kindly help me in collecting related data by filling up the questionnaire? The Information will be treated as confidential and use only for research purposes.

Thanking you,
Sincerely,
Prashant Shrivastava

* Required

Section-I: Personal and Institutional Information

Please provide the following information
Salutation (Prof./Dr./ Mr. / Ms. /Mrs.)

Mark only one

Professor
Dr.
Mr.
Ms.
Mrs.

Name
Job Position
Name of University/Institution/Organization
Area of Specialization
University / Institution has ETD service
URL of ETD

Section – II: Information about your University / Institution ETD Repository.

Please provide the following information

Q1. Does Your University presently maintain an ETD Repository for research outputs?

Mark only one

YES NO

Part A-If Yes (please mark appropriate choice)

Mark only one

Planned and Created and tested Established and not updated Configured and active Others

QA.1. Year of establishment of ETD Repository of your University.

QA.2. Do you think your University ETD Repository should be publicly accessible?

Mark only one.

Strongly Agreed

Agreed

Not Agreed

Not at all Agreed

Neutral

QA.3. What are the types of file formats currently allowed in your university's ETD?

Mark only one per row.

OPTIONS

MS WORD EXCEL
RIICH TEXT FORMAT TIIFF
TEMPLATE PDF
POWER POIINT PRESENTATIION
OPEN DOCUMENT FORMAT
EPUB

QA.4. Please choose approximate number of Items currently available in your university ETD Repository.

Mark only one

1-100

101-500

501-1000

1001-5000

More than 5000

QA.5. Please give approximate number of items have been added during year 2019, in your university ETD Repository.

Mark only one oval.

1-10

11-50

51-100

101-500

More than 500

QA.6. Which software package is used for the ETD Repository in your university?

Mark only one

Eprints
DSpace
Fedora
ETD-db
E-Print

QA.7. What was the driving thoughts in your university to consider an ETD repository? (Please select any that apply)

[5= Very important, 4= Important, 3=Neutral, 2= Not very important and1= Not at all important]

Mark only one per row.

1 2 3 4 5

To enhance the visibility off the Universities research outputs..

To provide free access to the university research outputs with ease to all researchers.

To preserve the Universities research outputs..

To maintain a unified tool for evaluation researchers and departments research outputs.

QA.8. Has your university any dedicated separate cell for ETD administration?

Mark only one.
Yes

No

QA.9. Please choose the department in your university which presently supervise

ETD repository.

Mark only one.

Library and Information Science
Computer Science Research Section Administration
Other:

Part B- If No: Please specify your university plan to establish ETD Repository for management of research outputs or critical issues to establish/maintain ETD Repository in your Institution.

Section-III: Shodhganga ETD Repository Thesis Submission Information
Q2. In Which format theses and dissertations are submitted in your central library?

Mark only one.

Printed

Digitized

Printed and Digitized both

Don't Know
Q3. Has your university received any financial assistance for digitization of back list of theses from UGC?

Mark only one oval.

Yes

No

Q4. What's your opinion about the need of training for teachers and research scholars for electronic submission of theses and dissertations to Shodhganga.
[5= Very important, 4= Important, 3=Neutral, 2= Not very important and1= Not at all important]

Mark only one oval per row.

1 2 3 4 5

Will enhance research output quality..
It will improve uniform documentation
Practice for research outputs..
It will be helpful to researchers to understand Shodhganga ETD resources..

Q5. How many teachers/research scholars of your university have been trained to Shodhganga ETD repository during year 2019?

Mark only one.

1-10

11-50

51-100

101-500

501-1000

Q6. Which anti-plagiarism software is used by the teachers /research scholars in your university?

Mark only one.

URKUND TURNITIN iTHENTICATE
OTHERS (Please specify)

Q7. Have you ever used Shodhganga ETD for your own research work? *

[5= Very frequent, 4= Normally, 3=Neutral, 2= Not very frequent and 1= Not at all used]

Mark only one oval.

1 2 3 4 5

Q8. What is your opinion about content search facilities in shodhganga ETD? *

[5= Strongly agreed, 4= Agreed, 3=Neutral, 2= Not agreed and 1= Can't Say]

Mark only one oval per row.

	1	2	3	4	5
Search Options are good enough in Shodhganga to find the content					
Single search box should be available for tittle, authors, university and departments search					
Discovery search should be available for all fields..					
Content search in Shodhganga PDF files cannot provide metadata					

Q9. What is your opinion about management of research outputs in Shodhganga ETD? *

Mark only one.

Very good
Normal
Not Good
May Improve

Q10. Please share your observation. Why did not all Indian universities registered Under Shodhganga ETD till date? *

Mark only one.

Lack of Policy Implementation
Infrastructure problems
Lack of professional staff
More training and orientation required
All the above

Section IV: Research Data Management

Q11. Has your university any policy for preservation of digital research data? *

Mark only one oval.

Not Planned
Under Planning
Established
Not required
Waiting for National Policy

Q12. Where do teachers /research scholars within your university store their research data? (You may click more than one) *

Check all that apply.

Portable Storage / Flash dries (USB) Drop Box
Computer hard Drive
CDs/DVDs Google Drive MS One Drive
Department Computer Server
Magnetic Tapes

Q13. What is your opinion about the need to host or manage research data repository? *

Mark only one.

Strongly Agreed
Not Agreed
Neutral
Agreed
Not at all Agreed

Q 14. Have you heard about any research data repository? *

Mark only one

YES

No
If Yes Please write names of some research data repository:
Q 15. Do you have information about any research data repository software? *

You may choose more than one

Check all that apply.

Figshare
DRYAD
GitHub
Harvard's Dataverse
CKAN Others.

Q16. Have you attended any Conference / Seminar / Workshop related to Research Data Management and also like to attend in future. *

(Please indicate your level of interest):

Mark only one oval per row.

INTERESTED
VERY INTERESTED
NOT INTERESTED

Research data.
Research data management.
Research data visualization resources.
Research data documentation and metadata.

Research data archiving.
Digitization off records.
Research data sharing and access.
Confidentiality off research data on Human participants.
Other (please specify)
_____

Q17. Do you think similar to Shodhganga repository concept, One Unified Open Research Data Repository should be available to researchers in India? *

Mark only one l.

Strongly Agreed
Not Agreed
Neutral
Agreed
Not at all Agreed

Q 18. What are your views about establishing National Research Data Repository for all research scholars in India? *

Mark only one oval.

Strongly Agreed
Not Agreed
Neutral
Agreed
Not at all Agreed

Q 19. What is your overall observation for level of Research Data Management process in Indian universities? *

Mark only one.

Not started yet
Required much time to start
Discussing on Policy level
National policy for Research Data Management is required
Started at Institutional level on some places
Others

Q 20. Would you like to get an experience to manage your research data and files on a free Research Data Repository (RDR) for Indian research scholars? *

Mark only one.

Interested
Don’t want to manage research data
Already used RDR
Not Interested Have Doubts

If yes, please mail to eshodhmanthan@gmail.com to get your personalize login details for academic research data repository.

Annexure 3- Interview Schedule for Research Data Experts

Respected Sir / Madam,

I am pursuing PhD on "Prospects of Institutional Repositories in Research Data Management Services with Special References to Shodhganga ETD" under the guidance of Prof. Dinesh K. Gupta, Professor, Department of Library Science, Vardhman Mahaveer Open University, Kota, Rajasthan (Presently working in CUH, Mahendergarh).
With reference to research data and preservation of research outputs at Shodhganga, national repository of theses and dissertations, I want to observe opinion of experts. May I request you to kindly help me in collecting related data by filling up the interview schedule? The Information will be treated as confidential and use only for research purposes.

Thanking you
Sincerely

Prashant Shrivastava

Personal and Institutional Information

Please provide the following information.

(a) Salutation

Mark only one

Professor
Dr.
Mr.
Mrs.
Ms.

(b) Name
(c) Designation
(d) Name of the University / Institution / Organization

Research Data Management

(a) What are your views about the status of Research Data Preservation in Indian Universities?

(b) In your opinion what are the most prevalent practices to store research data within Indian Universities / Institutions?

(c) What is your opinion about present policies for research data sharing around the world?

(d) What do you think about roles of libraries in managing research data?

(e) How do you observe pace of Research Data Management (RDM) in foreign universities?

(f) What is your overall observation for level of Research Data Management process in Indian universities?

(g) What is your opinion regarding impact of rules by regulatory authorities for mandatory submission of thesis / dissertation in Shodhganga repository?

(h) Do you think similar to Shodhganga repository concept, One Unified Open Research Data Repository should be available to researchers in India? If so, how it can be possible in your opinion?

(i) How to you recognize need of National Research Data Policy for a countries?

(j) Do you feel requirement of National Research Data Repository for researchers in India? How would it be beneficial?

(k) What is your opinion about the need to host or manage research data at institutional level in India?

(l) As you are familiar with Research Data Repositories (RDR). In your opinion which research data repository software is best for RDM?

(m) What are the bottlenecks you fell in implementation of Research Data Management in Indian conditions?

(n) What are your views about Research Data Management (RDM), as a best opportunity for library science professionals in India?

Annexure 4-eShodhmanthan-RDR Feedback Form

* Required

FIRST NAME
LAST NAME
DESIGNATION
UNIVERSITY / INSTITUTION / ORGANIZATION NAME *
DEPARTMENT
MOBILE NUMBER
Email Id

1. Has your university / organization / Institution any policy for preservation of digital research data?

Mark only one

Not Planned
Under Planning
Established
Very much required
Not required

2. Has your university / organization / Institution any research data management Services?

Mark only one.

Yes

No

3. Where do teachers / research scholars within your university / institution / Organization store their research data?

Mark only one.

Personal Storage Devices
Departmental Server
Google Drive
Drop Box
Departmental Repository

4. What is your opinion about the need to host or manage research data?

Check all that apply.

Strongly Agreed
Agreed
Neutral
Not Agreed

5. Do you know any free research data management service for scholars of Indian Universities?

Mark only one.

Yes

No

6. Have you joined eShodhmanthan RDR?
Mark only one oval.

Yes

No

7. eShodhmanthan Research Data Repository may be a free research data management service for Indian Scholars. Do you agree?

Mark only one.

Yes

No

8. Free Research Data Management Service to Indian Scholars may be fruitful to develop Research Data Literacy within Indian academic communities.

Mark only one.

Strongly disagree
Disagree Neutral Agree
Strongly agree

9. eShodhmanthan Research Data Repository may be a prototype design for National Research Data Management Service dedicated to Indian Research Scholars.

Mark only one.

Strongly Agree
Agree Neutral Disagree
Strongly Disagree

10. eShodhmanthan Research Data Management Service is very user friendly for researcher. What do you observe?

Mark only one .

Very easy to manage.
Demonstration required.
Personal training required.
Difficult to learn.

11. eShodhmanthan RDR has support for all type of research data formats. It Provides great help to researchers.

Mark only one.

Yes

No

12. Version control of research data within eShodhmanthan RDR provides best help to researchers.

Mark only one.

Yes
No
Not sure

13. eShodhmanthan Research Data Repository is a multifaceted service for all disciplines.

Mark only one.

True
False
Not Sure

14. eShodhmanthan RDR provides exclusive rights of research data to its author beyond administrative rights of repository administrator. Which provides support to researchers for sharing of their research data without any hesitation.

Mark only one.

True
False
Not sure

15. eShodhmanthan RDR provides open access to its published research data. Before publishing only authors of research data may manage it. How do you observe this feature?

Mark only one.

Very Good
Good
Not Good
Bad

16. eShodhmanthan research data repository uses DOI to make its provided research data persistent, unique and citable. How do you observe it.

Mark only one.

Very Good
Good
Not Good
Bad

17. eShodhmanthan research data repository uses URN to make its provided data Persistent, unique and citable. How do you observe it?

Mark only one.

Very Good
Good
Not Good
Bad

18. eShodhmanthan is an initial free of cost Research Data Management Service for Indian Research. How will you rate it on the scale?

Mark only one.

1 2 3 4 5

Normal service to **outstanding service**

Annexure 5 : List of Universities responses received

	List of Universities responses received
1	Andhra University, Visakhapatnam
2	Bharati Vidyapeeth, Pune
3	Karnatak University, Dharwar
4	Mandsaur Univeristy, Mandsaur
5	Assam University, Silchar
6	Bangalore University
7	Maulana Azad National Urdu University, Hyderabad
8	Gujarat University, Ahmedabad
9	North-Eastern Hill University, Shillong
10	University of Calicut, Kerala
11	University of Delhi, Delhi
12	University of Mumbai, Mumbai
13	Jiwaji University, Gwalior
14	Manipur University, Imphal
15	Solapur University, Solapur
16	University of Calcutta, Kolkata
17	University of Jammu
18	University of Lucknow, Lucknow
19	University of Madras
20	University of Mysore, Mysore
21	Vikram University, Ujjain
22	Bharathiar University, Coimbatore
23	Galgotias University, Raipur
24	Jadavpur University, Kolkata
25	Chaudhary Charan Singh University, Meerut
26	Kannur University, Kannur
27	C.U. Shah University
28	Kalasalingam University

29	Maharaja Krishnakumarsinhji Bhavnagar University, Bhavnagar
30	Osmania University, Hyderabad
31	Pondicherry University, Puducherry
32	Sir Padampat Singhania University
33	Annamalai University, Chidambaram
34	Banaras Hindu University, Varanasi
35	Central University of Karnataka, Gulbarga
36	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
37	Shri Jagdishprasad Jhabarmal Tibrewala
38	The University of Burdwan, Bardhaman
39	Babasaheb Bhimrao Ambedkar University, Lucknow
40	Sambalpur University, Jyoti Vihar
41	Madurai Kamaraj University, Madurai
42	Shivaji University, Kolhapur
43	Aligarh Muslim University, Aligarh
44	Doctor Harisingh Gour Vishwavidyalaya, Sagar
45	Chhatrapati Shahu Ji Maharaj University, Kanpur
46	Guru Nanak Dev University, Amritsar
47	Karnataka State Open University, Mysore
48	Mizoram University, Aizawl
49	Manonmaniam Sundaranar University, Tirunelveli
50	Indira Gandhi National Open University(IGNOU)
51	Panjab University, Chandigarh
52	Swami Ramanand Teerth Marathwada University, Nanded
53	Kuvempu University, Jnanasahyadri
54	Maharaja Sayajirao University of Baroda, Vadodara
55	Gulbarga University, Gulbarga
56	Gauhati University, Guwahati
57	Guru Ghasidas Vishwavidyalaya, Bilaspur
58	Bharathidasan University, Tiruchirappally
59	Mangalore University, Mangalagangotri
60	Sant Gadge Baba Amravati University, Amravati

61	Dr. Babasaheb Ambedkar Open University, Ahmedabad
62	Vidya Sagar university, Midnapore
63	Utkal University, Vani Vihar
64	Punjabi University, Patiala
65	Bundelkhand University, Jhansi
66	Alagappa University, Karaikudi

Annexure 6: Universities registered with Shodhganga ETD

Sl.no	Name of University (registered with Shodhganga ETD)
1	Alagappa University, Karaikudi
2	Aligarh Muslim University, Aligarh
3	Andhra University, Visakhapatnam
4	Annamalai University, Chidambaram
5	Assam University, Silchar
6	Awadhesh Pratap Singh University, Rewa
7	Babasaheb Bhimrao Ambedkar University, Lucknow
8	Banaras Hindu University, Varanasi
9	Banasthali Vidiyapeeth, Jaipur*
10	Bangalore University
11	Bharathiar University, Coimbatore
12	Bharathidasan University, Tiruchirappally
13	Bharati Vidyapeeth, Pune
14	Bundelkhand University, Jhansi
15	C.U. Shah University, Surendranagar*
16	Central University of Karnataka, Gulbarga
17	Chaudhary Charan Singh University, Meerut
18	Chhatrapati Shahu Ji Maharaj University, Kanpur
19	Doctor Harisingh Gour Vishwavidyalaya, Sagar
20	Dr. B.R. Ambedkar University, Agra**
21	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
22	Dr. Babasaheb Ambedkar Open University, Ahmedabad
23	Dr.C.V.Raman University, Bilaspur*
24	Galgotias University, Raipur
25	Gauhati University, Guwahati
26	Gondwana University , Gadchiroli
27	Gujarat University, Ahmedabad
28	Gujarat Vidyapith, Ahmedabad
29	Gulbarga University, Gulbarga
30	Guru Ghasidas Vishwavidyalaya, Bilaspur
31	Guru Nanak Dev University, Amritsar
32	Hemchandracharya North Gujarat University, Patan
33	Hindustan University, Chennai*
34	Indira Gandhi National Open University(IGNOU)**
35	Integral University, Lucknow*
36	Jadavpur University, Kolkata
37	Jiwaji University, Gwalior
38	Kalasalingam University, Krishnankoil*
39	Kannur University, Kannur
40	Karnatak University, Dharwar
41	Karnataka State Open University, Mysore*
42	Kuvempu University, Jnanasahyadri
43	Madhav University, Sirohi*
44	Madhya Pradesh Bhoj(Open) University, Bhopal
45	Madurai Kamaraj University, Madurai
46	Maharaja Krishnakumarsinhji Bhavnagar University, Bhavnagar
47	Maharaja Sayajirao University of Baroda, Vadodara
48	Mandsaur Univeristy, Mandsaur
49	Mangalayatan University, Aligarh*
50	Mangalore University, Mangalagangotri
51	Manipur University, Imphal
52	Manonmaniam Sundaranar University, Tirunelveli
53	Maulana Azad National Urdu University, Hyderabad

54	Mewar University, Chittorgarh*
55	Mizoram University, Aizawl
56	Mohanlal Sukhadia University, Udaipur
57	Monad University, Hapur*
58	Mother Teresa Women's University, Kodaikanal
59	National Brain Research Center, Manesar
60	Nims University
61	North Maharashtra University, Jalgaon
62	North-Eastern Hill University, Shillong
63	Osmania University, Hyderabad
64	Panjab University, Chandigarh
65	Parul Univesity, Vadodara
66	Periyar Maniammai University, Thanjavur*
67	Periyar University, Salem
68	Pondicherry University, Puducherry
69	Pt. Ravishankar Shukla University, Raipur
70	Punjabi University, Patiala
71	Rabindra Bharati University, Kolkata
72	Rabindranath Tagore University, Bhopal
73	Rai University, Ahmedabad*
74	Reva University, Kattigenahalli
75	Sambalpur University, Jyoti Vihar
76	Sant Gadge Baba Amravati University, Amravati
77	Sardar Patel University, Vallabh Vidyanagar
78	Saurashtra University
79	Savitribai Phule Pune University, Pune
80	Shivaji University, Kolhapur
81	Shri Jagdishprasad Jhabarmal Tibrewala*
82	Sir Padampat Singhania University, Udaipur*
83	SNDT (Shreemati Nathibai Damodar Thackersey) Women's University, Mumbai
84	Solapur University, Solapur
85	Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Kanchipuram*
86	Sri Krishnadevaraya University, Anantpur
87	Sri Venkateswara University, Tirupati
88	Swami Ramanand Teerth Marathwada University, Nanded
89	Swami Vivekananad University,Sagar*
90	Tamil University, Thanjavur
91	Tata Institute of Social Sciences, Mumbai
92	The Gandhigram Rural Institute-Deemed University, Dindigul
93	The IIS University, Jaipur*
94	The University of Burdwan, Bardhaman
95	Tilak Maharashtra Vidyapeeth, Pune
96	Tumkur University, Tumkur
97	University of Calcutta, Kolkata
98	University of Calicut, Kerala
99	University of Delhi, Delhi
100	University of Jammu
101	University of Kalyani, Kalyani
102	University of Kashmir, Srinagar
103	University of Kerala, Thiruvanathapuram
104	University of Kota, Kota
105	University of Lucknow, Lucknow
106	University of Madras
107	University of Mumbai, Mumbai
108	University of Mysore, Mysore
109	University of Science and Technology, Meghalaya*
110	Utkal University, Vani Vihar

