Shodhganga Metadata Standards and Other Electronic Theses & Dissertations (ETD) Standards: A Comparative Study and Analysis

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Abstract

Electronic Theses and Dissertations (ETDs) play a crucial role as valuable scholarly resources, requiring interoperable and internationally standardized metadata for effective discovery and sharing. Shodhganga, hosted by the INFLIBNET Centre, stands as a prominent repository for ETDs in India. It serves as a vital platform for preserving and disseminating research work conducted in academic institutions across the country. Since its establishment in 2011, Shodhganga has been collecting theses data from various universities and institutions in India. Similarly, repositories worldwide have recognized the significance of ETDs and have been established to collect and distribute these valuable works, providing researchers and the academic community with access to a wealth of knowledge. Notable repositories include ProQuestGlobal (PQDT), which hosts a comprehensive collection of ETDs from universities worldwide. DART-Europe E-theses Portal acts as a collaborative platform, granting centralized access to ETDs from European universities. The Networked Digital Library of Theses and Dissertations (NDLTD) is an international organization dedicated to promoting ETD adoption and dissemination. Additionally, PQDT Open, a subset of ProQuest, provides access to a substantial collection of open-access Theses and Dissertations.

These repositories serve as invaluable resources, enabling researchers to explore a wide range of research topics and facilitating knowledge sharing within the academic community. To ensure effective organization and description of the stored ETDs, repositories adhere to specific metadata standards. These standards guarantee consistent capture of essential details, such as Author names, Titles, Summaries, Subject categories, and Keywords. By employing these standards, repositories, simplify the process of discovering and utilizing ETDs, making research more streamlined and accessible. In line with the importance of metadata standards, this paper aims at comparing and analyzing the metadata standards employed by Shodhganga with other established ETD standards. The study seeks to identify similarities and differences between Shodhganga and widely implemented ETD standards. The outcomes of this analysis will contribute to advancing knowledge in metadata practices within the ETD field, ultimately aiding in the development of improved standards for ETD repositories.

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1. Introduction

In the contemporary landscape of academic and research dissemination, digital repositories have emerged as pivotal platforms for the storage, organization, and dissemination of scholarly output. Among these repositories, Shodhganga, created and maitained by the INFLIBNET Centre, has gained significant recognition in India. Serving as a digital library for Electronic Theses and Dissertations (ETDs), Shodhganga plays a crucial role in preserving and sharing valuable academic research works. ETDs, representing a wealth of research and knowledge, require standardized information to ensure their accessibility to a global audience. Shodhganga has been fulfilling this mission since its establishment in 2011, actively collecting ETDs from diverse universities and institutions across India. Moreover, Shodhganga holds a distinct status as a National Repository of ETDs awarded in Indian Universities. The search and discovery of ETD content within this repository are of paramount importance for researchers, necessitating a semantic approach. The creation of metadata and its organization into logically linked relations has been proposed, offering the potential for a semantic visual browser to enhance the user experience. (Manoj.K, 2012)[1].

The Institutional Repository (IR) is a modern concept that captures and makes available through internet and its intranet the institutional research output and other relevant documents to the users by way of digitizing the output. The IR's have already started emerging in India. Most of the repositories are using open source information repository software like E-Prints, DSpace, and Fedora. It is observed that generally documents like theses, dissertations, seminar papers, journal articles, etc., are being found more in the repositories as IR. (Chandran Velmurugan,2010)[2].

Similarly, repositories worldwide have recognized the significance of ETDs and have been established to collect and distribute these valuable works, providing Researchers and the academic community with access to a wealth of knowledge. Notable repositories include ProQuestGlobal, which host a comprehensive collection of ETDs from universities worldwide. DART- Europe E-theses Portal acts as a collaborative platform, granting centralized access to ETDs from European universities. The Networked Digital Library of Theses and Dissertations (NDLTD) is an international organization dedicated to promoting ETD Adoption and dissemination. Additionally, PQDT Open, a subset of ProQuest, Provides access to a substantial collection of open-access theses and dissertations.