111	Veer Narmad South Gujarat University, Surat
112	Vidya Sagar university, Midnapore
113	Vikram University, Ujjain
114	A P Goyal Shimla University
115	Abhilashi University, Mandi*
116	Acharya Nagarjuna University, Guntur
117	Adamas University, Kolkata
118	Adesh University, Bathinda
119	Adichunchanagiri University, Mandya
120	Adikavi Nannaya University, Rajahmundry
121	Ahmedabad University, Ahmedabad*
122	AKS University, Satna*
123	Aliah University , Kolkata
124	All India Institute of Medical Sciences, Deoghar
125	Alliance University, Bengaluru*
126	Ambedkar University, Delhi
127	AMET University
128	Amity University Haryana, Manesar
129	Amity University, Jaipur
130	Amity University, Madhya Pradesh*
131	Amity University, Noida*
132	Amrita Vishwa Vidyapeetham University, Coimbatore*
133	Anna University, Chennai
134	Ansal University,Gurgaon*
135	Apeejay Stya University, Gurugram
136	Arni University, Kangra*
137	Arunachal University of Studies, Namsai
138	Aryabhatta Knowledge University, Patna
139	Assam Don Bosco University, Guwahati*
140	Assam Down Town University, Guwahati
141	Assam Science and Technnology University , Guwahati
142	Avinashilingm Institute for home science and higher education for women, Coimbatore*
143	B.S.Abdur Rahman University, Chennai*
144	Baba Farid Univeristy of Health Science, Faridkot
145	Baba Ghulam Shah Badshah University, Rajouri
146	Baba Mastnath University, Rohtak
147	Babu Banarasi Das University, Lucknow*
148	Baddi University of Emerging Sciences & Technology, Solan*
149	Bahra University, Solan*
150	Barkatullah University, Bhopal
151	Bennett University, Greater Noida
152	Berhampur University, Berhampur
153	Bhagwant University
154	Bharath Institute of Higher Education & Research,Chennai*
155	Bhartiya Skill Development University , Jaipur
156	Birla Institute of Management Technology, Noida
157	Birla Institute of Technology & Science, Pilani
158	Blde University, Bijapur*
159	BML Munjal University, Gurugram
160	Bodoland University
161	BPS Mahila Vishwavidyalaya, Khanpur Kalan
162	Brainware Univeristy, kolkata
163	Career Point University*
164	Central University of Gujarat, Gandhinagar
165	Central University of Haryana, Mahendergarh
166	Central University of Himachal Pradesh, Dharamshala
167	Central University of Jammu

168	Central University of Jharkhand, Ranchi
169	Central University of Kashmir, Srinagar
170	Central University of Kerala, Kasaragod
171	Central University of Orissa, Koraput
172	Central University of Punjab, Bathinda
173	Central University of Rajasthan, Ajmer
174	Central University of South Bihar, Gaya
175	Central University of Tamilnadu, Thiruvarur**
176	Centurion University of Technology and Management, Bhubaneswar*
177	Chanakya National Law University, Mithapur
178	Chandigarh University, Mohali*
179	Charotar University of Science and Technology, Changa*
180	Chaudhary Devi Lal University, Sirsa**
181	Chaudhary Ranbir singh University, Jind
182	Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur
183	Chennai Mathematical Institute, Siruseri*
184	Chettinad Academy of Research & Education, Kelambakkam*
185	Chhattisgarh Swami Vivekanand Technical University , Bhilai
186	Children's University, Gandhinagar
187	Chitkara University, Chandigarh*
188	Chitkara University, Solan*
189	Christ University, Bangalore*
190	CMR University , Bangalore
191	Cochin University of Science & Technology, Cochin
192	Cotton University, Guwahati
193	Dakshina Bharat Hindi Prachar Sabha, Chennai
194	DAV University, Jalandhar
195	Davangere University , Davangere
196	Dayalbagh Educational Institute, Agra*
197	Dayananda Sagar University , Bangaluru
198	Deccan College Post Graduate & Research Institute, Pune*
199	Deen Dayal Upadhyay Gorakhpur University, Gorakhpur**
200	Deenbandhu Chhotu Ram University of Science and Technology, Sonipat**
201	Defense Institute of Advanced Technology, Pune*
202	Dehradun Institute of Technology (DIT) University, Dehradun
203	Delhi Pharmaceutical Science $ Research University, New Delhi
204	Delhi Technological University, New Delhi
205	Desh Bhagat University, Gobindgarh**
206	Devi Ahilya Vishwavidyalaya, Indore
207	Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT), Gandhinagar*
208	Dibrugarh University, Dibrugarh
209	Doon University, Dehradun
210	Dr. A.P.J. Abdul Kalam Technical University, Lucknow
211	Dr. B.R. Ambedkar University of Social Science-, Indore
212	Dr. Babasaheb Ambedkar Technological University, Lonera
213	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli
214	Dr. D. Y. Patil Medical College (Educational Society), Kolhapur*
215	Dr. D. Y. Patil Vidhyapeeth, Pune
216	Dr. K. N. Modi University
217	Dr. M.G.R. Educational and Research Institute University, Chennai*
218	Dr. Ram Manohar Lohiya National Law University, Lucknow
219	Dr. Rammanohar Lohia Avadh University, Faizabad
220	Dr. Sarvepalli Radha Krishnan Rajasthan Ayurved University, Jodhpur
221	Dravidian University, Kuppam
222	Eternal University, Baru Sahib*
223	Flame University, Pune

224	Forest Research Institute, Dehradun*
225	G H Raison University , Chhindwara
226	Gandhi Institute of Technology and Management (GITAM) University, Visakhapatnam
227	Ganpat University - Kherva, Mehsana*
228	Gautam Buddha University, Greater Noida**
229	GD Goenka University, Gurgaon
230	Geetanjali University, Udaipur**
231	GLA University,Mathura*
232	GLS University, Ahmedabad
233	Goa University, Goa
234	Gokhale Institute of Politics & Economics, Pune
235	Gopal Narayan Singh University, Jamuhar
236	Govind Guru Tribal Univeristy, Banswara
237	Graphic Era Hill University, Dehradun
238	Graphic Era University, Dehradun*
239	Gujarat Forensic Sciences University, Gandhinagar*
240	Gujarat National Law University(GNLU)
241	Gujarat Technological University, Gandhinagar*
242	Guru Gobind Singh Indraprastha University, New Delhi
243	Guru Jambheshwar University of Science & Technology, Hisar
244	Guru Kashi University, Bathinda*
245	Gurukul Kangri Vishwavidhyalaya, Haridwar
246	Hemwati Nandan Bahuguna Garhwal University, Srinagar
247	Hidayatullah National Law University, Raipur
248	Himachal Pradesh University, Shimla
249	Himalayan Garhwal University, Solan
250	Homi Bhabha National Institute, Mumbai*
251	I. K. Gujral Punjab Technical University, Jalandhar
252	IASE Deemed University, Churu*
253	ICFAI University Jharkhand*
254	ICFAI University, Dehradun
255	ICFAI University, Dimapur
256	ICFAI University, Solan
257	IEC University, Pinjore**
258	IFTM University, Moradabad*
259	IIMT University , Meerut
260	IMS UNISON University , Dehradun
261	Indian Institute of Foreign Trade (Deemed to be University), New Delhi
262	Indian Institute of Space Science and Technology, Thiruvananthapuram*
263	Indian Maritime University, Chennai
264	Indira Gandhi Delhi Technical University for Women, New Delhi
265	Indira Gandhi National Tribal University, Amarkatnak
266	Indira Kala Sangeet Vishwavidyalaya, Khairagarh
267	Indraprastha Institute of Information Technology Delhi, Delhi
268	Indus University, Ahmedabad*
269	Institute of Advanced Research , Gandhinagar
270	Institute of Chemical Technnology, Mumbai
271	Institute of Infrastructure Technology Research and Management, Ahmedabad
272	Institute of Transdisciplinary Health Sciences and Technology (ITDHST-TDU), Yelahanka*
273	International Institute for Population Science, Mumbai*
274	International Institute of Information Technology, Banglore*
275	International Institute of Information Technology, Hyderabad*
276	Islamic University of Science & Technology,Pulwama
277	ITM University, Gwalior*
278	ITM University, Raipur
279	J.S. Univeristy , Shikohabad
280	Jagadguru Rambhadracharya Handicapped University, Chitrakoot

281	Jagan Nath University, Jaipur*
282	JaganNath University, Jhajjar
283	Jagran Lakecity University, Bopal
284	Jai Narain Vyas University, Jodhpur
285	Jain University, Bangalore*
286	Jain Vishva Bharati Institute, Ladnun
287	Jaipur National University, Jaipur
288	Jamia Hamdard University, Hamdard Nagar
289	Jamia Millia Islamia, New Delhi
290	Janardan Rai Nagar Rajasthan Vidhyapeeth, Udaipur
291	Jawaharlal Nehru Technological University, Anantapur
292	Jawaharlal Nehru Technological University, Hyderabad
293	Jawaharlal Nehru Technological University, Kakinada
294	Jawaharlal Nehru University, New Delhi
295	Jayoti Vidyapeeth Women's University, Jaipur*
296	Jaypee Institute of Information Technology, Noida*
297	Jaypee University of Engineering & Technology, Guna*
298	Jaypee University of Information Technology, Solan*
299	JECRC University, Jaipur*
300	Jharkhand Rai University, Ranchi*
301	JIS University, Kolkata
302	JK Lakshmipat University, Jaipur*
303	JSS Academy of Higher Education & Research (Deemed to be University), Mysore*
304	JSS Science and Technology University , Mysuru
305	K.R. Mangalam Univeristy , Gurgaon
306	Kakatiya University, Warangal
307	Kalinga University , Raipur
308	Kameshwar Singh Darbhanga Sanskrit Vishwavidyalaya, Darbhanga
309	Kannada University, Hampi
310	Karnataka Samskrit University, Chamarajpet*
311	Karnataka State Women's University, Bijapur
312	Karpagam University, Coimbatore*
313	Kavayitri Bahinabai Chaudhari North Maharashtra University Jalgaon, Jalgaon
314	Kavikulaguru Kalidas Sanskrit University
315	Kazi Nazrul University , Asansol
316	Khwaja Moinuddin Chishti Urdu, Arabi~Farsi University , Lucknow
317	KIIT University, Bhubaneswar*
318	King George's Medical University, Lucknow
319	KLE Technological University, Hubli
320	KLE University, Belgaum*
321	Kolhan university, Chaibasa
322	Koneru Lakshmaiah Education Foundation, Vaddeswaram*
323	Krantiguru Shyamji Krishna Verma Kachchh University, Kachchh
324	Krishna Institute of Medical Sciences Deemed University, Karad*
325	Krishna Kanta Handiqui State Open University, Guwahati*
326	Krishna University, Machilipatnam
327	Kumaun University Nainital
328	Kurukshetra University, Kurukshetra**
329	Kushabhau Thakre Patrakarita Avam Jansanchar Vishwavidyalaya, Raipur*
330	Lakshmibai National Institute of Physical Education (LNIPE), Gwalior
331	Lingaya's University, Faridabad*
332	Lovely Professional University, Jalandhar*
333	M S Ramaiah University of Applied Science, Bangalore
334	Magadh University,Gaya
335	Mahapurusha Srimanta Sankaradeva University , Nagaon
336	Maharaja Agrasen University, Baddi
337	Maharaja Ganga Singh University,Bikaner

338	Maharaja Ranjit Singh Punjab Technical University , Bathinda
339	Maharaja Vinayak Global University, Jaipur
340	Maharashtra University of Health Sciences, Nasik
341	Maharishi Mahesh Yogi Vedic Vishwavidyalaya, Katni**
342	Maharishi Markandeshwar University, Mullana- Ambala*
343	Maharishi Markandeshwar University, Sodapur
344	Maharshi Arvind University, Jaipur
345	Maharshi Dayanand Saraswati University, Ajmer
346	Maharshi Dayanand University, Rohtak
347	Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya, Wardha
348	Mahatma Gandhi Central University, Patna
349	Mahatma Gandhi Chitrakoot Gramoday Vishwavidyalaya, Satna
350	Mahatma Gandhi Mission (MGM) University , Aurangabad
351	Mahatma Gandhi Univeristy of Medical Science & Technnology , Jaipur
352	Mahatma Gandhi University, Kottayam
353	Mahatma Gandhi University, Nalgonda
354	Mahatma Jyotiba Phule Rohitkhand University, Bareilly
355	Mahatmma Gandhi Kashi Vidyapith, Chetganj
356	Makhanlal Chaturdevi National Univeristy of Journalism & Communication, Bhopal
357	Manav Rachna International Institute of Research and Studies, Faridabad
358	Manav Rachna Univesity, Faridabad*
359	Manipal Academy of Higher Education, Manipal*
360	Manipal University,Jaipur*
361	Manipur Technical Univeristy, Imphal West
362	Martin Luther Christian University, Shilong*
363	MATS University, Raipur
364	Medi Caps University , Indore
365	Meenakshi Academy of Higher Education and Research, Chennai
366	MGM Institute of Health Sciences, Navi Mumbai**
367	MIT-ADT University, Pune
368	Mody Univeristy of Science and Technnology, Sikar
369	MVN University,Palwal*
370	Nagaland University
371	Nalanda University, Rajgir**
372	Nanaji Deshmukh Veterinary Science University, Jabalpur
373	Narendra Deva University of Agriculture and Technology , Ayodhya
374	Narsee Monjee Institute of Management Studies, Mumbai*
375	National Institute of Educational Planning and Administration (NIEPA), New Delhi
376	National Institute of Food Technology Entrepreneurship and Management (NIFTEM),Sonipat
377	National Law Institute University, Bhopal
378	National Law School Of Indian University, Bengaluru
379	National Law University , Odisha
380	National Law University and Judicial Academy, Guwahati
381	National law University, Delhi
382	National University of Advanced Legal Studies, Kochi
383	Navrachana University, Vadodara*
384	Nehru Gram Bharati University, Allahabad*
385	NIIT University, Alwar
386	Nirma University, Ahmedabad*
387	Nitte University, Mangalore *
388	Noida International University, Noida**
389	Noorul Islam Centre for Higher Education, Kanyakumari*
390	O P Jindal University, Raigarh
391	OPJS University, Churu*
392	Oriental University, Indore*
393	Pacific Academy of Higher Education and Research Univeristy, Udaipur

394	Padmashree Dr. D.Y. Patil Vidyapeeth, Navi Mumbai
395	Pandit Deendayal Petroleum University
396	Patna University, Patna
397	People's University , Bhopal
398	PES University, Banglore
399	Poornima University
400	Pravara Institute of Medical Science Deemed University, Loni*
401	Presidency University,Kolkata
402	Prist University, Thanjavur*
403	Pt. Sundarlal Sharma (Open) University, Bilaspur
404	Raffles University, Neemrana
405	Raiganj University, Uttar Dinajpur
406	Rajarshi Tandon Open University, Prayagraj
407	Rajasthan Technical University, Kota
408	Rajendra Agricultural University, Pusa Samastipur
409	Rajiv Gandhi National University of Law, Sidhuwal
410	Rajiv Gandhi Prodyogiki Vishwavidyalya, Bhopal
411	Rajiv Gandhi University, Doimukh
412	Raksha Shakti University, ahmedabad
413	Rama University, Kanpur*
414	Ramakrishna Mission Vivekananda Educational and Research Institute, Howrah
415	Rani Channamma University, Belagavi
416	Rani Durgavati Vishwavidyalaya, Jabalpur
417	Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
418	Rayalaseema University, Kurnool
419	Rayat Bahra University, Mohali
420	Regional Centre for Biotechnology (An Institution of National Importace), Haryana
421	RIMT University, Mandi Gobindgarh
422	RK University, Rajkot*
423	RKDF University, Bhopal**
424	SAGE University, Indore
425	Sam Higginbottom University , Prayagraj
426	Sampurnanand Sanskrit University , Varanasi
427	Sanchi University of Buddhist-Indic Studies, Bhopal
428	Sangam Univeristy, Bhilwara
429	SankalChand Patel University, Visnagar
430	Sant Baba Bhag Singh University, Jalandhar
431	Sant Longowal Institute of Engineering and Technology, Longowal*
432	Santosh Deemed To Be Univeristy , Ghaziabad
433	Sardar Patel University , Balaghat
434	Sarvepalli Radhakrishnan University, Bhopal*
435	Sastra University, Thanjavur*
436	Sathyabama University, Chennai**
437	SGT University, Gurugram*
438	Shakuntala Misra National Rehabilitation University , Lucknow
439	Sharda University, Greater Noida*
440	Shiv Nadar University, Gautam Budh Nagar*
441	Shobhit University, Gangoh
442	Shobhit University, Meerut**
443	Shoolini University, Solan*
444	Shree Somnath Sanskrit University, Veraval
445	Shree Venkateshwara University, Amroha
446	Shri Lal Bahadur Shastri Rashtriya Sanskrit Vidyapeetha,New Delhi
447	Shri Mata Vaishno Devi University(SMVDU), Katra
448	Shri Ramswaroop Memorial University, Lucknow*
449	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore*
450	Shridhar University, Pilani*

451	Sidho Kanho Birsha University, Purulia**
452	Sido Kanhu Murmu University, Dumka
453	Sikkim Manipal University , Gangtok
454	Sikkim University, Gangtok
455	Siksha "O" Anusandhan University, Bhubaneswar*
456	South asian University, New Delhi*
457	Sree Sankaracharya University of Sanskrit, Kalady
458	Sri Balaji Vidyapeeth,Pillaiyarkuppam**
459	Sri Devaraj Urs Academy of Higher Education and Research, Kolar
460	Sri Guru Granth Sahib World University, Fatehgarh Sahib
461	Sri Padmavati Mahila Visvavidyalayam (women's university), Tirupati
462	Sri Ramachandra University, Porur*
463	Sri Sai University, Palampur*
464	Sri Satya Sai University of Technology and Medical Sciences, Sehore*
465	Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati
466	Srinivas University, Mangalore
467	SRM University, Delhi-NCR, Sonepat**
468	SRM University, Kattankulathur*
469	St.Peter's Institute of Higher Education, Chennai*
470	Starex University, Gurugram
471	Sumandeep Vidhyapeeth, Vadodara*
472	Sunrise University, Alwar
473	Suresh Gyan Vihar University, Jaipur*
474	Swami Rama Himalayan University, Dehradun
475	Swami Vivekanand Subharti University, Meerut*
476	Swami Vivekananda Yoga Anusandhana Samsthana, Bengaluru*
477	Swarnim Gujarat Sports University, Gandhinagar
478	Swarrnim Startup & Innovation University, Gandhinagar
479	Symbiosis International University, Pune*
480	T. M. Bhagalpur University, Bhagalpur
481	Tamil Nadu Agricultural University, Coimbatore
482	Tamil Nadu Open University, Chennai
483	Tamil Nadu Physical Education And Sports University*
484	Tamilnadu Teachers Education University, Chennai**
485	Tantia University, Sri Ganganagar**
486	Techno India University, Kolkata
487	Teerthanker Mahaveer University
488	Telangana University, Nizamabad
489	TERI University, New Delhi*
490	Tezpur University, Tezpur
491	Thapar Institute of Engineering and Technology, Patiala
492	The Assam Kaziranga University
493	The Datta Meghe Institute of Medical Sciences,Wardha
494	The English and Foreign Language University, Hyderabad
495	The ICFAI University, Tripura **
496	The IIHMR University, Jaipur
497	The Indian Law Institute, New Delhi
498	The LNM Institute of Information Technology (LNMIIT), Jaipur
499	The Northcap University*
500	The Potti Seeramulu Telugu University, Hyderabad
501	The Tamil Nadu Dr. Ambedkar Law University, Chennai
502	The Tamil Nadu Dr. M.G.R. Medical University, Chennai
503	The WB National University of Juridical Sciences, Kolkata
504	The West Bengal University Of Teachers' Training, Education Planning And Administration, Kolkata
505	Thiruvalluvar University, Serkadu
506	Thunchath Ezhuthachan Malayalam University, Malappuram*

507	Tripura University, Agartala
508	Uka Tarsadia University, Barodli
509	University Of Allahabad
510	University of Engineering and Management, Kolkata
511	University of Gour Banga, Malda
512	University of Hyderabad, Hyderabad
513	University of North Bengal, Darjeeling
514	University of Petroleum and Energy Studies(UPES), Dehradun*
515	University of Rajasthan, Jaipur
516	University of technology, Jaipur
517	Uttarakhand Open University, Haldwani (Nainital)
518	Uttarakhand Sanskrit University, Haridwar*
519	Uttarakhand Technical University
520	Uttaranchal University, Dehradun*
521	V.B.S Purvanchal University, Jaunpur
522	Vardhman Mahaveer Open University, Kota
523	Veer Kunwar Singh University , Katira
524	Veer Surendra Sai University of Technology:BURLA
525	Vel Tech Dr.RR & Dr.SR Technical University, Avadi*
526	Vellore Institute of Technology (VIT) University, Vellore*
527	Vels University, Chennai*
528	Vignan's Foundation for Science, Technology and Research, Guntur
529	Vijayanagara Sri Krishnadevaraya Univeristy , Ballari
530	Vinayaka Mission's Research Foundation, Salem
531	Vinoba Bhave University, Hazaribag**
532	Vishwakarma University, Pune
533	Visva Bharti University, Santiniketan
534	Visvesvaraya Technological University, Belagavi
535	Vivekananda Global University, Jaipur*
536	Yashwantrao Chavan Maharashtra Open University, Nashik
537	Yenepoya University, Someshwar
538	YMCA University of Science and Technology, Faridabad

Annexure 7: Universities registered with Shodhganga ETD with LIS Departments.

Sl.No	Name of the University with LIS Department
1	Alagappa University, Karaikudi
2	Aligarh Muslim University, Aligarh
3	Andhra University, Visakhapatnam
4	Annamalai University, Chidambaram
5	Assam University, Silchar
6	Awadhesh Pratap Singh University, Rewa
7	Babasaheb Bhimrao Ambedkar University, Lucknow
8	Banaras Hindu University, Varanasi
9	Banasthali Vidiyapeeth, Jaipur*
10	Bangalore University
11	Bharathiar University, Coimbatore
12	Bharathidasan University, Tiruchirappally
13	Bharati Vidyapeeth, Pune
14	Bundelkhand University, Jhansi
15	C.U. Shah University, Surendranagar*
16	Central University of Karnataka, Gulbarga
17	Chaudhary Charan Singh University, Meerut
18	Chhatrapati Shahu Ji Maharaj University, Kanpur
19	Doctor Harisingh Gour Vishwavidyalaya, Sagar
20	Dr. B.R. Ambedkar University, Agra**
21	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
22	Dr. Babasaheb Ambedkar Open University, Ahmedabad
23	Dr.C.V.Raman University, Bilaspur*
24	Galgotias University, Raipur
25	Gauhati University, Guwahati
26	Gondwana University , Gadchiroli
27	Gujarat University, Ahmedabad
28	Gujarat Vidyapith, Ahmedabad
29	Gulbarga University, Gulbarga
30	Guru Ghasidas Vishwavidyalaya, Bilaspur
31	Guru Nanak Dev University, Amritsar
32	Hemchandracharya North Gujarat University, Patan
33	Hindustan University, Chennai*
34	Indira Gandhi National Open University(IGNOU)**
35	Integral University, Lucknow*
36	Jadavpur University, Kolkata
37	Jiwaji University, Gwalior
38	Kalasalingam University, Krishnankoil*
39	Kannur University, Kannur
40	Karnatak University, Dharwar
41	Karnataka State Open University, Mysore*
42	Kuvempu University, Jnanasahyadri
43	Madhav University, Sirohi*

44	Madhya Pradesh Bhoj(Open) University, Bhopal
45	Madurai Kamaraj University, Madurai
46	Maharaja Krishnakumarsinhji Bhavnagar University, Bhavnagar
47	Maharaja Sayajirao University of Baroda, Vadodara
48	Mandsaur Univeristy, Mandsaur
49	Mangalayatan University, Aligarh*
50	Mangalore University, Mangalagangotri
51	Manipur University, Imphal
52	Manonmaniam Sundaranar University, Tirunelveli
53	Maulana Azad National Urdu University, Hyderabad
54	Mewar University, Chittorgarh*
55	Mizoram University, Aizawl
56	Mohanlal Sukhadia University, Udaipur
57	Monad University, Hapur*
58	Mother Teresa Women's University, Kodaikanal
59	National Brain Research Center, Manesar
60	Nims University
61	North Maharashtra University, Jalgaon
62	North-Eastern Hill University, Shillong
63	Osmania University, Hyderabad
64	Panjab University, Chandigarh
65	Parul Univesity, Vadodara
66	Periyar Maniammai University, Thanjavur*
67	Periyar University, Salem
68	Pondicherry University, Puducherry
69	Pt. Ravishankar Shukla University, Raipur
70	Punjabi University, Patiala
71	Rabindra Bharati University, Kolkata
72	Rabindranath Tagore University, Bhopal
73	Rai University, Ahmedabad*
74	Reva University, Kattigenahalli
75	Sambalpur University, Jyoti Vihar
76	Sant Gadge Baba Amravati University, Amravati
77	Sardar Patel University, Vallabh Vidyanagar
78	Saurashtra University
79	Savitribai Phule Pune University, Pune
80	Shivaji University, Kolhapur
81	Shri Jagdishprasad Jhabarmal Tibrewala*
82	Sir Padampat Singhania University, Udaipur*
83	SNDT (Shreemati Nathibai Damodar Thackersey) Women's University, Mumbai
84	Solapur University, Solapur
85	Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Kanchipuram*
86	Sri Krishnadevaraya University, Anantpur
87	Sri Venkateswara University, Tirupati
88	Swami Ramanand Teerth Marathwada University, Nanded
89	Swami Vivekananad University,Sagar*
90	Tamil University, Thanjavur
91	Tata Institute of Social Sciences, Mumbai

92	The Gandhigram Rural Institute-Deemed University, Dindigul
93	The IIS University, Jaipur*
94	The University of Burdwan, Bardhaman
95	Tilak Maharashtra Vidyapeeth, Pune
96	Tumkur University, Tumkur
97	University of Calcutta, Kolkata
98	University of Calicut, Kerala
99	University of Delhi, Delhi
100	University of Jammu
101	University of Kalyani, Kalyani
102	University of Kashmir, Srinagar
103	University of Kerala, Thiruvanathapuram
104	University of Kota, Kota
105	University of Lucknow, Lucknow
106	University of Madras
107	University of Mumbai, Mumbai
108	University of Mysore, Mysore
109	University of Science and Technology, Meghalaya*
110	Utkal University, Vani Vihar
111	Veer Narmad South Gujarat University, Surat
112	Vidya Sagar university, Midnapore
113	Vikram University, Ujjain

Annexure 8: Registration Letter, Course work certificate, Dataverse Platform Permission.

VARDHAMAN MAHAVEER OPEN UNIVERSITY, KOTA
(Department of Research)

No.: VMOU/R&D/ /2016/ 5054 -5058 Date: 4/7/16

The Head/Convener/Incharge
Department of Library and Information Science
Vardhaman Mahaveer Open University,
Kota

Registration No: VMOU/Research/Ph.D/LS/2015/74

Dear sir,

With reference to your endorsement on the application and approved synopsis of **Prashant Shrivastava** for registration as a Research Scholar to supplicate for the Ph.D. Degree of the University as per UGC guideline-2009. I am to inform you that he/she has been permitted by the Vice-Chancellor on behalf of the Research Board to carry on Research on the title **"Prospects of Institutional Repositories in Research Data management Services with special reference to Shodhganga ETD",** under the supervision of Prof. Dinesh Kumar Gupta, Professor, Department of Library and Information Science, VMOU, Kota.

Please intimate:
(a) Date of commencement of Ph.D. work and;
(b) **Medium of writing of thesis.**
(c) **Hindi/English Transcription of title of your proposed research work.**

The date of commencement of research work may be the date on which the candidate commences work or an earlier date but it should not be earlier than the date of the meeting of the Research Board in which the proposal of the candidate was submitted and approved.

The candidate has to follow the general instructions for Ph.D. and act as per guidelines issued by the University as per the UGC Regulations-2009.

Yours truly

—sd—
Director

Copy forwarded to:

1. Prof. Dinesh Kumar Gupta, Professor, Department of Library and Information Science, VMOU, Kota.
2. Director, ……., VMOU, Kota.
3. Director, Academic, VMOU, Kota
4. Incharge, Central Library, VMOU, Kota.
5. Prashant Shrivastava S/O Sh. R. K . Shrivastava 88- D Mig Dda Flats Shivam Enclave Jhilmil Phase - Ii , Pkt – C East Delhi- 110032
6. File

Dy. Director

Serial No. 14

Vardhman Mahaveer Open University, Kota

RESULT-CUM-DETAILED MARKS CERTIFICATE

Pre Ph.D. Course Work Examination, 2015

(.....Library and Inf. Science.....)

Roll No. .....VMOU/15/LS/74.....

Name .....Prashant Shrivastava.....

Father's Name .....R. K. Shrivastava.....

Mother's Name .....Pushpa Shrivastava.....

	Mode of Evaluation	Max. Marks	Marks Obtained	Grade Obtained
	I. Continuous Assessment (CA)			
	Assignments	50	44	
	Presentation of research proposal	25	21	
	Review of five research papers	50	42	
	Review of five articles	25	20	
	Review of a book	10	08	
	Annotated bibliography of two books	10	07	
	Writing of 30 references and bibliography in APA, MLA and Chicago format	30	24	
	Total (Qualifying marks in CA: 60% of CA or Grade C)	200	166	A
	II. Term End Examination (TEE)			
	Part 'A' Module I and Module II	40	26	
	Part 'B' Module III	60	34	
	Total (Qualifying marks in TEE: 50% of TEE or Grade C)	100	60	C
	Grand Total (Part I and Part II)	300	226	
	Overall Result	300	226	B

Grade obtained in Continuous Assessment (CA).....A.....

Grade obtained in Term End Examination (TEE).....C.....

Grade obtained in Overall (CA and TEE).....B.....

Date of Declaration of Result.....23.04.2016.....

Result Prepared by.....

Result Checked by.....

B Arun Kumar

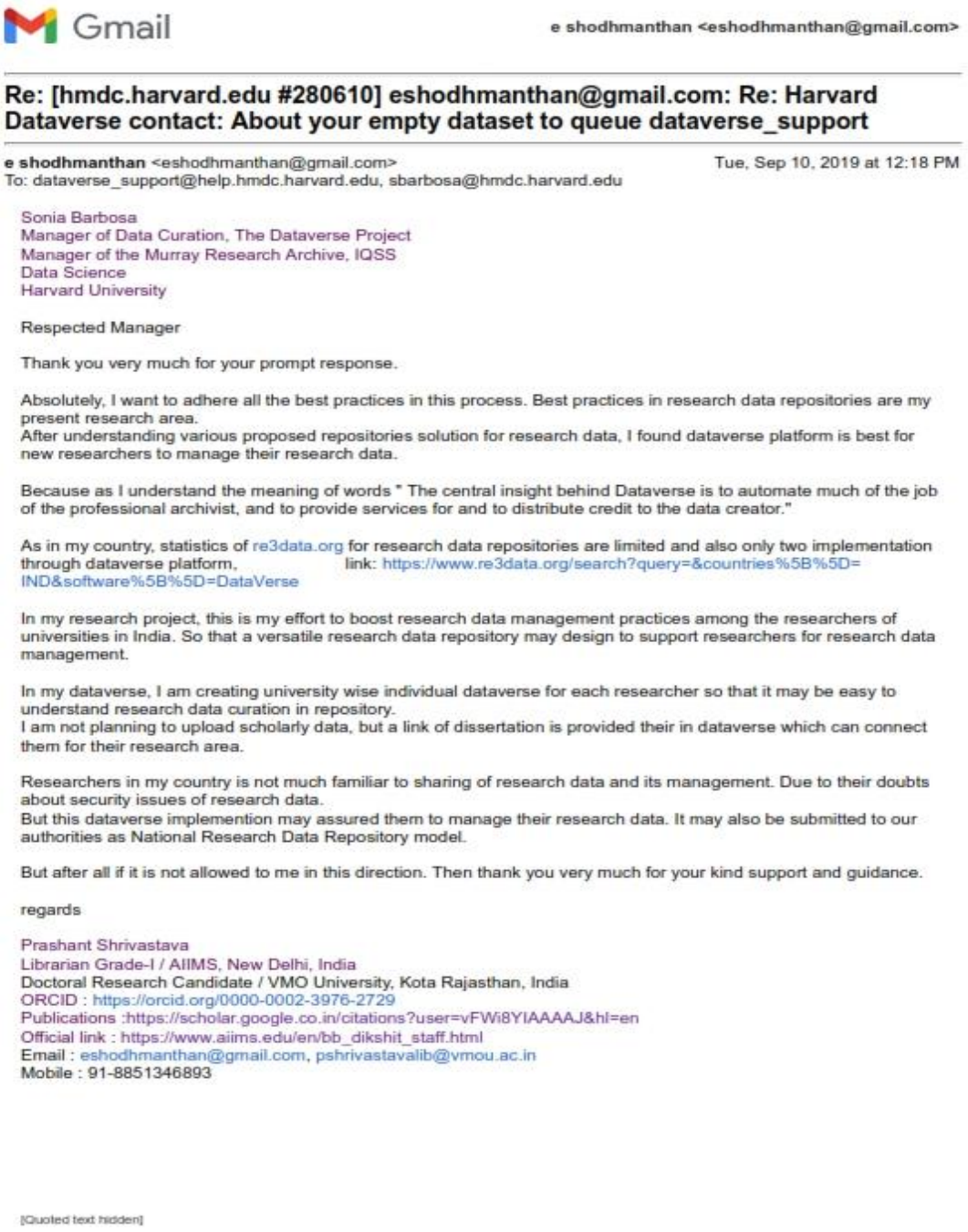
Controller of Examinations

Note: The total aggregate marks/grade obtained by the researcher in all the three modules is added to determine his / her final performance to get admission in Ph.D. programme. To qualify in the course work the student requires 60% of marks or Grade C in Continuous Assessment (CA) mode of evaluation and 50% of marks or Grade C in Term End Examination (TEE) mode of evaluation separately and in total (CA and TEE), 60% marks or Grade 'C' is necessary for a student to be declared successful for enrolment in Ph.D. programme. The final result is expressed in Alphabetical Grade on Four Point Scale.

Range of % age	Grade
80 +	A (Excellent)
71- 80	B (Good)
60-70	**C (Average)**
40- 59	D* (Unsatisfactory)

** If a student gets Grade 'D' in final result (in CA and TEE) then he or she needs to complete the Pre Ph.D. course work again.*

Dataverse Platform Permission approved by Data Curation Manager, Harvard University, USA.



Gmail — e shodhmanthan <eshodhmanthan@gmail.com>

Re: [hmdc.harvard.edu #280610] eshodhmanthan@gmail.com: Re: Harvard Dataverse contact: About your empty dataset to queue dataverse_support

e shodhmanthan <eshodhmanthan@gmail.com> Tue, Sep 10, 2019 at 12:18 PM
To: dataverse_support@help.hmdc.harvard.edu, sbarbosa@hmdc.harvard.edu

Sonia Barbosa
Manager of Data Curation, The Dataverse Project
Manager of the Murray Research Archive, IQSS
Data Science
Harvard University

Respected Manager

Thank you very much for your prompt response.

Absolutely, I want to adhere all the best practices in this process. Best practices in research data repositories are my present research area.
After understanding various proposed repositories solution for research data, I found dataverse platform is best for new researchers to manage their research data.

Because as I understand the meaning of words " The central insight behind Dataverse is to automate much of the job of the professional archivist, and to provide services for and to distribute credit to the data creator."

As in my country, statistics of re3data.org for research data repositories are limited and also only two implementation through dataverse platform, link: https://www.re3data.org/search?query=&countries%5B%5D=IND&software%5B%5D=DataVerse

In my research project, this is my effort to boost research data management practices among the researchers of universities in India. So that a versatile research data repository may design to support researchers for research data management.

In my dataverse, I am creating university wise individual dataverse for each researcher so that it may be easy to understand research data curation in repository.
I am not planning to upload scholarly data, but a link of dissertation is provided their in dataverse which can connect them for their research area.

Researchers in my country is not much familiar to sharing of research data and its management. Due to their doubts about security issues of research data.
But this dataverse implemention may assured them to manage their research data. It may also be submitted to our authorities as National Research Data Repository model.

But after all if it is not allowed to me in this direction. Then thank you very much for your kind support and guidance.

regards

Prashant Shrivastava
Librarian Grade-I / AIIMS, New Delhi, India
Doctoral Research Candidate / VMO University, Kota Rajasthan, India
ORCID : https://orcid.org/0000-0002-3976-2729
Publications :https://scholar.google.co.in/citations?user=vFWi8YIAAAAJ&hl=en
Official link : https://www.aiims.edu/en/bb_dikshit_staff.html
Email : eshodhmanthan@gmail.com, pshrivastavalib@vmou.ac.in
Mobile : 91-8851346893

[Quoted text hidden]

Gmail e shodhmanthan <eshodhmanthan@gmail.com>

Harvard Dataverse contact: Hello From Harvard Dataverse - reply requested

e shodhmanthan <eshodhmanthan@gmail.com> Sat, Sep 28, 2019 at 11:43 AM
To: "Barbosa, Sonia" <sbarbosa@g.harvard.edu>

Hi Sonia,

Thanks for yesterday skype conversation.

May I now proceed further for my RDR development.

regards

Prashant Shrivastava
[Quoted text hidden]

Gmail e shodhmanthan <eshodhmanthan@gmail.com>

Harvard Dataverse contact: Hello From Harvard Dataverse - reply requested

Barbosa, Sonia <sbarbosa@g.harvard.edu> Sat, Sep 28, 2019 at 9:49 PM
To: e shodhmanthan <eshodhmanthan@gmail.com>

Yes, of course you can. Please continue and let me know if you require further assistance.

Best
[Quoted text hidden]

Annexure 9: List of papers published

1. Shrivastava, P., & Gupta, D. K. (2016). National level ETD efforts: A comparative analysis. *Gujarat: INFLIBNET Centre*.
2. Shrivastava, P. (2017). Research Data Services in Prominent Life Sciences and Medicine libraries around the world. Surat: *National Conference HSLACON 2017.*
3. Shrivastava, P., & Gupta, D. K. (2018). Research data preservation in India: An analysis based on research data registry. World Digital Libraries-An international journal, 11(2), 107-121.
4. Shrivastava, P., & Gupta, D. K. (2019). Emergence of research data literacy with special reference to India. SRELS Journal of Information Management, 56(2), 112-118.

Full Text Papers enclosed.

Annexure 10: Plagiarism Check Report

Prashant shrivastava VMOU PHD <pshrivastavalib@vmou.ac.in>

Plag. Report

Research Deptt., VMOU, Kota <research@vmou.ac.in> Fri, Jun 25, 2021 at 2:53 PM
To: Prashant shrivastava VMOU PHD <pshrivastavalib@vmou.ac.in>
Cc: dineshkg.in@gmail.com

Dear Sir/Student
आप द्वारा प्रस्तुत शोध ग्रन्थ के अंतिम प्रारूप की शोध नकल जांच 03 प्रतिशत आने के बाद आपको निर्देशित किया जाता है कि आप अपना शोध ग्रन्थ अपने शोध पर्यवेक्षक से अग्रेषित करवाकर जमा करवा सकते हैं। आपकी शोध नकल जांच रिपोर्ट संलग्न है।
--
yours sincerely

----SD-----
Director
Research, VMOU, Kota

Prashant Plag. Report0001.pdf
427K

Director Research & Development VMOU <research@vmou.ac.in>

Fwd: [Ouriginal] 3% similarity - kchaudhary@vmou.ac.in

1 message

Dr. Kshamata Chaudhary <kchaudhary@vmou.ac.in> Fri, Jun 25, 2021 at 2:41 PM
To: Director Research & Development VMOU <research@vmou.ac.in>

---------- Forwarded message ---------
From: <noreply@ouriginal.com>
Date: Thu, Jun 24, 2021, 12:02 PM
Subject: [Ouriginal] 3% similarity - kchaudhary@vmou.ac.in
To: <kchaudhary@vmou.ac.in>

Document sent by: kchaudhary@vmou.ac.in
Document received: 6/24/2021 7:49:00 AM
Report generated 6/24/2021 8:32:20 AM by Ouriginal's system for automatic control.

Student message:

Document : Prashant Shrivastava-Thesis Chap 1to6.docx[D109613694]

About 3% of this document consists of text similar to text found in183sources. The largest marking is 108 words long and is 96% similar to its primary source.