These repositories serve as invaluable resources, enabling researchers to explore a Wide range of research topics and facilitating knowledge sharing within the academic Community. To ensure effective organization and description of the stored ETDs, Repositories adhere to specific metadata standards. These standards guarantee Consistent capture of essential details, such as Author names, Titles, Summaries, Subject categories, and Keywords. By employing these standards, repositories Simplify the process of discovering and utilizing ETDs, making research more Streamlined and accessible. In line with the importance of metadata standards, this Paper aims to compare and analyze the metadata standards employed by Shodhganga with other established ETD standards.

The study seeks to identify similarities and differences between Shodhganga and Widely implemented ETD standards. The outcomes of this analysis will contribute to Advancing knowledge in metadata practices within the ETD field, ultimately aiding in the development of improved standards for ETD repositories.

As per University Grant Commission (UGC) notification (Minimum Standards & Procedure for award of M.Phil. / PhD Degree, Regulation, 2009) dated 1st June 2009 which was amended in 2016/2018 mandates for every Indian university for submitting all newly awarded PhD theses into Shodhganga repository within 30 days of award of PhD degree by the University Coordinator/Researchers. To ensure effective organization and accessibility, Shodhganga employs a consistent file naming convention and categorization for the uploaded ETDs. The repositories are designed to give access to individual components in thesis such as chapters, abstract, preliminary contents including title pages, table of content, list of tables, references, and recommendations. 80_Recommendation is special metadata field, which is mandatory to provide the most important part of Recommendation of a thesis, conclusions or future directions. The splitting of thesis is done inured to download chapter wise in a bandwidth restricted devices such as mobile, tablets etc. Initially few of the theses were as big as 500 MB to 1GB in size. Uploading such huge thesis usually get interrupted by Bandwidth available in Universities.

The following table outlines the file naming conventions and types used within Shodhganga:

Name of Files	Content
01_title.pdf	TitlePage
02_certificate.pdf	Certificate
03_abstract.pdf	Abstract
04_declaration.pdf	Declaration
05_acknowledgement.pdf	Acknowledgment
06_contents.pdf	Content/Index page
07_list_of_tables.pdf	List of Tables
08_list_of_figures.pdf	List of Figures
09_abbreviations.pdf	Abbreviations
10_chapter1.pdf	First Chapter
11_chapter2.pdf	Second Chapter
12_chapter2.pdf	Third Chapter—Onwards
13_conculsion.pdf	Conclusion
14_references.pdf	References
15_appendex.pdf	Appendix
16_summery.pdf	Summary
80_Recommendation	Recommendations/Future Directions

Table 1: Outlines the file naming conventions and types used within Shodhganga

By adhering to this standardized file naming convention, Shodhganga ensures that each ETD is organized in a structured manner, allowing researchers and scholars to easily navigate and access specific sections of the work. The submission process of PhD thesis is very simple, and it's completed in six steps. These steps for submission of thesis in Shodhganga are listed below.
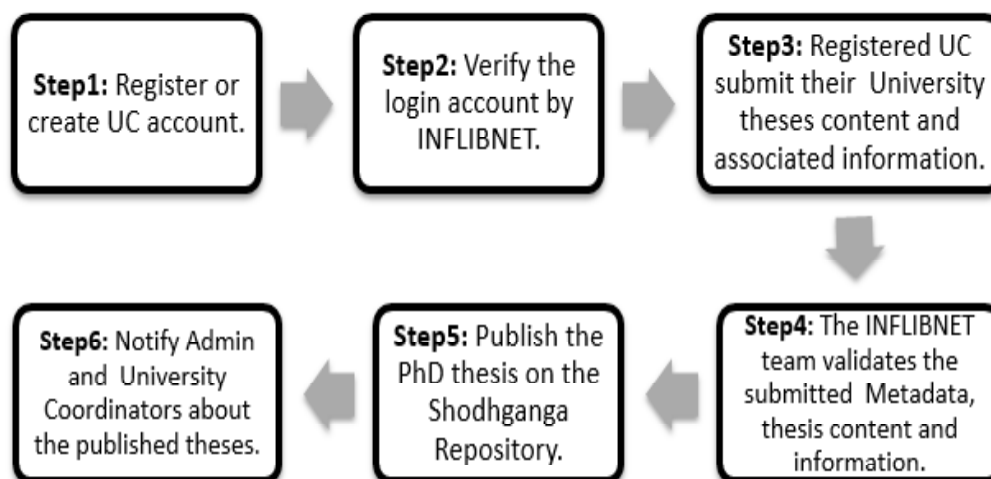

Figure -1: Steps for Submission of Thesis in Shodhganga

This consistency facilitates efficient discovery and utilization of the research contained within the ETDs. In the subsequent phases of this study, compare and analyze the metadata standards employed by Shodhganga with other established ETD standards. This comparative analysis will provide valuable insights into the practices and potential areas of improvement in metadata standards for ETD repositories.

2. Objectives

Prior research has highlighted the importance of metadata standards in Electronic Theses and Dissertations (ETD) repositories. Building upon existing literature, this study aims to investigate the metadata standards employed by Shodhganga, a prominent ETD repository, and compare them to other recognized ETD standards. By examining the coverage, granularity, interoperability, and compliance of Shodhganga metadata standards, this research seeks to provide insights and recommendations for enhancing the effectiveness and interoperability of ETD repositories on a global scale.

The objectives of the study are as follows:

❖ Evaluating Shodhganga ETD Metadata Standards.

❖ Comparative analysis Shodhganga ETD Metadata Standards with other Metadata Standards such as Dublin core, ETD-MS, VRA core set of elements, MODS set of elements, METS set of elements, etc.

❖ To make recommendations for improving Shodhganga metadata standards and contributing to the progress of ETD repositories worldwide.

3.   Methodology

The rationale of this study is to understand and compare Shodhganga Metadata Standards with Other Electronic Theses and Dissertations (ETD) Standards like MODS, METS, Dublin Core, ETD-MS, and VRA Core etc. Therefore, both the qualitative and quantitative research approaches were pursued in order to answer the formulated research questions. The study will employ a systematic and comprehensive research methodology to achieve the research objectives. The research methodology involves a comparative analysis of Shodhganga metadata standards against the global ETD standards identified in the literature review. A systematic evaluation framework is developed to assess various aspects, such as metadata elements, granularity, interoperability, extensibility, and compliance with international standards.

The following research methods outline the key steps and procedures that will be undertaken.

4.   Literature Review

Conduct a pervasive literature review to gain a deep understanding of ETD metadata standards, Shodhganga, and global ETD Standard. This includes reviewing academic articles, conference papers, technical reports, and relevant documentation.

❖ B.P. Singh (2020) in the Article "Electronic Thesis And Dissertations (ETD) Submission At Shodhganga Repository By Indian Universities: An Evaluative Study" discuss about the role of Shodhganga to develop the higher education with the help of ETDs of M. Phil and PhD. In his writing he also mention about the standard for file naming convention to ETD submission in Shodhganga repository which was developed by INFLIBNET, Gandhinagar. To preserve uniformity, all Indian universities submit their PhDs to the Shodhganga repository using a consistent and clear file naming scheme. Additionally, he discusses in this study how library professionals' roles are changing, specifically in relation to the administration of ETDs in Indian universities.

❖ Manoj Kumar, Nirmal Chand and Savita Gandhi (2012) in the Article "Ontological Mapping for Semantic Search in Shodhganga: A National Repository of Electronic Theses and Dissertations (ETDs)" describe about how Shodhganga Finding the right material in ETDs which requires a researcher to use a semantic approach to content discovery and research. This article also addresses how to create and apply a conceptual framework for ontology with reference to ETDs, based on the standard and advanced ontological model.