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National Level ETD Efforts: A Comparative Analysis

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Abstract

Purpose: The theme of this paper is to explore cooperative ETD efforts in U.K, India, USA and China that have larger education systems and larger number of higher education graduates. Also to analysis ETD movement of India in comparison.
Design/ Methodology/Approach: This paper starts with introduction of cooperative ETD movement in four countries, namely USA, U.K, India, China then proceed with an effort to discuss comparative analysis of findings.
Findings: ETD movement has been adopted by various countries around the world. This study found that there is a requirement of national level ETD service in each country for the swift growth of ETDs around the world. The authors found that universities level ETD programs are the key factors to promote national level ETD service.
R**esearch Implications :** This paper gives the recommendation for further analysis to explore the solutions to excel cooperative ETD movement in various countries around the world.
Originality / Value : ETD development in various countries has been explored by various studies but comparative analysis of cooperative ETD service of various nations have not been done. It will be an effort to explore national electronic thesis service of USA, U.K, India and China.
Keywords : ETD, National Thesis Service, Shodhganga, CALIS-ETD, EThOS, Co-operative ETDs,

1. Introduction :

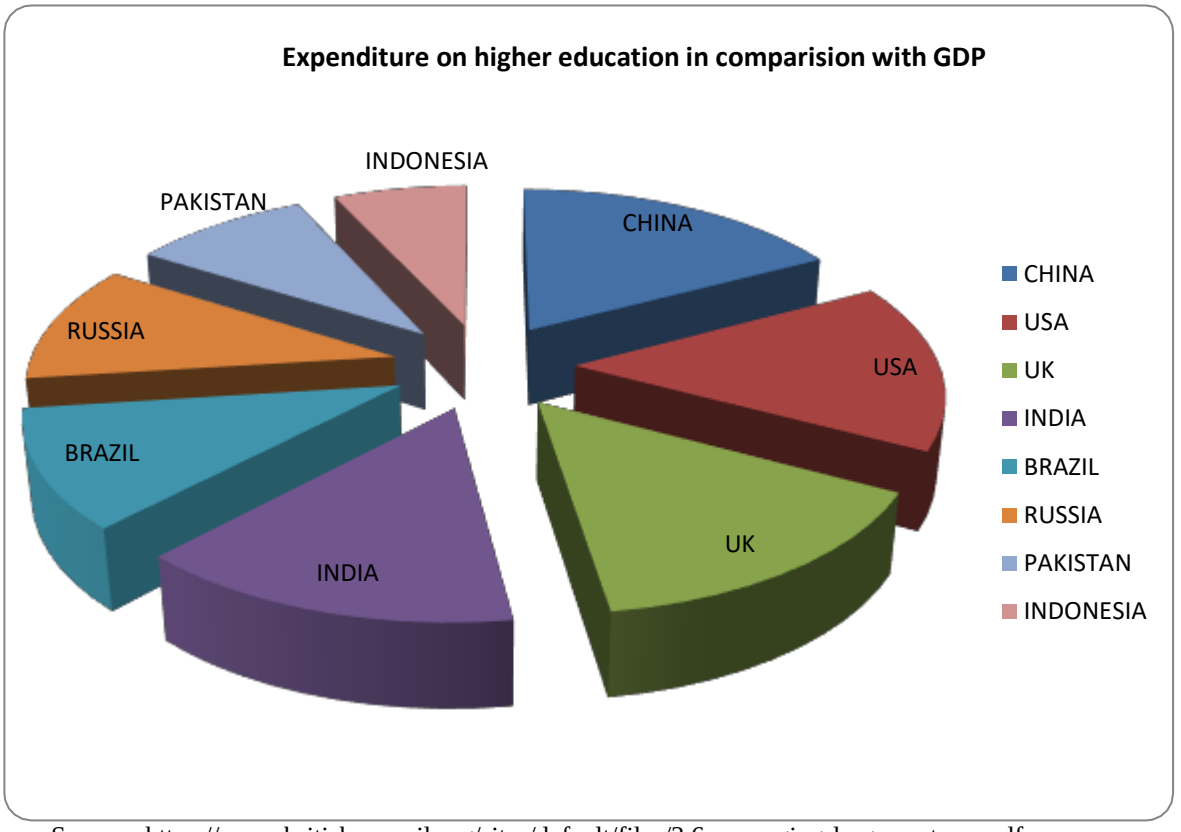
Higher education infrastructure and policies of a country represents a vital parameter to measure growth rate and capabilities to face challenges. Now market for higher education is global and universities and higher learning institutions are operating cross countries.. Standards and outputs are measure at international level based on various parameters. The outputs in terms of theses and dissertation are considered as an success indicator for academic/ research community of the country. Large number of institutions have system to keep ETDs on their websites and institutional repositories. There are arrangements for collaborative repositories to the extent to the national and international level.
Various studies have been undertaken to signify the role and challenges of the ETDs in different countries (Gould, 2016), (Cayabyab, 2015), (Panda, 2016), (Zeng &Sun, 2014), (Zhao & Jiang, 2004).

The present paper describes four national level ETD repositories exist in the China, USA, UK and India. These countries comprise large part of the student population. According to British Council report, represented at Global Conference in Miami (2014), " Nine countries around the world

covers 2/3rd global student population. These countries are Brazil, China, India, Indonesia, Nigeria, Pakistan, Russia, U.K and USA".

Tertiary education defines as the higher education after completion of secondary education. It can be a catalyst for stronger society and solution for critical problems. According to orld Bank Open Data (http://data.worldbank.org) and "British Council report 2015- Managing large systems, A Comparative analysis : Challenges and opportunities for large higher education systems", the governments of four countries China, USA, UK and India are leading to allocate expenditure on tertiary education in comparison with GDP shows by chart:1.

It can be clearly shown in table:1 that China, USA, UK and India are four leading countries being government expenditure on tertiary education in comparison with GDP, resulting in larger in numbers of graduates from tertiary education, both sexes.



Source : https://www.britishcouncil.org/sites/default/files/3.6_managing-large-systems.pdf

Chart : 1

Data Set : Education

Indicator : Graduates from tertiary education, both sexes

Sl.No	Countries	No. of Graduates from Tertiary Education
1	CHINA	9366202
2	INDIA	8846030
3	USA	3784640
4	UK	791945

*Source : UNESCO INSTITUTE OF STATISTICS (Date : 05 Sept 2016 URL:http://www.uis.unesco.org)

Table : 1

Higher education system in selected four countries have different setup and approaches in regard to repository provisions of ETDs. As Ph.D programmes are the best pillars for systematic education quality for graduate education system. Thesis and dissertations are the research outputs and reports of the graduate and Ph.D scholars. Advancement of ICT has presented latest tools and techniques to support researchers. As the name described " Electronic Thesis and Dissertations" are the electronic forms of thesis and dissertation. The idea of ETD was first started in Virginia Tech polytechnic in 1987 (Sengupta, 2015). The efforts were supported by various sources with in a period of ten years. As a result, Networked Digital library of thesis and dissertation (NDLTD) has been framed (Fox, 2013).

NDLTD is a non-profitable U.S based organization with aim to promote ETD education, development, dissemination of information, creation of standards and extended cooperation between ETD groups.
Most detailed understanding of ETD terms may be in word of Virginia tech polytechnic,
"A thesis is a work generated in support of candidature for a doctorate or master's degree respectively which presents the author's research and findings. Electronic versions of thesis and dissertations are called ETD" (Sengupta, 2015).

In the age of open access of research data, ETDs plays key role for sharing of resources. ETDs do have advocacy for open access which enhance visibility of research work. Due to fast searching facilities it may be easily explored by the researchers to get fruitful results.

2. Cooperative ETDs

China, USA, UK and India have large number of universities. These countries have primary goal to provide higher education to a larger mass of students. As, ETDs have been recognized as a best supportive tool for researchers. There is immediate requirement of cooperative ETD repository at national level.

The success of a National ETD repository rests on regular contribution by their members. So it is necessary to study the existing ETD facilities and services in the countries under study.

3. National cooperative ETD efforts:

3.1 China ETD Program:

China Academic library and information system (CALIS) has been founded in 9^{th} five year program of china. Under national administrative centre, Ministry of Education of china in 1996. The synthesis of CALIS has been done to build a strong academic library system in china. CALIS head quarter of National Administrative Centre has been situated in peeking university. This project has been implemented in various phases. National effort for Cooperative ETD named as CALIS-ETD has been launched in 1999. It has been completed three phases and forth phase is running. CALIS has established "Electronic Thesis and Dissertation Digital Library (CALIS-ETD-DL)". The framework of this library has been planned in distributed digital setup. CALIS-ETD project has more than 100 member libraries. Around 1.72 million Chinese ETD are recorded. It has been launched for the ETD resource sharing among universities in china. CALIS-ETD-DL project has been planned to cater ETD resources sharing among 1000 or more Chinese universities. CALIS-ETD platform is an integrated system of available sources for Thesis and Dissertation in china. Electronic Thesis and Dissertations from member libraries, NDLTD, PQDT have been pooled under one system.

Figure : 1

3.2 USA ETD Program:

3.2.1 Virginia Tech in USA is a well known educational body for Virginia polytechnic institute and State University**.** Initiation of ETD concept has been credited to Virginia Tech University since 1980. The mandate for online submission of thesis and dissertations started from 1997. Virginia tech ETDs primary goal is to provide open access to Thesis and Dissertation database.

Figure : 2

3.2.2 The USETDA has been started in 2009 by ETD active professionals in United States. The United States Electronic Thesis and Dissertation is a non-profit association in higher education with in the United Nation. It has been constituted to fulfil the goals of development of state vide ETD initiatives, to organize information on best practice, to provide best available education & training to ETD professionals within U.S and provide co-operation to international ETD organization.

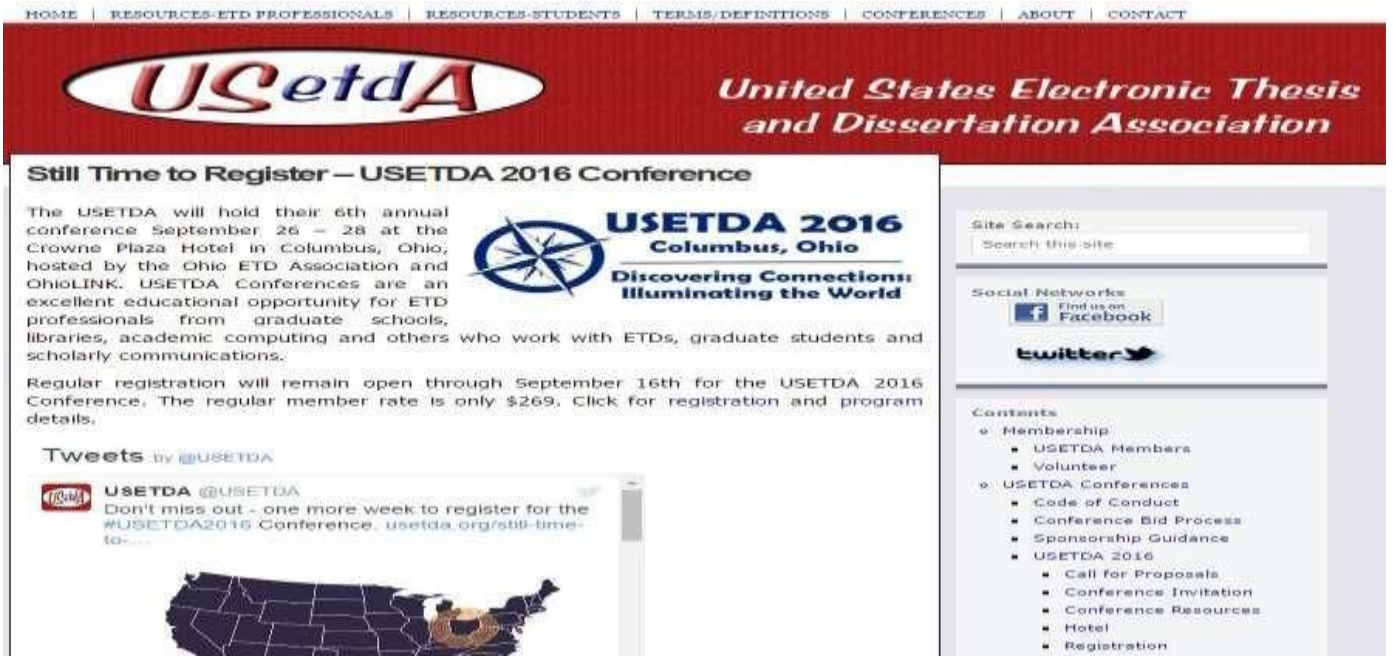


Figure : 3

3.3 U.K ETD Program :

UKTG : UK Thesis Online Group was the first initiation of ETDs in U.K. It was established in 1990. The theme of establishment was to connect various peoples related to Thesis and Dissertations. UKTG have done various efforts to enhance ETDs usability in UK universities. In this series a big survey has been conducted with the help of British Library and Joint Information Systems Committee (JISC).
Universities in UK generally send duplicate copy of thesis to British Library. While there is not any regulation in existence for the purpose. British library EThOS electronic thesis service has been started in 2009.

UK institutions awarded thesis has been covered by EThOS upto 87%.

Figure : 4

3.4 Indian ETD Program:

National knowledge commission of India has been setup in 2005 by the planning commission of India. Its aim to preserve knowledge in best possible ways and maximize sharing of resources. National Knowledge Network has been planned to maintain various aspects of national digital contents. ETD has been recommended one of the best ways to preserve and disseminate national research output.

Informational and library network which is an inter university centre of university grant commission of Government of India known as INFLIBNET Centre. On the recommendation of National Knowledge Commission and funding of Ministry of Human Resource and Development a national ETD repository project SHODHGANGA has been planned in 2009 and started in 2010 by INFLIBNET.

Figure : 5

In year 2009 University Grant Commission passed a regulation called eligibility criteria for the award of MPhil and PhD degrees. It is mandatory for the research scholar to submit the electronic version of MPhil/PhD dissertation.

Shodhganga is a national level open access ETD repository of Indian Electronic Thesis and Dissertation. It has been designed on open source software DSpace, a digital repository software.

China, U.K and India have National Thesis service based on cooperative ETD model. United States of America has various good ETD repositories; these are growing at leading stage internationally. But USA doesn't have National thesis service.

So National ETD repository service in China, U.K and India will be considered for comparison.

Sl.No	**Parameters**	**U.K**	**CHINA**	**INDIA**
1	Name of National ETD Service	ETHOS	Calis –etd	Shodhganga
2	Year of start	1990	1999	2009
3	Regulatory authority	UK Thesis Online Group	China Academic library and information system	INFLIBNET Centre/UGC
4	Funding agency	British Library and Joint Information Systems Committee	National Administrative Centre, Ministry of Education of China	Ministry of Human Resource and Development, Govt of India
5	Universities contributed / Total Number of Universities	Around 111/135	Around 100/1000	Around 261/759
6	Access	Free	Free	Free
7	Resources covered	Thesis, Dissertation, Articles	Thesis, Dissertation, Articles, Digital resources	Thesis and Dissertation
8	Full Text Thesis Statics	170000	1720000	99995
9	Search options Available	Basic and Advanced	Basic, Title, Author, keyword, summery, Tutor	Basic, Advance, Universities, Departments, Subject, Date Submitted, Researcher & Guide, Title, Keyword, Google search
10	RDM facility	Not Available	Planned in Phase IV	Not Available

11	Meta data used	Open Archives Initiative Protocol for Metadata harvesting	Open Archives Initiative Protocol for Metadata harvesting	Open Archives Initiative Protocol for Metadata harvesting
12	Implementation	Distributed	Decentralize	Centralized
13	Mandatory deposit act	No Act in Existence	No Act in Existence	University Grant Commission Act
14	Search Engine Used	Web based	E-du Search Engine	DSpace Enable
15	User Management	Free User Service	Unified Authentication system part of CALIS cloud service	Free User Service
16	Full Text Access	Login Based	ILL Based	Free world wide
17	Portal Interface	World Wide Web	CALIS-ETD Central System	Semantic Web based Application

Table : 2

4. Analysis and Findings:

National cooperative ETD services of three countries are the best effort of cooperative ETD movements among the largest mass of higher education students. The growth and development of these ETD repositories are analysed at various parameters as under :

4.1 Growth Rate:

Cooperative ETD movement at national level have been started in 1990 by EThOS, British National thesis service in U.K. After nine years in 1999, CALIS-ETD has been started in China as national thesis service and after ten years in 2009, Indian national thesis service has been started as Shodhganga. Presently EThOS, British thesis service completed around 25 years and 87% of Ph.D awarding institutions are its regular contributors. Still 13% Institutions are in process to cover under national thesis service.
While China national thesis service CALIS-ETD has been completed more than 15 years but around 100 institutions / Universities are covered under national thesis service. While, china have more than 1000 universities/ institutions for higher education.
CALIS-ETD has to cover a long way to achieve 100 % submission of Ph.D thesis in national thesis repository.

Indian national ETD program has completed just around 7 years. But shodhganga national ETD repository has achieved significant growth year by year. University Grant Commission has recorded 759 universities while 261 universities have their thesis contribution in shodhganga national ETD repository.
Indian national ETD service has been covered 30% of universities contribution in last five years. It is good growth rate but Indian ETD movement may discover better mile stone if ETD movement will be implemented at state level also with national supported infrastructure.

4.2 Mandatory Deposit regulation

Life of a ETD repository solely depend on contribution of records and cooperative national ETD may grow by contribution of members.
British thesis service EThOS and china thesis service CALIS-ETD don't have any regulation for universities to contribute mandatory in national thesis service.
Indian national thesis service shodhganga has been framed by UGC regulation of universities for mandatory contribution.

4.3 Implementation and Access

EThOS, CALIS-ETD and Shodhganga national cooperative thesis service repository are free to access. All these repositories have various search facilities for readers while full text access is controlled in CALIS-ETD repository. EThOS and Shodhganga provides free of cost direct full text access.
All three ETD repositories have OAI-PMH enable metadata service. Implementation of EThOS and CALIS-ETD are decentralized but shodhganga has centralized system for national ETD repository.
Shodhganga ETD search has discovered results only from Indian thesis and dissertations while EThOS and CALIS-ETD have integrated database with other ETD collections.

4.4 NDLTD Support

Around the world National Digital Library Thesis and Dissertation known as non-profitable organization dedicated to ETD development and research projects. NDLTD provides the support for ETD establishment projects at national and states level in various countries.
India and USA are two leading countries have measure share in NDLTD members. While, U.K and China have least participation. The significant growth of shodhganga ETD projects has remarkable contribution of NDLTD support at state and institution level. More than 50 universities and institutions in India have their ETD institutional repository with membership of NDLTD.

4.5 Areas for Future Concern

Electronic thesis and dissertation is a rising concept in universities around the world, yet various universities don't have infrastructure for Information and communication technology. Comparative analysis of EThoS, CALIS-ETD and Shodhganga extract that remarkable achievement of ETD concept may discover by implementing it at various levels as under:

- National level ETD repository should be framed.
- Submission of Electronic Thesis and Dissertation should be mandatory to award Ph.D. degree.
- National level ETD development training programs should be available.
- Information and communication technology enable campus should be mandatory requirement for accreditation of Universities.
- State vide ETD development programs should be started.

5. Conclusion :

National cooperative ETD efforts study has presented an efficient picture of cooperative ETD movements around the world. Advancement of Informational and communication technology has provided various efficient tools to manage research. Due to changing paradigm of research to e-research a data intensive research approach has been in practice.

ETD movement around the world is required to setup an international standard and guidelines to manage research contents and data. As volume of data in research is increasing and important, it is very much required to develop a well-planned ETD framework with research data management capabilities.

The challenge to the national cooperative ETD service is to cover complete thesis and dissertation work of their respective country. Further requirement of research is to discover hurdles on ground realities in process to develop ETD services in these countries. Research data management enabled ETD programs of a country may provide a unique portal for research developments.

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Research Data Services in prominent Life Sciences and Medicine Libraries around the world.

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Abstract

Purpose: The objective of this paper is to explore management of various research data services in world leading life science and Medicine University libraries.

Design / Methodology: This study first explore top ranked health science libraries and then analyse respective research data management services.

Findings: This paper summarized the efforts of research data services development in the health science libraries. Havard University and University of Oxford are the leader of this concept.

Research Implications: Present paper gives the recommendation for further analysis to explore specialised research data services for life science and medicine research projects.

Keywords: Research Data Services, Research Data, Research Data for Life Sciences, Type of Research Data services.

Introductions:

The concept of health science library is developed as an interactive information system to full fill information needs of their health science professionals, research scholars, students and patients. Present age of computer technology has a great impact on information requirement, retrieval and availability. Now most of the information is digital and available online. Research scholars are always power users of libraries. Traditional research methods has been transformed into E-Research. Now a days lots of data is required to analyse a problem or any research objective. Similarly large amount of data has been generated during life cycle of research.

Today health science libraries are not mere collection of resources but may provide great services to deal management of research data for research scholars and scientists (Amos, H, M Frances, and T Ruthven., 2010). Data intensive research has evolved new frontiers for libraries in research support services (Shearer, et al, 2010).

Research data have many aspects for researchers and library professionals. Libraries already have much more support in various researches. Curation and management of research data is a new challenge for higher education systems around the world (Winn, Joss, 2013).

Around the world the emergence of research data management has been realized. Research data management consists the activities of documentation, curation, preservation,

dissemination of research data (Flores, 2015). Prominent health science libraries are also providing research data services to the readers.

Objectives:

Research data is a valuable resource for universities around the world. Knowledge centers and libraries are paying much attention to develop infrastructure and funds to deal large amount of research data in multiple disciplines. The purpose of this study is to explore following facts:

i. What are the leading universities list in the field of life science and medicine?
ii. Present status of policies regarding research data management in top ten universities in the list.
iii. Analysis of research data services provides by the universities.

Today world leading universities have setup research data management facilities for their research scholars.

SUBJECT AREA **Life Sciences & Medicine**

2017 RANK	2016 RANK		Country / Territory	Academic	Employer	Citations	H	Overall
1	1	Harvard University		100	96	92.8	100	97.8
2	2	University of Cambridge		98.3	100	90.8	93.2	95.3
3	3	University of Oxford		97.5	99.3	89.6	95	95.1
4	4	Massachusetts Institute of Technology (MIT)		93.9	92.8	100	88.5	94
5	5=	Stanford University		95	88.3	90.4	92.6	92.6
6	5=	Johns Hopkins University		96.9	67.3	89.4	97.6	92.2
7	9	Karolinska Institute		96.9	79.9	85.3	90.6	90.7
8	10	University of California, Los Angeles (UCLA)		92	78.2	88.7	92.4	89.9
9	7	University of California, San Francisco (UCSF)		94.2	51.9	92.7	94.3	89.6
10	8	Yale University		91.6	84.6	88	89.2	89.4

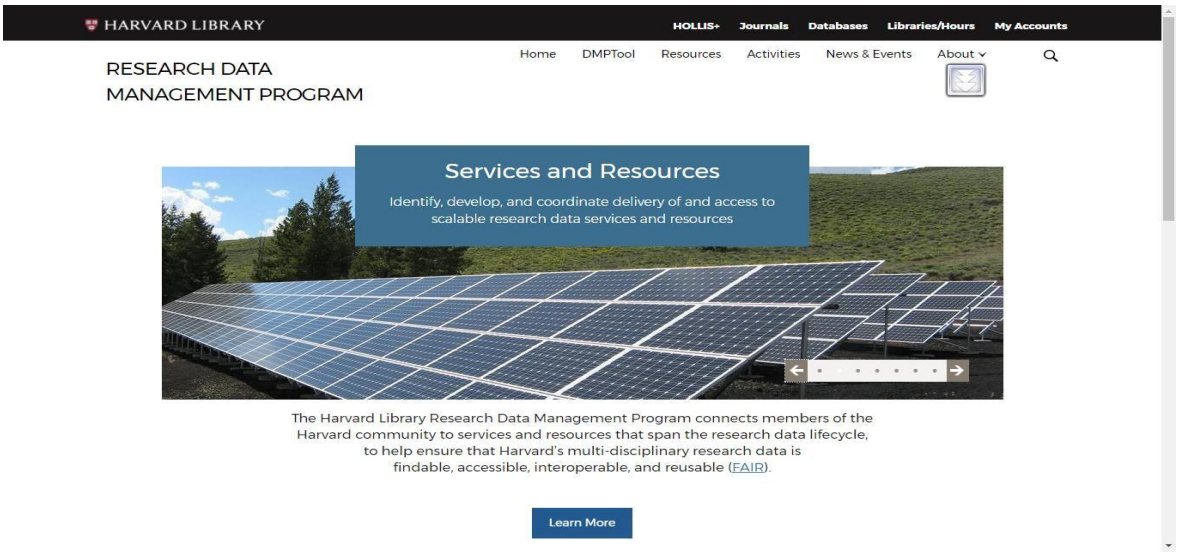
QS University ranking 2017

Complete list of world ranking of universities in life sciences and medicine subject is enclosed in Annexure -1

Methodology:

Present study first explore world ranking of top universities then filtered the selection with life science and medicine subject as indicator. Leading ten universities in life science and medicine are analysed for research data services mandate. Further analysis proceeded with intense web site investigation procedure of all ten universities for research data management services.

1. Harvard university :



The Prime objective of Harvard library research data management program is to network Harvard community for valuable resources and services in whole life cycle of research data. Harvard research data is managed to make it easily findable, accessible, interoperable and reusable.

Research data services in Harvard University includes following activities:

i. Early planning of data management in projects.
ii. Proper designing of roles and responsibilities for different research data activities.
iii. Planning of provided budget grant for the research projects.
iv. Data ownership decisions
v. Creation, management and documentation of data storage.

Research data Tools and Software services:

i. The Dataverse Project: It is an open source research data software for repository management.
ii. DMP tools: The DMP tools assist research scholars to create planning for data management.
iii. ORCID: ORCID provides an unique identifier for researchers. They provide open tools that enable transparent and trustworthy connections between researchers and affiliations.
iv. COS: Centre for open science framework to connect the entire research cycle.

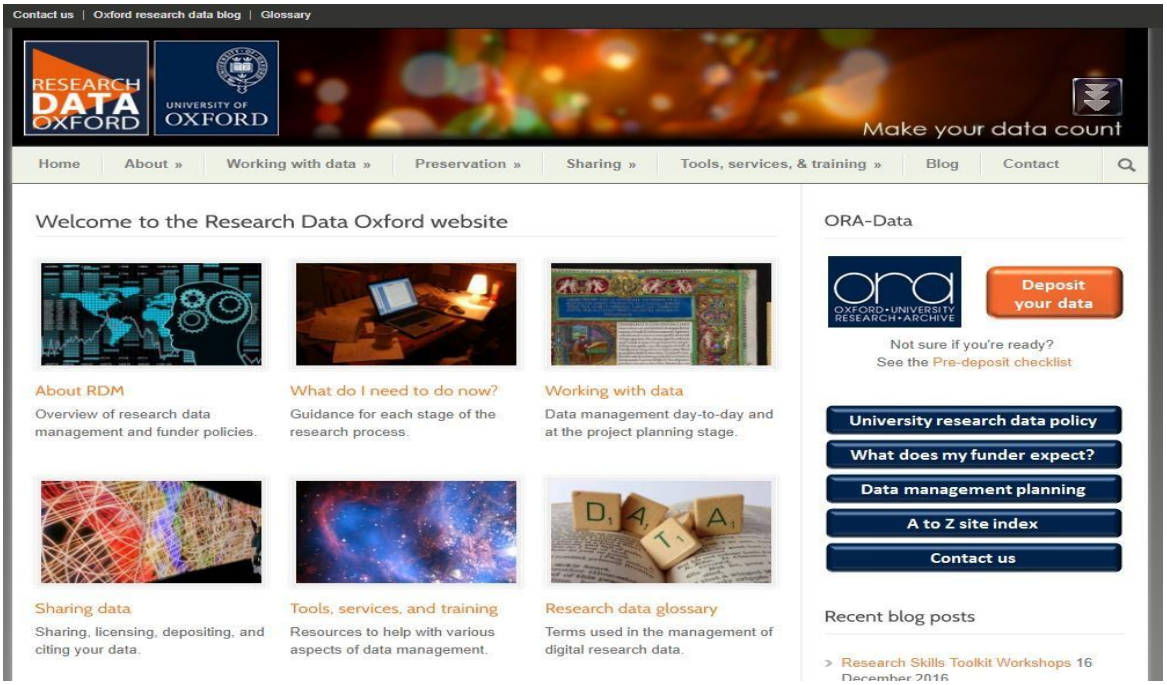
v. Figshare : It is a repository for the researchers where scholarly research outputs may be citable, sharable and discoverable.
vi. Re3data.org: It is a registry for research data repositories around the world.

2. University of Cambridge:

Academic and research community of Cambridge university have keen attention on organization and sharing of research data. University has policy to make available research data with minimum restrictions.

i. Training and support services : Cambridge university provides training and support for researcher to manage research data which is generating in entire life cycle of research.
ii. Data Management Plan Service : University has an advice service to prepare data management plans for the researchers before starting their research.
iii. University has provide an online software DMPonline for the data management planning.
iv. Research grants sanction and requirement for the Data Management is also advised.
v. University also have support to archive research data for researchers.
vi. Interactive Website of Cambridge University also collaborate research data support services from other universities.

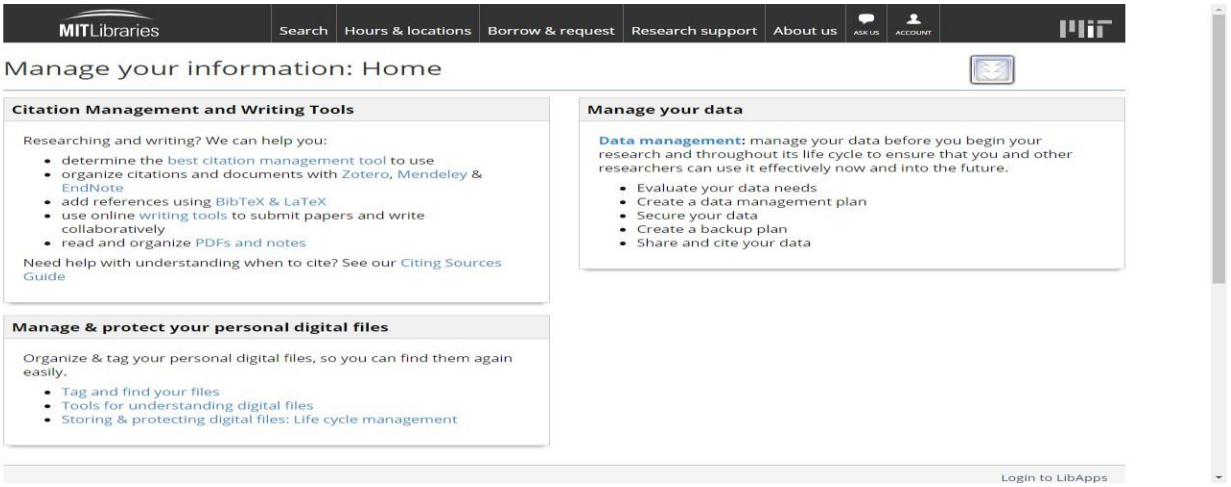
3. University of Oxford:



University of Oxford has policy for research data to support, facilities and services to help researches. ORA-Data is Oxford University Research Archive. It is a group of research data service to assist researches for creation, arching, and sharing. Following services are concluded in ORA-Data:

i. Researcher's dataset are entered in Oxford catalogue of research data.
ii. Permanent links of research data and publication are provided.
iii. Storage management of research data is maintained through a repository.
iv. Data collection are organized to share better and citable with international standards.
v. Each dataset has defined with Digital Object Identifier.

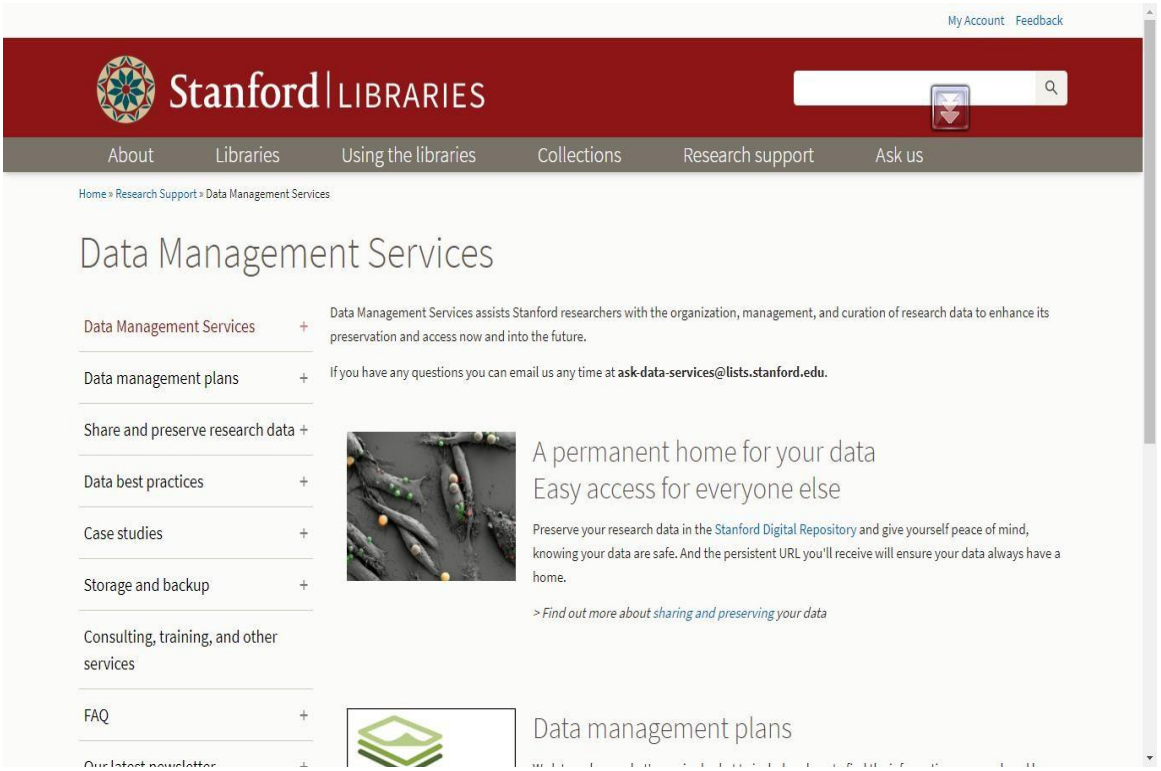
4. Massachusetts Institute of Technology:



Research data management in MIT has been support well. Researcher are assists to manage research data by counselling to understand their data management needs.
It further suggested to create data management plans as per requirements of researchers. Various aspect are identified and data security related issues are incorporated. After that research data storage and backup plan has been created. Further best sharing and citable repository and tools are suggested.

University also provides special support to researchers by expert librarian for research data management. Various training programs are provided to well inform researcher for data management. Research data of university researchers are stored in Dspace@MIT repository.

5. Stanford University:



Standford university assists researchers with organization, management and curation of research data for continuous access. Research data management services of university provide help for Data management plan (DMP) to researchers. DMP is finalised after analysing requirement of funding agency and type of research. Cost of information technology support specific to Standord University has been accessed.

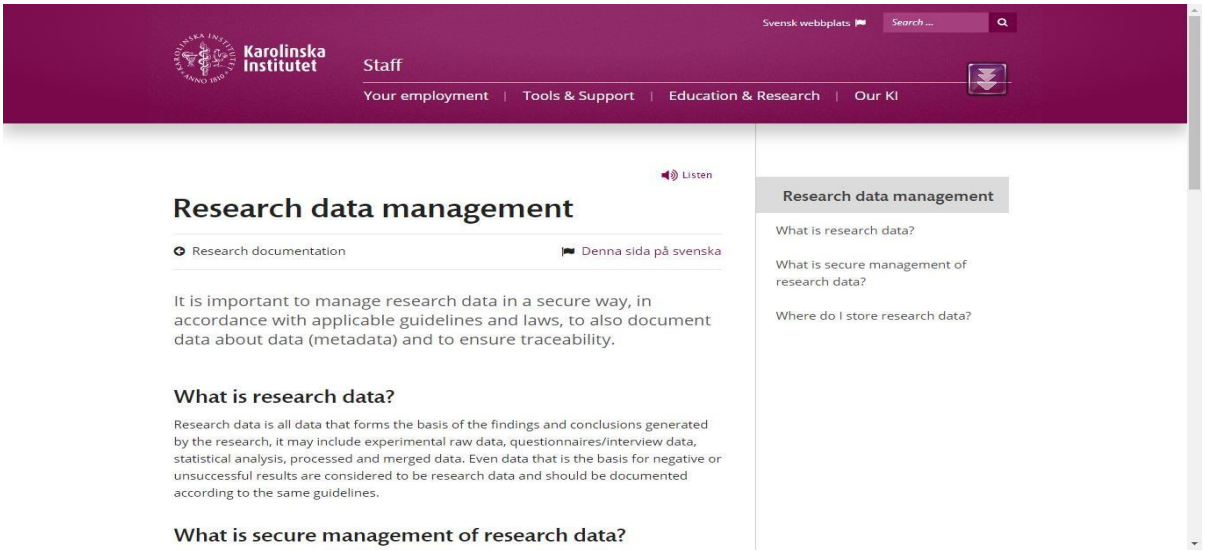
After that Storage and backup, data best practices, sensitive data regulation are supported by expert librarians. Standford Digital Repository service is provided to researcher to manage digital preservation, access management and storage of research data. It support researchers to manage permanent reliable web link, control over public availability of research data.

6. Johns Hopkins University:

JHUDMS : Johns Hopkins University Data Management Services are planned to support researchers by providing guidance, education, training, archiving and sharing services. It has been launched in 2011 in entrepreneurial library program of the JHU Sheridan Libraries. The Data Management Services became the part of Data Management Directorate of the Sheridan libraries. This service supports the researchers at all stages of research as they plan their research project, manage and analyse data, publish and share data. Free assistance to develop data management plans are provided. Expert advice for specific research data management are provided by Data Management Services Consultant.

Johns Hopkins University is a Institutional partner of Open Science Framework. It has been collaborated to increase transparency and enhance visibility of research.
JHU Data Archive is a repository hosted at Dataverse repository service. Researchers can archive their research datasets in this repository.

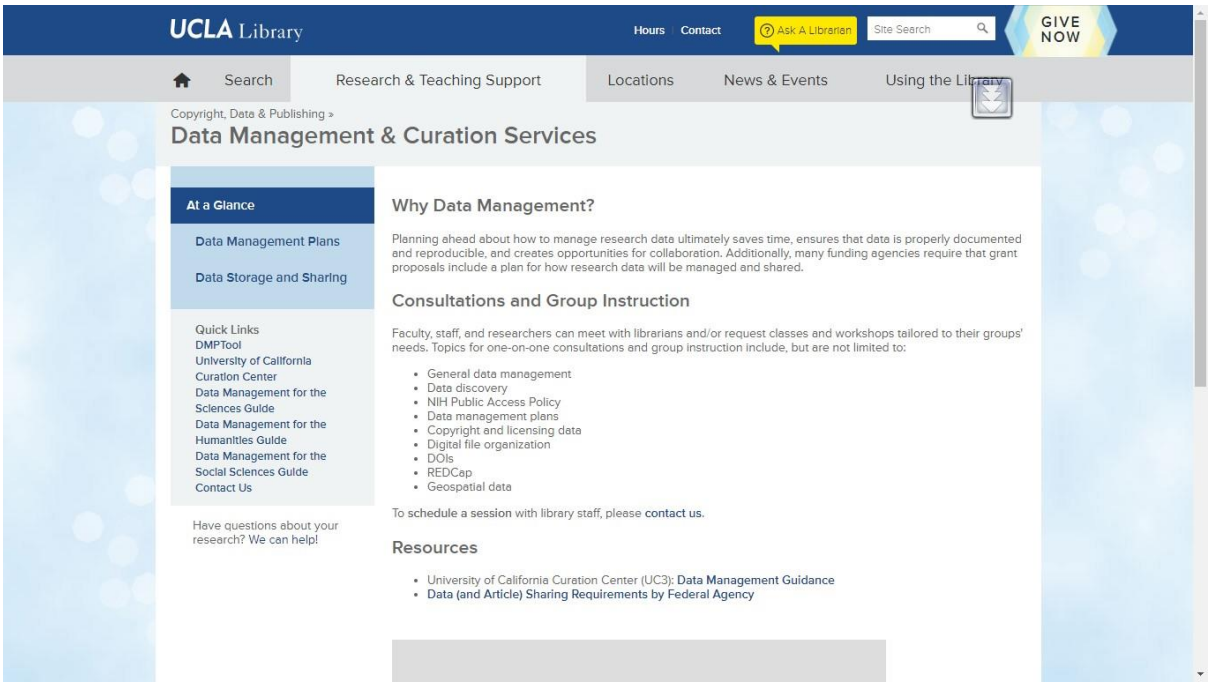
7. Karolinska Institute:



Karolinska Institute research data policy has evolved with vision of best documentation of research from hypothesis, to publish results and conclusions.

As per the regulation it is mandatory for KI researcher to document their research electronically from 1 January 2018. The guidelines of Karolinska Institute are developed one for experimental research and second for clinical epidemiological research.
Research documents are required to submit in the KI central archive. Guide for document management helps how and when research data and documentation can be discarded as well as whether archiving should be done on paper or electronically.
Now research data can be managed through other data storage solutions.

8. University of California Los Angiles:



University of California Curation Center : UC3 helps researches and the UC libraries manage, preserve and provide access to their important digital assets.

Dash: Data Sharing made easy service :

i. Dash is a self-service tool for researchers to describe, upload and share their research data. It prepare data for curation by reviewing best practice guidance for the acquisition of digital research data.
ii. Select appropriate research data for curation.
iii. Identify data with DOI for citation and better search.
iv. Preserve and manage for enhance retrieval.

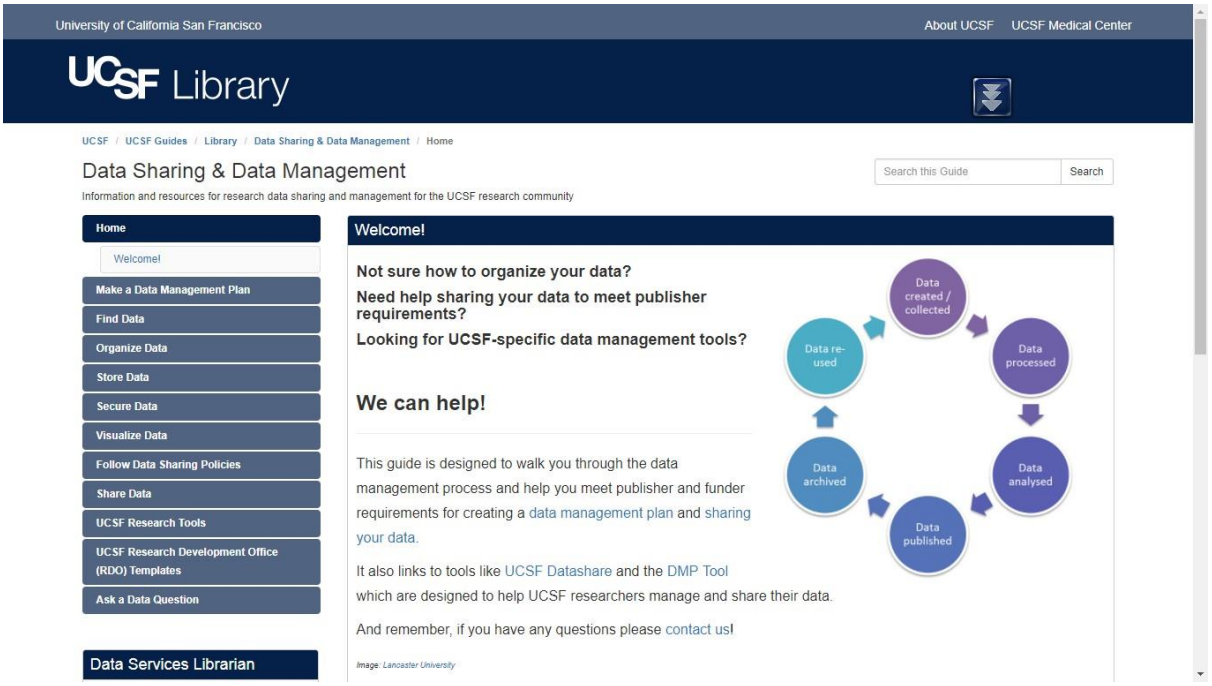
DMP tool : It is used for Data management planning for researches.

EZID : It is used to make it easy to create and manage unique, persistent identifiers.

Merritt : It is repository service that lets you manage, archive and share valuable digital contents.

Web Archiving Activities : Used to capture and access to web archived content and creation of tools to support users.

9. University of California San Francisco:



UCSF Library provide guide to researcher through out research life cycle. It also provides tools like UCSF Datashare and the DMP Tool which are designed to help UCSF researchers manage and share their data. Data management plans of UCSF research funders are specific to National Institute of Health Data Management Plan,
Nationals Science Foundations Data Management Plans.
UCSF has provide many data storage plans as

UCSF BOX : UCSF Box is for UCSF business only and should not be used for personal files. Now offers unlimited amounts of storage and an encrypted, HIPAA – complaint folder.

MyResearch : It is Professionally managed, web-based, and secure collaborative environment in which to store files containing sensitive data.

UCSF IT Storage Services : It is centralized managed highly available and scalable for vide range of applications.

UCSF Minimum security standard checklist : It is outlining the minimum IT security standards for all UCSF departments.

UCSF IT Encryption Services : Encryption services for the UCSF community.

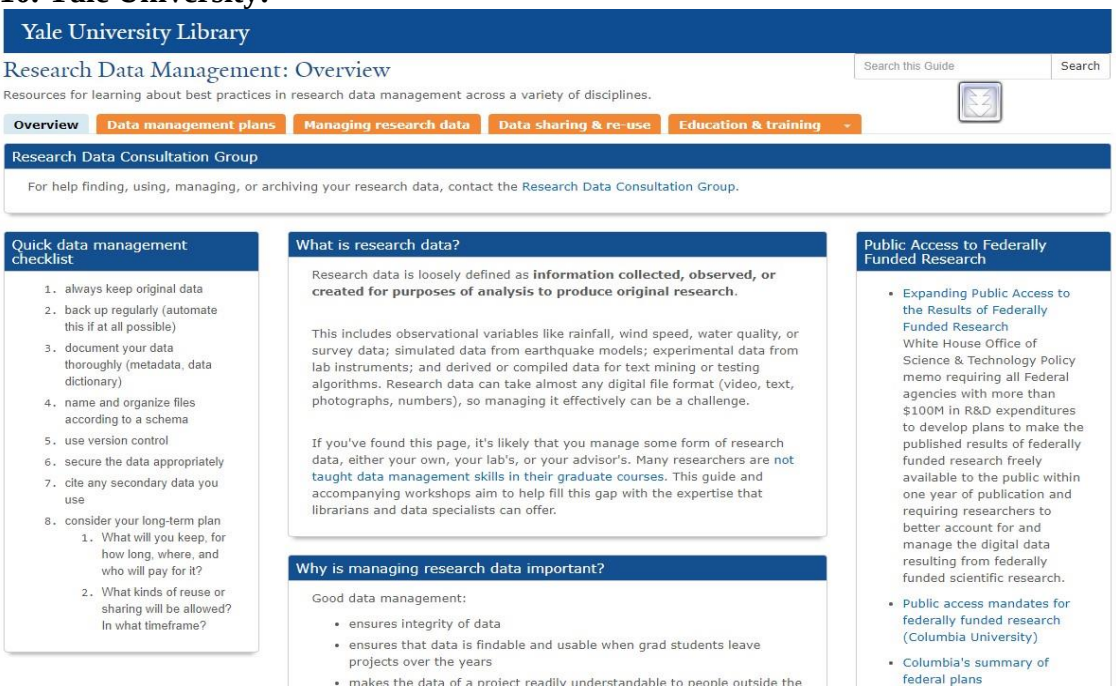
UCSF IT Data Destruction Services : It is free drive, tape and data destruction service. IT can be used to destroy media containing PII and PHI.

Information Security Checklist : It is practice guide to information security.

Good Passwords: UCSF It's guide to creating strong passwords.

Various free / Licensed tools are available as PubMed@UCSF, Embase, Pivot Funding Opportunities & Researcher Profiles, DMP Tool, Sage Research Methods, REDCap, Qualtrics, STATA, ATLA.ti, eScholarship.

10. Yale University:



Yale university research data services are very interactive as researcher are provided help at every step of their research. Specialised research support services are provided by discussing objective in workshops and training programs. Research data consultation Groups are formed to know better solutions. Various self service solutions are provide as creation of data management plans, appropriate research data repository, identification of resources.

According to Yale university research data and materials policy "Yale is committed to improving the world today and for future generations through outstanding research and scholarship, education, preservation, and practice." Yale university has infrastructure for improved management through help of ITS and the Yale Center for research computing.

Research community of Yale University provides DMPTool for development of Data Management Plans. Yale Center for Analytical sciences and medicine & University IT Partners provides help to researchers. The office of the provost or deans of self-supported schools are the relevant units for approaching research data management plans involving commitment of university resources.

Analysis and findings:

Research data is getting high attention around the globe. While research data stakeholders are planning to speed up the process of implementation and adaptation of research data policies.

Research Data Management Services can be analysed in types as consultative research data services and technological services type services.

Consultative research data services: These services have group of activities as discussion of research data services in the campus, inputs to research data policy developments, development of training programs for professional staffs, discussions on data management

plans, collaboration of Research data services of other universities, preparation of guidelines for documentation of research data and its uses. Harvard university, University of Cambridge, University of Oxford and MIT have leading edge in establishment of research data policy, development of infrastructure and professionals also development of latest technology. While standford university, KI, Johns Hopkins University, UCLA,UCSF and Yale university are following steps of leading four universities. Research data policies are in developing phase in last six universities.

Technological Research Data Services: These services are the group of activities of providing technical support for RDS systems, Identifying of datasets, generation of metadata for datasets, reframing of data and datasets for deposition in repositories, data sharing policy implementation.

Havard University has leading edge in technological research data services with Dataverse project, ORCID development and implementation, Figshare and Re3data.org repositories development are the new outcome of their innovative research data management policy. University of Oxford is also equally capable and technical sound to deal latest research data services trends. Oxford University Research Archives is the repository ti support and maintain research data services in the university. CODATA is the committee on data of the international council for science. Its mission is to promote global collaboration to improve the availability and usability of data for the all areas research.

While MIT and University of Cambridge also developing their research fraternity up to global standards. All other universities are using technological support of third party software or online services to fulfil their requirements.

Conclusion and Recommendations

Research data is new meadow for library and information science professionals while they are required to equip themselves. Life sciences and Medicine are the vital subject for research. International Research giants always ready to grants funds for latest research projects in these subjects. Top world ranking universities are equally realising these facts and transforming their libraries and knowledge centers to deal the requirements. But research data management is not a trend or facility it is requirement of every research society. International collaborative centers for research data management development are need of the time.

Research data services have a wide prospects for libraries with good help of computer experts.

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Annexure – 1

QS world university by life sciences and medicine subject 2017.
Accessed from http://www.iu.qs.com/wp-content/uploads/woocommerce_uploads /2017/03/proof_v8_24451.pdf

2017 rank	Institution name	Country	Academic reputation	Employer reputation	Citations	Research impact	Score
1	Harvard University	United States	100	100	96.1	100	99
2	University of Oxford	United Kingdom	95.8	97.8	95	95.6	95.8
3	University of Cambridge	United Kingdom	96.1	97.3	95.3	92.7	95.2
4=	Johns Hopkins University	United States	92	75.7	95	99.6	93
4=	Stanford University	United States	92.4	92.7	93.8	93.3	93
6	Karolinska Institute	Sweden	97.7	79.9	91.1	92	92.8
7	University of California, Los Angeles (UCLA)	United States	88.9	84.5	94.1	94.5	91.2
8	Yale University	United States	89	88.2	92.6	89.9	90
9	UCL (University College London)	United Kingdom	85.9	82.7	92.9	95.6	89.8
10	University of California, San Francisco (UCSF)	United States	88	62.9	96.1	96	89.5
11	University of Toronto	Canada	83.6	82.9	92	96.5	88.9
12=	Imperial College London	United Kingdom	87.8	85.5	92.6	88.1	88.8
12=	Massachusetts Institute of Technology (MIT)	United States	87.1	93.8	96.6	81.9	88.8
14	Columbia University	United States	81.7	83.8	94.9	94.6	88.4
15	The University of Sydney	Australia	86.3	84.7	89.2	89.6	87.7
16	King's College London (KCL)	United Kingdom	85.9	79.7	91.9	89.3	87.6
17	Duke University	United States	79.4	75.7	95.9	94.7	87
18	University of Pennsylvania	United States	78.8	74.9	94.8	96.7	86.9
19	The University of Melbourne	Australia	86.3	83.4	87.6	86.7	86.4
20	University of California, San Diego (UCSD)	United States	80.6	70.2	94	93.2	86.1
21	University of Washington	United States	78.5	68.5	92.8	96	85.5

22	McGill University	Canada	81.9	80.1	90.7	86.5	85.1
23	University of Edinburgh	United Kingdom	80.3	72.2	94.2	88.6	85
24	University of Michigan	United States	78.1	68.8	92.7	92.4	84.4
25	London School of Hygiene & Tropical Medicine	United Kingdom	78	69.5	96.8	87.8	84.3
26	The University of Tokyo	Japan	87.9	87.1	82.2	78.5	84
27	University of British Columbia	Canada	79.1	78.1	89.5	86.6	83.5
28	University of Chicago	United States	78.4	71.1	93.2	86.6	83.4
29=	National University of Singapore (NUS)	Singapore	85.3	89	84.7	76.5	83.3
29=	Monash University	Australia	82.5	80.6	86.2	82.8	83.3
31	Cornell University	United States	75.8	77.8	91.9	87.7	83
32	Washington University in St. Louis	United States	75.1	59.3	95.9	91.8	82.9
33	New York University (NYU)	United States	76.4	74.7	91.4	87.8	82.8
34	University of Hong Kong (HKU)	Hong Kong	85.7	82.3	85	75.9	82.7
35	McMaster University	Canada	76.4	61.8	95	88.6	82.6
36	University of Amsterdam	Netherlands	75.6	66.8	92.6	88.8	82.3
37	University of Copenhagen	Denmark	73.6	72.6	90.4	90.6	82
38	University of Pittsburgh	United States	74.2	56.5	92.9	91.6	81.5
39	University of Glasgow	United Kingdom	75.8	72.4	93.8	81.6	81.4
40	Seoul National University (SNU)	South Korea	80	79.3	84.6	80.1	81.1
41	Erasmus University Rotterdam	Netherlands	73.5	61.1	93.3	88.1	80.9
42=	Ruprecht-Karls-Universität Heidelberg	Germany	75.4	68	89.2	84.1	80.3
42=	Baylor College of Medicine	United States	76.4	53.2	92.2	85.5	80.3
42=	The University of Queensland (UQ)	Australia	77.6	76.3	84.9	81.7	80.3

45	Ludwig-Maximilians-Universität München	Germany	75.4	71.1	87.6	83.9	80.1
46	National Taiwan University (NTU)	Taiwan	79.7	82.6	82.9	76	79.9
47=	The Chinese University of Hong Kong (CUHK)	Hong Kong	79.8	80.8	86.3	73	79.8
47=	The University of Manchester	United Kingdom	75.7	71.1	87.9	81.6	79.8
47=	Boston University	United States	68.1	70.2	92.6	89.6	79.8
50	The University of New South Wales (UNSW)	Australia	76.9	81.4	85.2	78.1	79.7

Volume 11 • Issue2 • December 2018

WORLD DIGITAL LIBRARY

An International Journal

Printed and published by Dr Ajay Mathur on behalf of The Energy and Resources Institute, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi- 110 003, and printed at Innovative Designers & Printers, F-32/6, 1st Floor, Okhla II, New Delhi - 110 020. Editor Dr Partha Kalyan Bhattacharya

World Digital Libraries 11(2): 107-121 (2018)
DOI: 10.18329/09757597/2018/11207

Research Data Preservation in India: An Analysis based on Research Data Registry

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Abstract

The transformation of research toe-research emphasizes on the value of research data. Development of re3data.org, a unique registry for research data preservation across countries, is a great opportunity for researchers. This registry has been using a tool to identify the most effective repository resources for desired research. The primary objective of this article is to explore research data understanding in the Indian research community and the auxiliary objective is to depict an overview for present development of research data preservation in Indian repositories.

Keywords: Research, Data preservation, Research data repositories, Research data registry

5 Introduction

The term 'research data' is earning prominencein academic and research circles over a period of decade. It has been realized to enhance more visibility and sharing for research data. Distinguished international research organizations have been planning to share research data with open policy (Van et al., 2011). The preservation efforts ofresearch output are acquiring pace at various levels. While around the world research methodsare evolved as data-intensive research or e-research due to advancement oflnformation and Communications Technology. Thesis and dissertations are being digitized at a larger scale and data generated during research has been digitized and managed for sharing as well as long-lasting usage (Applebee and Bannon 2007).

Presently, the preservation of research outputshas been evolved as preservation of research data. ?lobally, top-ranked universities are developing mfrastructure and policies to preserve and manage the research data (Nielsen and Hjorland,2014). In India, the National Data Sharing and Accessibility Policy (NDSAP)-2012, strongly supported and convinced to share the government and research data which is generated through public funds by open data policy (NDSAP-2012). It has been realized publicly that sharing of data will determine better transparency and openness and standards(Report on Open Government Data in India). Preservation of scholarly work with latest techniques and vital sharing of resources were on the agenda of the National Knowledge Commission which came into existence in 2005. Distinguished efforts are underway by various research institutes and universities to preserve research outputs in terms of ETD (electronic thesis and dissertations). A national-level repository, Shodhganga, was established to achieve the aim of maximising the visibility of scholarly work and enhance its usage.

In this scenario, distinguished Indian research institutes and universities are coping to initiate digital preservation of research outputs, a relatively P new concept for the Indian research community. There continue to be certain instances of preservation of (research) data by research organizations in India as recognized by Research Data Repositories (RDRs).

Presently, re3data.org (Registry of ResearchData Repositories) has gathered more than 2,943 RDRs by various countries. Re3data. org is developed as a combined effort of the Department of Library and Information Services, German Research Centre for Geosciences, the Berlin School of Library and information at the Humboldt-University Berlin and the Library of Karlsruhe Institute of Technology.

Due to the distinguished nature of research data in various disciplines, re3data.org has been configured to accommodate various research data repositories as a contributor of research dataas well as users of it (Pampel et al., 2013). This article is an effort in understanding the workflowfor re3data.org registry and also analyse the Indian research data repositories registered on re3data.org.

6 Objectives

The core objectives of this study are as follows:

: ■ To observe research data awareness in theIndian context;

: ■ To describe the present workflow and schemaof re3data.org;

- To have an overall scenario oflndian RDR in re3data.org;
- To identify and analyse research data initiatives taken up in India as per the above directory.

7 Scope

While there are various available registries for repositories as Registry of Open Access Repositories (ROAR), Directory of Open Access

Repositories (OpenDOAR), etc., the number of RDRs indexed in these is quite less. Re3data.org is a research data-specific registry, so this study is limited to RDRs registered in re3data.org registry. The Indian RDR registered repositories have been identified and analysed.

8 Methodology

The heterogeneous nature of research data repositories makes it difficult to analyse as research data is available in plenty in every discipline and its volume is increasing progressively. The international non-for-profitbody, DataCite has initiated re3dat.org in the year 2016 with a vision of better sharing and visibility of research data.

A number of repositories are supporting digital curation of contents in the Indian environment. Some Indian repositories are specially supported to research data preservationin subject-specific domain. These initiatives
are considered to analyse the status of Indian research data preservation. In this study, the authors have explored basic set oflaws utilized for assessment of RDR landscape. Recently, Schema 3.0 for re3data.org has been introduced.Further analysis of Indian RDRs inre3data.org has been conducted through in-depth website investigations for each RDR.

9 Review of Literature

The RDM movement at the global level is a decade long. Effective management of researchdata in universities and research institutions
is being emphasized in literature worldwide. While looking at the literature published in Indiaby Indian authors, the following studies are pertinent:

Tripathi et al. (2017) have discussed that "the university libraries in India are in the veryearly stage of providing support for archiving, organizing and maintaining raw data; though a
similar trend has been reported from other partsof the globe." It has emphasized that research fraternity supports availability of free data for anyone. But researchers are not convinced to share their data.

The Indian Council of Social Science Research (ICSSR) has brought out the Data Deposit and Access Policy Guideline which describes that the ICSSR Data Service has been set up as a portal for the social science research communityand generators of datasets in India to deposit, use, reuse and analyse data with the objective of strengthening research and policy analysis capability.

Dora and Kumar (2015) have identified the need for management of research data in research institutions. They experienced that "In Indian Institute of Management, Ahmedabad, research is being emphasized for faculty recruitment and evaluation, leading to a situationwherein large volumes of research data would
be generated. In addition to this type of data, an increase in research data-based reference servicesby the library has forced the implementation of RDM service in the library."

Chand (2014) finds that quick and efficient research data services to the users in social science research libraries are a challenge to the librarians. Digital curation is a service by which librarians can provide well-organized and easy access to research data by using technology to theresearch community. The researchers' desire for new data drives data acquisition and that needs to be curated for wider access and preservation.

Chattopadhyay (2006) concludes in the paperthat "Preservation of digital information has
to deal not only with maintenance of the files themselves but also with ways of keeping them accessible." He realized compatibility of systems and formats with the advancement of technologyfor long-lasting data accessibility.

Arora (2006) emphasizes that "Preserving digital documents may require substantial new investments, since the scope of this problem extends beyond the traditional library domain, affecting digital records such as government records, environmental and scientific data, data on nucleic acid sequences,

human genome, documentation of toxic waste disposal, medical records, corporate data, and electronic-commerce transactions." He explained various issues of digital preservation in the view of librarians. Some significant issues are institutional policy and obligations, metadata implementation and copyright issues.

Beena et al. (2018) describing transferring IR into bibliographic system and indicates that content added to Dyuthi-the institutional repository is through searching of the web and subscribed databases. Due to this reason, the repository is not exhaustive in nature. Further contemplations took to the idea of creating personalized bibliographic systems for the individual faculty members or in other words a Bibliographic Information System for Science & Technology (BISSAT) to manage academic productivity of the institutions which facilitates information discovery from linked information, such as collaborative authors, multidisciplinary groups, and related works. The University Library thereby developed 'Yuj', the research gateway of Cochin University of Science & Technology, powered by open source software.

Mahato and Gajbe (2018) find that that Dataverse repository software focuses mainly onsocial science data, its improvisational tools to analyse and explore only for tabular data. The large datasets of geospatial data is handled by the Dataverse and with the help of world map, itcan tag the map using geolocation tag. Dataversealso has some features, such as the Guestbook template which allows recording the details of the users downloading the data, besides, it has option to make Dataverse featured and journal integration with OJS.

Manu (2018) presents the overview of the list of tools, techniques, and learning resources available for better managing the research data. The article will be helpful for critically analysing the various available tools and techniques that can be used for better research data management.

Shivarama et al. (2018) find that there is greatneed for digital curation in modern research libraries as the data and research they deal withcan never become obsolete, and would remain relevant for re-use and re-purposing. The paper focusses on recent trends and development in the subject digital curation. It analyses and defines the term digital curation, role oflibraries, archives, museums, and other organizations involved in heritage management.

Indian National Policy for Data

Through the Right to Information Act oflndiaof 2005, the Government of India initated public access of government data through public authority. Further emphasis on making data available in open access particularly the one generated from public funding has been highly emphasized. Dr Manmohan Singh, the former Prime Minister of India had addressed reliable data value in the Conference of Management of Statistics in September 9, 2008, at New Delhi. He said that, "Reliable statistics are necessary not only for economic decision making. Democratic governments also have a responsibility to consciously promote information sharing policies, which make information more widely available" (Singh 2008).

After long deliberations, the National Data Sharing and Accessibility Policy (NDSAP) has been framed in 2012. The objective of this policy is to share government authority owned data through an efficient network with easy format for machines and man. The NDSAP has been implemented in all government organizations. However, there continues to be a state of urgency to observe research data preservation value for the growth of the social, economic, and scientific growth of India.

Re3data.org Metadata Schema

The Re3metadata metadata schema has been compiled with general scope, taxonomy of contents, policy, and trustworthiness parameters. The metadata schema for RDR has been designedto analyse properties of a repository as well as designing of standards for RDR.

Repositories are classified on various parameters in re3data.org registry as detailed in Figure 1.

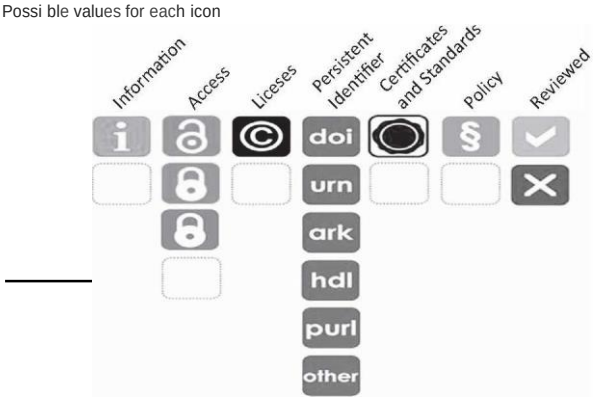

Figure 1 : Parameters for research data repositoriesin re3data.org
Source doi : 10.1371/ journal.pone.0078080 .g002

Accordin g to Schema 3.0 of re3data.org availableat <http://doi.org/10.2312/re3.008>, a repository has to qualify followingconditions:

1. Repository should have concentration on research data;
2. Administration and establishment of RDR representative body should be set up by laws;
3. Access for RDR should be properly defined;
4. Policy for usages is required.

Workflow procedure for re3data.org

Re3data .org has an open policy to initiate registration of RDR in registry. After submissionof required inform ation, it undergoes a round of editorial board review. Mandatory requirementsare checked through schema rules. All new suggestions for inclusion of records in registry pass through different editors for review; the workflow of registration in Re3data.org registry is summarized in Figure 2:

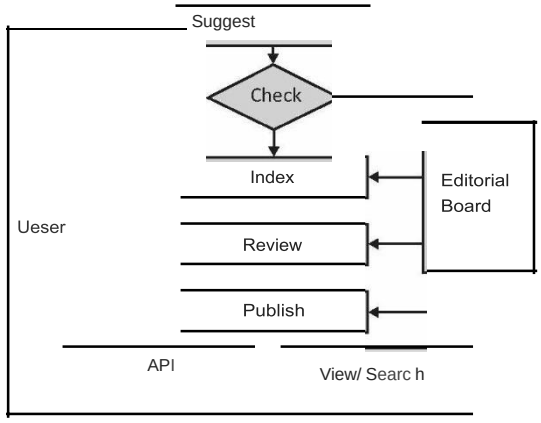

Figure 2: Workflow diagram for re3data.org

Indian institutions at re3data.org

Re3data.org has compiled research data repositories of 72 countries. Re3data.org has a procedural framework to analyse any RDR.

Sl.no	Country	No. of Research Data Repositories
	United States	980
2	Germany	324
3	United Kingdom	290
4	European Union	192
5	Canada	145
6	France	97
7	Australia	84
8	Switzerland	65
9	Japan	57
10	The Netherlands	50
11	India	43
12	China	38
13	Austria	33
14	Italy	31
15	Belgium	28

Table 1 : List of Top 15 countries, registered with re3data.org with maximum RDRs

As per statistics available on re3data.org, United States has maintaining highest numberregistered RDR in re3data.org, also Germany, United Kingdom, and European Union are following in numbers.

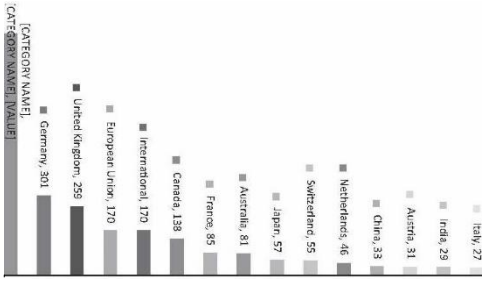

Figure 3: Present status of registered Research Data Repositories in re3data.org

India has a share of 43 registered repositories in re3data.org registry and has 11th position in countries with maximum registered research data repositories listed in Annexure-1.

Authors have explored each repository and analysed various indicators for 43 Indian research data repositories. Most of the efforts arein preliminary phase of repository registration while large data have not been populated in it.

On the basis of research data access and records availability, the following nine repositories have been selected and analysed:

10 Indicator: Y-Yes and N-No

I. Histome: It is a database of human histones and their post-translational modifications and modifying enzymes. Histome is a

Table 2 : Indian Research Data Repositories as per parameters of re3dat.org registry

Sl.no	Title of Research data repository	Additional Information on its services	Open access Policy for data access	licenses for sharing	Persistent identifier system applied	Certificationand Repository systems	Repository Policy available
	Histome	y	y	y	N	N	N
2	Human Protein Reference Database	y	N	y	N	N	y
3	Human Proteinpedia	y	y	y	N	N	y
4	India Biodiversity Portal	y	y	y	N	N	y
5	India Water Portal	y	y	y	N	N	y
6	Marine Microbial Database of India	y	y	y	N	N	y
7	MolTable	y	y	y	N	N	N
8	Open Government Data Platform India	y	y	y	N	N	y
9	Oral Cancer Gene Database	y	y	y	N	N	N

collaboration of two research institutes—Advanced Centre for Treatment, Research and Education in Cancer (ACTREC), Navi Mumbai, and the Centre of Excellence in Epigenetics (CoEE), Indian Institute of Science Education and Research (IISER), Pune. The Histone database consists of 5 types of histones, 8 types of their post-translational modifications, and different classes of modifying enzymes. The Histone database is organized in four modules as Histones and Variants, Post-translational modifications of histone proteins, the histone Infobase, and Histone modifying enzymes. The search option has been implemented by Google custom search and the advanced option has a covered option for selective database search.

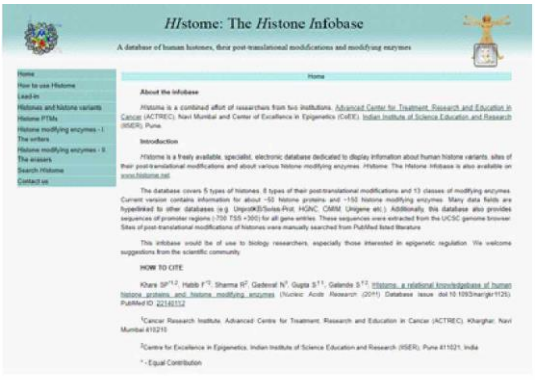

Figure 4: HISTOME website (Source URL: www.actrec.gov.in/histome)

2. **Human Protein Reference Database:** It is a repository to provide graphical and associated information related to domain architecture, post-translational modifications, interaction networks and disease association for each protein in human proteome. It is maintained by private organizations. The search options for various related databases are available with a drop down menu.
3. **Human proteinpedia repository:** It is a central database for human protein data.

Figure 5: Human Protein Reference Database website (Source URL: http://www.humanproteinpedia.org/)

Figure 6 : Human proteinpedia repository website (Source URL: http://humanproteinpedia.org/index_html)

This repository has sharing services for research data related to human protein data. Human proteinpedia repository initiative is the effort of private organizations.

4. **Indian biodiversity portal:** It is a combined initiatives of five institutions as Ashoka Trust for Research in Ecology and the Environment, Bangalore; Agharkar Research Institute, Pune; Foundation for the Revitalisation of Local Health Traditions, Bengaluru; National Chemicals Laboratory, Pune; University of Agricultural Sciences, Bengaluru, to manage biodiversity information of India. This repository, initiated in 2008, is also in the development phase and is utilized for aggregating and disseminating biodiversity information. All data is available with a creative commons license.

Figure 7: Indian biodiversity portal website (Source URL: Indianbiodiversity.org)

5. Indian water portal: It is a database for water-related knowledge in India. This repository is an effort of National Knowledge Commission and is managed by Arghyam, an Indian public charitable foundation. This is a database about Indian water resources and specific region problems. Resources are shared under creative commons attribution-share Alike license.

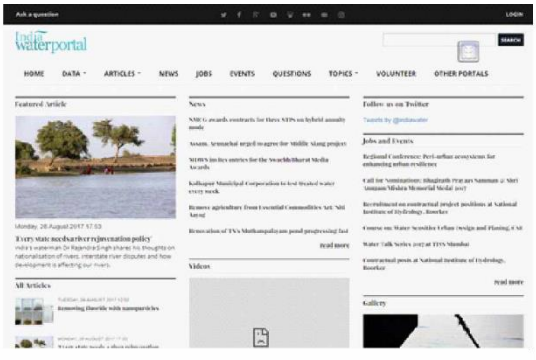

Figure 8 : Indian water portal (Source URL: www.indianwaterportal.org)

6. BioSearch: Marine biodiversity database of India: It is an initiative of Biodiversity Informatics Group and National Institute of Oceanography, Goa.
This database has been established to utilize and share marine biodiversity of Indian waters. The BioSearch database provides information about various distinguished water organisms with different parameters.

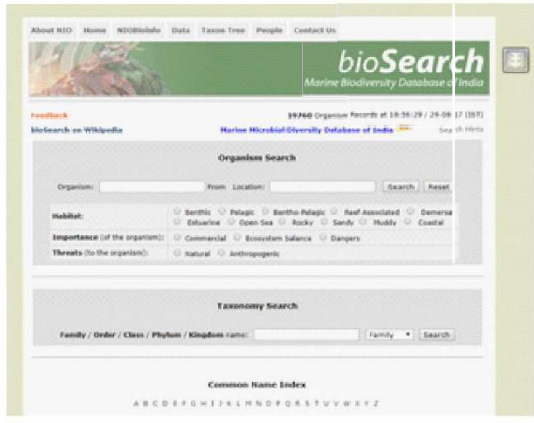

Figure 9 : BioSearch website (Source URL: http://www.biosearch.in)

7. Moltable: Open Molecular Repository: It has been initiated by Digital Information Resource Centre, National Chemical Laboratory, CSIR, Pune.
This repository contains harvested chemical information and molecular data from the Google search engine which is utilized in latest research.

Figure 10: Moltable website (Source URL: http://www.actrec.gov.in/OCDB/index.htm)

8. Open Government Data (OGD) Platform of India: It is a repository to systematize and share data resources developed by various departments and ministries of the Indian government. A joint initiative of the National Informatics Centre, Government of India and General Service Administration, United States Government, this platform is

Figure 11: Open Government Data (OGD) Platformof India website (Source URL: https://data.gov.in/)

developed on D rupal, O pen source contentm anagem ent software. The OGD repositoryhas wide variety o f data w ith around
117.485 resources, 4.219 catalogues, and 106contributed departm ents / ministries.

9. O ral Cancer Gene Database: It is developed by Advanced Centre for Treatm ent, Research & Education in Cancer, Tata

M em orial Centre, an autonom ous grant-in- aid institution of the D epartm ent o f Atomic Energy (DAE), G overnm ent of India. This

repository has resources about various genes

related to oral cancer.

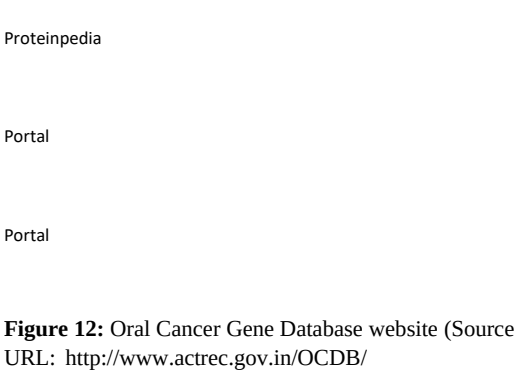

Figure 12: Oral Cancer Gene Database website (Source URL: http://www.actrec.gov.in/OCDB/

index.htm)

Analysis

The authors have explored registered Indian research data repositories in re3data.org for different datasets sufficient data. These repositories have beenanalysed w ith the following parameters:

1. **RDR provides additional inform ation on its services:** All nine RDRs have additional inform ation on its services, w hich implies exploring datasets links. The users have further options to analyse and extract the required inform ation.
2. **RDR provides open access to its data:** The H um an Protein Reference Database m anaged by private organizations has not opened access for users while all eight RDRs have the open access policy for users.
3. **The terms o f use and licenses o f the data are provided by the RDR:** All nine RDRs have either term s of use or licenses for data sharing

Table 3 : Types of licenses in Indian Research Data Repositories registered with re3data.org

Sl.no	data repository	Title of Research	Terms of use & licenses for sharing
1		Histome	Public domain
2	Reference Database	Human Protein	Copyrights
11	Proteinpedia	Human	Intellectual Property Policy
12	Portal	India Biodiversity	Data Sharing Policy & CreativeCommons
13	Portal	India Water	Copyrights and Creative Commons
14	Database ofIndia	Marine Microbial	Data use agreement &Open license
15		Mol Table	Open policy
16			Open Government Data Platform

and resources. O ut o f 43 RDR, only 9 repositories are functional and have

Figure 11: Open Government Data (OGD) Platform of India website (Source URL: https://data.gov.in/)

developed on Drupal, Open source content management software. The OGD repository has wide variety of data with around 117.485 resources, 4.219 catalogues, and 106 contributed departments / ministries.

9. Oral Cancer Gene Database: It is developed by Advanced Centre for Treatment, Research & Education in Cancer, Tata Memorial Centre, an autonomous grant-in-aid institution of the Department of Atomic Energy (DAE), Government of India. This repository has resources about various genes related to oral cancer.

Figure 12: Oral Cancer Gene Database website (Source URL: http://www.actrec.gov.in/OCDB/index.htm)

Analysis

The authors have explored registered Indian research data repositories in re3data.org for different datasets and resources. Out of 43 RDR, only 9 repositories are functional and have sufficient data. These repositories have been analysed with the following parameters:

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Table 3 : Types of licenses in Indian Research Data Repositories registered with re3data.org

Sl.no	Title of Research data repository	Terms of use & licenses for sharing
1	Histome	Public domain
2	Human Protein Reference Database	Copyrights
3	Human Proteinpedia	Intellectual Property Policy
4	India Biodiversity Portal	Data Sharing Policy & Creative Commons
5	India Water Portal	Copyrights and Creative Commons
6	Marine Microbial Database of India	Data use agreement & Open license
7	Mol Table	Open policy
8	Open Government Data Platform India	Terms of use and Open policy
9	Oral Cancer Gene Database	Open policy

4. **RDR uses DOI to make its provided data persistent, unique and citable** All registered RDRs do not have any DOIs to make the 'provided' data persistent, unique, and citable.

5. **Timeline for registration oflndian RDRs:** Development of registration of Indian RDR in re3data.org has been observed since 2012.

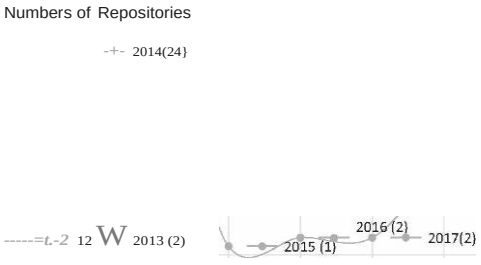

Figure 13 : Timeline of development for re3data.org registered Research Data Repositories in India

6. **Keywords for RDRs:** All the registered RDRs in re3data.org have been classified under various keywords in the registry. The maximum number of RDRs have been registered under keyword as 'India'.

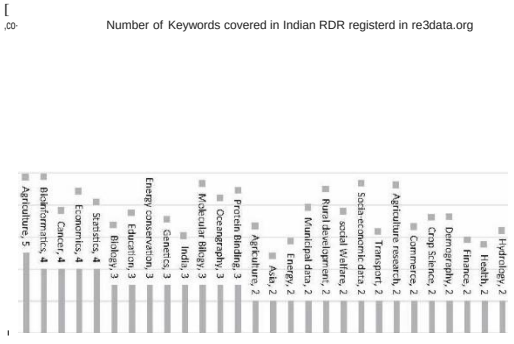

Figure 14: Keywords classification of Indian RDRs in re3data.org registry

7. **Indian repository having any repository standard or certification** All the Indian RDRs are in the primary phase of research data preservation. While the Open Government Data Portal has been designed by the National Informatics Centre, India with robust capabilities to deal datasets of diversified disciplines. This public domain database provides facilities to interact with users through visualization and APIs, Alerts, etc. Open Government Data portal is an initiative by the Government of India to measure the requirements and orientations of data generated by government ministries and departments. None of the Indian data repositories have any repository standards or certifications.

18 Conclusion

Research data is valuable and pervasive with infinite possibilities for usage. The government bodies are spending a good share of public funds on research. In this view, research data should be a free to access resource for the public.The Indian research community is realizing research data relevance and utilization. In the last decade, the Government of India had finalized various policies to digitally preserve and distribute research data, such as the NDSAP, Digital India Initiative, Digital Governance, National Knowledge Commission, Shodhganga national thesis repository, etc. Presently, Indian research data & output is in the planning phase of preservation and management. We do not just require digital preservation but policies that are able to deal research data with Research Data Management concepts. It is imperative that the national policy for curation and management of research data be declared which may be a pioneer step in this direction.

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20 Annexure 1: List of Indian RDR in re3data.org

Sl.no	Research data repository	Year of Origin	Affiliation
1	ACEpepDB: Peptide Database	**2014**	CSIR Central Food Technological Research Institute
2	bioSearch: Marine Microbial Database of India	**2014**	National Institute of Oceanography, Bioinformatics Centre
3	Chickpea Transcriptome Database	**2016**	Private Institute
4	Clinical Trials Registry-India	**2014**	**ICMR** National Institute of Medical Statistics
5	Cotton Database	**2018**	Central Institute for Cotton Research In India.
6	**CSISA** Data Repository	**2018**	Cereal Systems Initiative forSouth Asia **(CSISA)** Research Data
7	Database on Indian Economy	**2014**	Reserve Bank of India
8	Experimental Tropical Watersheds	**2015**	Private Institute
9	Export Import Data Bank	**2014**	Department of Commerce & Industry, Govt of India
10	Histome	**2014**	Indian Institute of Science Education and Research
11	Human Protein Reference Database	**2014**	Private Institute
12	Human Proteinpedia	**2014**	Private Institute
13	ICRISAT Dataverse Network	**2013**	Private Institute
14	ICSSR Data Service : Social Science Data Repository	**2017**	Social Science Data Repository

Annexure 1: Contd..

Sl.no	Research data repository	Year of Origin	Affiliation
15	IMEx	2014	The International Molecular Exchange consortium
16	India BiodiversityPortal	2014	Private Institute
17	India Energy Portal	2014	Government of India, National Knowledge Commission
18	India EnvironmentPortal	2014	Government of India, National Knowledge Commission
19	India Water Portal	2014	National Knowledge Commission
20	Indian Genetic Disease Database	2014	Indian Institute of ChemicalBiology, CSIR Initiative
21	Indian Space ScienceData Center	2014	Indian Space Science Data Center
22	lndiaVotes	2018	Private
23	Krishi - Knowledge based Resources Information Systems Hub for Innovations in Agriculture	2013	Indian Council of Agricultural Research
24	Lok Dhaba	2018	Private
25	Maharashtra StateData Bank	2018	Govt of Maharastra (India)
26	International OceanDiscovery Program	2018	Integrated Ocean Discovery Program
27	MolTable	2012	National Chemical Laboratory, Digital Information Resource Center
28	National Genomic Resources Repository	2017	Private
29	North East ResourcesDatabank	2014	North Eastern Development Finance Corporation Ltd.

Contd...

21 Annexure 1: List of Indian RDR in re3data.org

Sl.no	Research data repository	Year of Origin	Affiliation
30	Ocean Data and Information System	2014	Indian National Centre for Ocean Information Services
31	Open Government Data Platform India	2014	Government of India, National Informatics Centre
32	Open Government Data Portal of Sikkim	2018	Government of Sikkim
33	Open Government Data Portal of Surat City	2018	Surat Municipal Corporation, India
34	Open Government Data Portal of Tamil Nadu	2018	Government of Tamil Nadu, India
35	Oral Cancer GeneDatabase	2014	Advanced Centre for Treatment, Research and Education in Cancer, Tata Memorial Centre
36	Pune Datastore	2018	Municipal Corporation ofPune
37	TBNet India	2014	Institute of Bioinformatics, Bangalore
38	Telangana Open DataPortal	2018	Government of Telangana
39	The International Molecular Exchange Consortium	2014	Private Institute
40	TropFlux	2014	Earth System Science Organization - Indian National Centre for Ocean Information Services
41	Unified-District Information System for Education	2014	National University of Educational Planning and Administration, Department of Educational Management Information System

Annexure 1: Contd..

ISSN (Print): 0972-2467
ISSN (Online): 0976-2477
DOI: 10.17821/srels/2019/v56i2/131578

Sl.no	Research data repository	Year of Origin	Affiliation
42	World Data Centre for Geomagnatism, Mumbai	2014	Indian Institute of Geomagnetism, Mumbai
43	WorldClim - GlobalClimate Data	2016	Private Institute

(http://www.re3data.org accessed on 26 June 2018)

Emergence of Research Data Literacy with Special Reference to India

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Abstract

Preservation of research data is an important policy requirement for universities and research organizations so as to manage research data at organizational level and make it available lifelong. However, the importance research data management especially in the context of e-research and data intensive research is not widely recognized both by researchers and research organizations due to lack of research data literacy. In the Indian context, it is essential to formulate a national data sharing and accessibility policy so that Indian universities and research organizations can cope research data.

Keywords: Research Data, Research Data Literacy, Research Data Management, Research Data Literacy-India

1. Introduction

Universities and research organisations have always been focussed on research and, in recent years, the need to make research data freely accessible has been emphasized; many institutional repositories and subject/national repositories have been established. In the course of any research a large amount of data gets generated. Not all of this data will find a place in the final theses / dissertation or research report which necessitates managing this data. Though research data literacy concept is about a decade old it has not been explored so far in this country and this study is an attempt in this direction.

1.1 Objectives

The core objectives of this study are to:

a. Examine the relevance for research data globally.
b. Examine the status of research data management in prominent universities and to discuss relevance and barriers of research data literacy.
c. Analyse research data literacy preparedness in India

1.2 Scope

Research data management is being considered significant for better research outcomes at the global level. The scope of this study is to examine the mandate for research data management in prominent universities and organizations.

1.3 Methodology

This paper is divided into two parts; part one covers global developments about research data management and research data literacy. This part is based on secondary sources of information. Various research papers, reports, repositories, policy documents have been used. For part two, which deals with India's preparedness, secondary sources along with primary information received about the CSIR (re3data.org) is used along with the observations about the developments taking place in the country.

2. Towards Research Data Literacy: Developments at the Global Level

21st century is the age of data which is generated, utilized, converted, analysed, transformed and applied in day to day life. during the course of research, data gets generated, which when applied generates more data. Problem specific data have been utilized in various decision and policy framing activities. Data is available everywhere and is

openly accessible worldwide, while its interpretation and orientation decide its value (Gurria, 2007). It is essential to develop research data literacy to achieve global scientific standards. Research data and data literacy are both basic pillars of research data literacy. In the words of John Wilbanks, "Modern research may be conducted on the shoulders of research data dealing parameters those define capacity of archiving of data, analysis and management of data (Shearer, *et al.*, 2010). Present data intensive research demands extensive support of research data management (Hey, *et al.*, 2009).

OECD (Organization for Economic Co-operation and Development) - a special group of thirty countries to address global challenges - has realized that global development will happen through innovative scientific growth and has recommended guidelines for research data. It will only be possible through global exchange of research data based on agreed principles. The aim of OECD is to assemble a research data efficient global science infrastructure (Gurria, 2007). The outline report of UK Data service in 2014, recommended various measures including enabling researcher to understand their responsibility about research data. Secondly it recommends transparency of generated research data as required by governments and research funding agencies. Finally, efficient management of research data is also a requirement for economic development (Mandinach, & Gummer, 2013).

In 2003 the Committee of Support of Research at U.K prepared a report on policies and futuristic demand for curation of primary research data. The recommendations related to digital research data preservation and suggested high end management of research data as having the potential to contribute to save funds to avoid infrastructure expenditure (Woollard, & Corti, 2014).

The data working group of Cornell University submitted a digital research data curation report in 2008 suggesting the need to develop an environment that supports efficient curation, transformation, analysis and sharing of research data (Albert, *et al.*, 2008).

Understanding of research data demands data literacy curriculum starting at higher secondary education level. Data literacy abilities of researchers should make them capable of dealing with the process of transformation from raw data to linked information. The set of skills for data literacy comprises proper understanding of data with required archiving techniques and organizational knowledge (Vahey, *et al.*, 2006).

3. Conceptualising Research Data Literacy

According to Engineering and Physical Sciences Research Council "Research data is 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" (EPSRC expectations on Research Data Management, n.d.).

Elsevier support services indicate that "the precise notion of what constitutes research data will differ from field to field". It may be any type of data which is directly linked to the output and results. Research data may be observational, statistical, data without analysis, the records and output of a scientific device, data from surveys, digital scans / readings (Research data policy at Elsevier support services, n.d.).

There have been many other institutions and organizations that have defined research data (Research data policy, n.d.; Defining Research data, n.d.; Data guide, n.d.; University of Edinburgh data policy, n.d.; Steen, 1999.

4. Research Data Management Policies

Canadian Association of Research Libraries Data Management Sub-committee prepared a toolkit for data management in 2008 The report admitted the role of efficient management of research data to achieve swift scientific progress. It was observed in the report that shared research data can increase the visibility of research. The report recommended management of research data in projects funded by funding agencies (CARL Data Management Sub-Committee, 2009).

Monash University research data management policy explained that research data for various disciplines may be different in nature. Social science researchers may generate research data in the form of statistics, results and interviews while humanities research work may be

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in texts. Sometimes research involves using existing data, collecting or creating new data itself" (Managing research data, n.d.).

5. Barriers to Research Data Literacy

Data literacy is a combination of information, digital, visual and media literacy. The present working generation in research and education is not fully digitally literate but due to versatile experience they have authority to command and frame the future development. It has been identified many times on failure of policies (Ridsdale, *et al.*, 2015).

It has been observed in various fields that data skill of employees always enhances their performance and output, but daOpen data initiatives are getting attention around the world. Research data literacy may be developed by connecting open data repositories with capabilities of translation, format interchange and analytical tools, also back end support of an efficient federated search engine.

6. Echo of Research Data Management

Research data management comprises organization of research data during complete life cycle of data. Many universities and research organizations. The League of European Research Universities (LERU) Roadmap for Research Data has acknowledged the new era of data driven science in universities (Clements, 2013). Research data policies/practices at different universities around the world are summarized.

The University of Iowa identified pitfalls in research data management by interviewing individual researchers and drafted a data management report (Educause, 2006). Monash University, Australia published a *Research Data Management Strategy and Strategic Plan 2012–2015*, (Johnsson, & Ahlfeldt, 2015). Loughborough University started a new platform to manage research data. It had been launched to maintain long-term archiving and provides unique search facilities (Johnston, 2014). University of St Andrews initiated research information management infrastructure to support research data management (Lin, 2012).

Michigan State University, University of Minnesota and University of California, University of Pittsburg in the USA have also initiated research data management (Max, 2016; Nordenberg, 2009; Rice, 2013; Courses: Research Data Management and Sharing, n.d.). Lund University, Sweden and La Trobe University, Australia have also initiated research data management (CSIR Central : Mandate, n.d.). It was observed that in most cases the research data gathered by researchers is stored in user devices and there was a lack of awareness of the importance of long-term preservation and sharing of research data. Users surveys have suggested a loss of productivity and resources. Research data management needs to be made a component of research policy of universities and research organizations so as to educate researchers (Trewhella, 2014). Te Pokai Tera University, New Zealand introduced a Research Data Management framework in 2016. A research data working group was established to diagnose status of research data in all units. After long deliberations of research data working group several key benefits are noted in the report. Recommendations have also been made to start programmes about knowledge and use of research data (MANTRA: Research Data Management Training, n.d.).

University of Edinburg started Research Data Management planning to support nationwide research data service. It has been initiated with a mission to change researcher perception regarding research data. The roadmap for management of research data has been framed with a governance model that includes combined efforts of academicians and technologists. The University developed DMPonline tool for research data management life cycle (Wright, 2012).

7. Learning Opportunities for Research Data Literacy

Research data literacy and data literacy are two related concepts while research data is a subset of data. The need of research data literacy has risen due to importance of data in research. Various Suitable training for research data management have been proposed: For example, the University of Edinburg offers a free 9-module online course, MANTRA (Shrivastava, & Gupta, 2018). University of North Carolina and the University of Edinburg offer a MOOC on Research Data Management and Sharing.

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8. Research Data Literacy for India

Global review strongly indicates the importance of research data management. Preparedness for research data literacy in India cannot be assessed easily as all Indian research output is still not available in digital form. Research data understanding in Indian information professionals and research communities is developing slowly, after launching of programmes as Shodhganga – a national thesis and dissertation repository in 2009, National Data Sharing and Accessibility Policy – 2012 and Digital India programme in 2015 and The Data (Privacy and Protection) Bill in July 2017.

Indian government efforts at open data movement have been started by framing of National Public Information Infrastructure. Also, National Spatial Data Infrastructure as a specific division of Government of India has been established to evaluate open data projects worldwide. Such developments for open data in Indian government policies and practices are indicators of data intensive governance, which may be achieved by sharing research data created by government or public funded research.

CSIR, being one of the leading institutions for research in India is considered here to sense readiness. For this purpose, Scimago institutions ranking has been used taken. CSIR (Council of Scientific and Industrial Research) has got first rank in Scimago ranking.

CSIR is a leading research organization of India collaborating with industrial partners. Presently, it has 44 specialized laboratories which conduct research in various fields. Under CSIR open access mandate each laboratory is required to develop an (Institutional Repository (IR) to provide open access to full texts of research publications with in respective laboratory. There is also a CSIR-Central repository.

DataCite is a not for profit organization, which has developed Re3data.org, a registry to index research data repositories. Identification of IR as research data repository is done on various parameters (presented in Schema 3 of re3data.org).

Awareness of research data literacy in Indian research community can be gauged by development of IRs by CSIR laboratories. So, all working IRs of CSIR were submitted to registry of re3data.org.

Only 32 of the 44 CSIR laboratories have registered IRs (Annexure 1). Only 13 IRs were found working. Central Glass and Ceramic Research Institute has highest number of items registered.

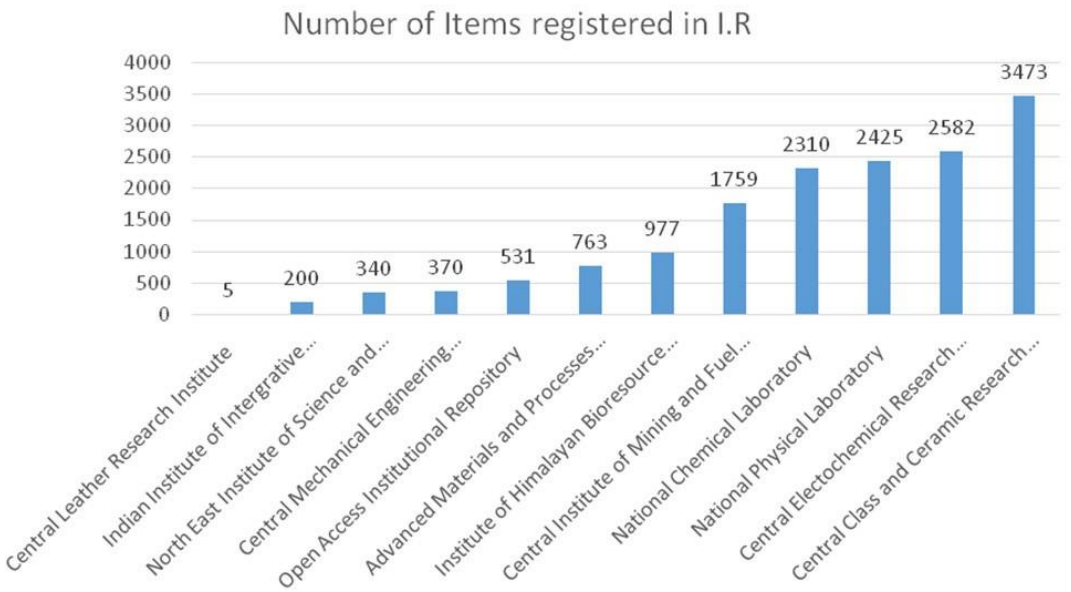

Figure 1. CSIR working I.R with number of registered items

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Re3data.org registry has an open contribution service for research data repositories. IRs of all CSIR laboratories were submitted by the authors to the registry for evaluation. After analysis of the contents and its structure none of the IRs was found suitable to be considered as research data repository by re3data.org.

It was advised by the registry to develop focused research data preservation to qualify for registration.

A previous study by the authors had suggested that Re3data.org registry has around 43 Indian research data repositories. These are in preliminary phase of repository registration and the IRS are not populated with large data. This emphasises the need for research data literacy in India. In a recent development, Indira Gandhi National Centre for Arts has started a new part-time one-year Post Graduate Course on Digital Library and Data Management.

9. Conclusion

Research data management needs proper planning covering organizational and technological aspects. The planning phase of research data management requires mandatory research data literacy for researchers and stake holders. Management of research data is essential for present and future. It is widely recognized that research data literacy for successful research data management. Research data literacy should be an integral part of higher education curriculum. Long term and need based research data literacy need to be introduced in India for bringing out a change in the mindset about research data management.

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Annexure 1

Sl.no	Institutional Repository	CSIR Institute	Items	Full text	Open access	Working Status
1	ir@ampri	Advanced Materials and Processes Research Institute	763	13%	2%	Working
2	ir@csir-ceeri	Cental Electronics Engineering Research Institute	NA	NA	NA	Working
3	ir@cbri	Central Building Research Institute	N/A	N/A	N/A	N/W
4	ir@cgcri	Central Class and Ceramic Research Institute	3473`	83	6	Working
5	ir@cdri	Central Drug Research Institute	N/A	N/A	N/A	N/W
6	ir@cecri	Central Electochemical Research Institute	2582	98	46	Working
7	ir@cftri	Central Food Technological Research Institute	N/A	N/A	N/A	Working
8	ir@cimfr	Central Institute of Mining and Fuel Research	1759	43	6	Working
9	ir@clri	Central Leather Research Institute	5	100	100	Working

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10	ir@cmeri	Central Mechanical Engineering Research Institute	370	0	0	Working
11	ir@crri	Central Road Research Institute	N/A	N/A	N/A	N/W
12	ir@csmcri	Central Salt & marine Chemicals Research Institute	N/A	N/A	N/A	N/W
13	ir@c-mmacs	Centre for Mathematical Modelling and Computer Simulation	N/A	N/A	N/A	N/W
14	ir@iict	Indian Institute of Chemical Technology	N/A	N/A	N/A	N/W
15	ir@iiim	Indian Institute of Intergrative Medicine	200	100	1	Working
16	ir@iip	Indian Institute of Petroleum	N/A	N/A	N/A	N/W
17	ir@iicb	Institute of Chemical Biology	N/A	N/A	N/A	N/W
18	ir@igib	Institute of Genomics and Integrative Biology	N/A	N/A	N/A	N/W
19	ir@ihbt	Institute of Himalayan Bioresource Technology	977	83	11	Working
20	ir@imtech	Institute of Microbial Technology	N/A	N/A	N/A	N/W
21	ir@immt	Institute of Minerals and Materials Technology	N/A	N/A	N/A	N/W
22	IR@NAL	National Aerospace Laboratories	N/A	N/A	N/A	N/W
23	ir@ncl	National Chemical Laboratory	2310	77	49	Working
24	IR@NEERI	National Environmental Engineering Research Institute	N/A	N/A	N/A	N/W
25	IR@NIIST	National Institute for Interdisciplinary Science and Technology	N/A	N/A	N/A	N/W
26	IR@NIO	National Institute of Oceanography	N/A	N/A	N/A	N/W
27	IR@NISCAIR	National Institute of Science Communication and Information Resources	N/A	N/A	N/A	N/W
28	IR@NML	National Metallurgical Laboratory	N/A	N/A	N/A	N/W
29	ir@npl	National Physical Laboratory	2425	100	29	Working
30	ir@neist	North East Institute of Science and Technology	340	100	100	Working
31	ir@neeri	Open Access Institutional Repository	531	99	16	Working
32	IR@SERC	Structural Engineering Research Centre	N/A	N/A	N/A	N/W

Conference Attended

1. The Environment : Challenges and opportunities of E-Resources Organized by United Nations Information Centre for India and Bhutan, National Social Science Documentation Centre (ICSSR) & Delhi Library Association on 16 September 2016 at New Delhi.

The Environment: Challenges and Opportunities of E-Resources

Discussion organized by

United Nations Information Centre for India and Bhutan
National Social Science Documentation Centre (ICSSR)
&
Delhi Library Association

This is to certify that MR. PRASHANT SHRIVASTAVA *participated in the above discussion as Delegate/~~Guest Speaker~~ on 16 September 2016 in New Delhi.*

Mr. Rajiv Chandran
Officer-in-Charge
UNInformation Centre for India &Bhutan

2. 3rd iETD National Conference Organized by INFLIBNET on 5th to 7th October 2016 at Gandhi Nagar Gujarat.

ETD-2016
Electronic Theses and Dissertations
shodhganga
A reservoir of Indian theses

INFLIBNET

Certificate

Date : 07/10/201

of Participation

Awarded to

Mr. Prashant Shrivastava

for paper presentation / participation in the 3rd iETD National Conference on

"Evolving ETDs to Knowledge Repositories"

organised by Information and Library Network (INFLIBNET) Centre
from 05th to 07th October, 2016 at Gandhinagar, Gujarat, India.

(Manoj Kumar K)
Convener

(Dr. Jagdish Arora)
Director

3. Four days International conference on digital libraries (ICDL) – 2016 on 13th – 16th Dec 2016, organized by the TERI, New Delhi.

The Energy and Resources Institute

ICDL 2016: SMART FUTURE

Knowledge Trends that will Change the World

13–16 December 2016 | IHC, New Delhi, India

CERTIFICATE OF PARTICIPATION

This is to certify that

PRASHANT SHRIVASTAVA from AIIMS, N. Delhi

has participated/presented paper/poster in the conference.

Ajay Mathur
Chair, ICDL 2016
Director-General, TERI

Prabir Sengupta
Co-Chair, ICDL 2016
Distinguished Fellow, TERI

P K Bhattacharya
Organizing Secretary, ICDL 2016
Fellow and Area Convenor
Knowledge Management Division, TERI

Shantanu Ganguly
Organizing Secretary, ICDL 2016
Fellow
Knowledge Management Division, TERI

4. One day national seminar on " NML-ERMED consortium : role of medical librarianship" on 07 April 2017, organized by National Medical Library, Director General of Health Services , GOVT of India.

सत्यमेव जयते

National Medical Library
Directorate General of Health Services
Ansari Nagar, New Delhi 110029

Certificate

awarded to

Prof/Dr / Mr / Mrs. Prashant Shrivastava Paper Presenta for participating in one day National Seminar on " NML ERMED CONSORTIUM : Role of Medical Librarianship " on 07th April 2017.

Dr. K. P. SINGH
Director
National Medical Library

OXFORD UNIVERSITY PRESS · Wolters Kluwer · CAMBRIDGE UNIVERSITY PRESS · BMJ · WILEY

Workshop Attended

1. One day workshop on role of Library in Clinical Research organized by BBDL, AIIMS, New Delhi on 27 July 2016 at AIIMS, New Delhi.

All India Institute of Medical Sciences
Dr. B.B. Dikshit Library
New Delhi

शरीरमाद्यं खलु धर्मसाधनम्

Presents this

Certificate of Participation

to

Dr./Mr./Ms. Prashant Srivastava

for his / her active and invaluable participation during the conduct of an one day workshop on "*Role of Libraries in Clinical Research*" organized by Dr. B.B. Dikshit Library, AIIMS, New Delhi held on 27th July, 2016 at Conference Hall, AIIMS, New Delhi.

Given this 27th July, 2016 in New Delhi, India.

Dr. S. Siva Chidambaram
Organising Secretary
Chief Librarian

Prof. M. C. Misra
Director, AIIMS, New Delhi

2. Two day workshop on Institutional Digital Repository and Medial Metadata Engineering on 20-21 Oct 2016 organized by B.B.D.Library, AIIMS, New Delhi and IIT khargpur under Digital Library Project.

National Digital Library (NDL)
(A NMEICT Project, MHRD, Govt. of India)

शरीरमाद्यं खलु धर्मसाधनम्

CERTIFICATE

This is to Certify that Dr./Mr./Ms./Mrs. Prashant Srivastava
from B.B.D. Library, AIIMS, New Delhi
has participated in two days "Workshop on Institutional Digital Repository and Medical Metadata Engineering" during 20th & 21st October, 2016 jointly organized by Dr. B.B. Dikshit Library, All India Institute of Medical Sciences, New Delhi and IIT Kharagpur under National Digital Library Project sponsored by MHRD, Govt. of India at AIIMS, New Delhi.

Dr. S. Siva Chidambaram
Chief Librarian
AIIMS, New Delhi

Prof. S. Rajeshwari
Professor In-charge/Library
AIIMS, New Delhi

Dr. B. Sutradhar
Librarian
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