❖ Mr. Prashant Shrivastava and Dr. Dinesh K. Gupta (2016) in the article "National Level ETD Efforts: A Comparative Analysis" discuss about the cooperative ETD efforts in USA, UK, India and China's higher educational system also compare with the ETD movement of India. The rapid expansion of ETDs worldwide depends on each nation having national level ETD service. According to the authors,

the primary drivers of national ETD service promotion are university-level ETD programmes. Effective global movements that leverage information and communication technology for effective research management are revealed by this study on cooperative ETD activities.

❖ Mohamed Haneefa K (2018) in the chapter of book named "Electronic Theses and Dissertations (ETDs) in India" discuss about the various ETD Platforms and collecting, software, and policy frameworks of ETDs in different Indian academic and scientific institutions. According to him, Because of the internet's explosive growth, Indian academic institutions are investigating the possibilities of electronic Theses repositories, or ETDs. The UGC Regulations, 2005 were implemented by the University Grants Commission with the aim of enhancing the country's capacity to produce ETDs and manage national and university databases. Reputable research institutes such as the Indian Institute of Science have begun to make their ETDs available via open access archives. Organizations such as CSIR, Vidyanidhi, INDEST Consortium, and INFLIBNET Centre are developing bibliographic databases and open access ETDs
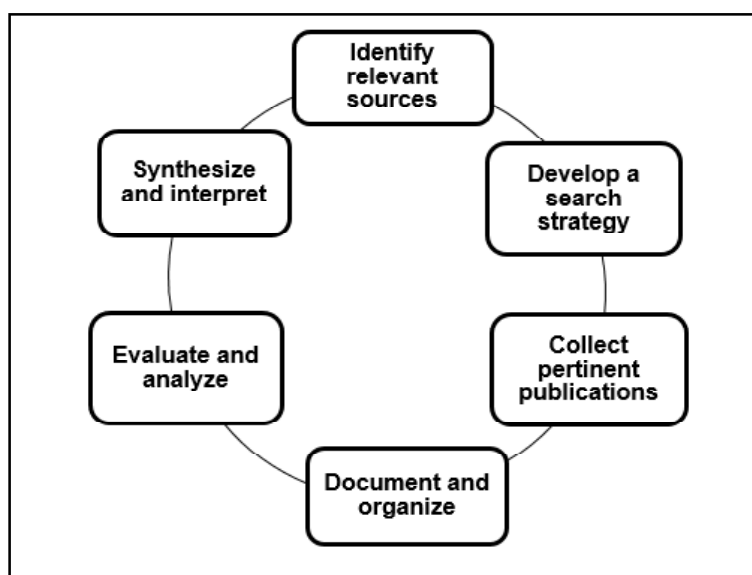
Figure 2: Data Collections and Analysis

5. **Data Collection and Analysis**

❖ **Identify relevant sources:** Use academic databases, Shodhganga government websites, and the websites of standards organisations, International ETDs like ProQuset (PQDT Open),DART and NDLTD.

❖ **Develop a search strategy:** Create a search strategy by using terms linked to Shodhganga metadata standards, ETD standards, and specific metadata standards such as Dublin Core, ETD-MS, METS, MODS, etc.

❖ **Collect pertinent publications:** Search and review literature, read abstracts and introductions to determine relevance, and collect articles, conference papers and reports.

❖ **Document and organize:** Maintain a record of collected publications with bibliographic details, and use reference management tools for organization.

❖ **Evaluate and analyze:** Read selected publications thoroughly, focusing on metadata standards, ETD repositories, and comparative analyses. Identify key findings, similarities, differences, recommendations, challenges, and opportunities.

❖ **Synthesize and interpret:** Summarize the findings, analyze strengths and weaknesses of Shodhganga metadata standards compared to global ETD standards, and generate insights.
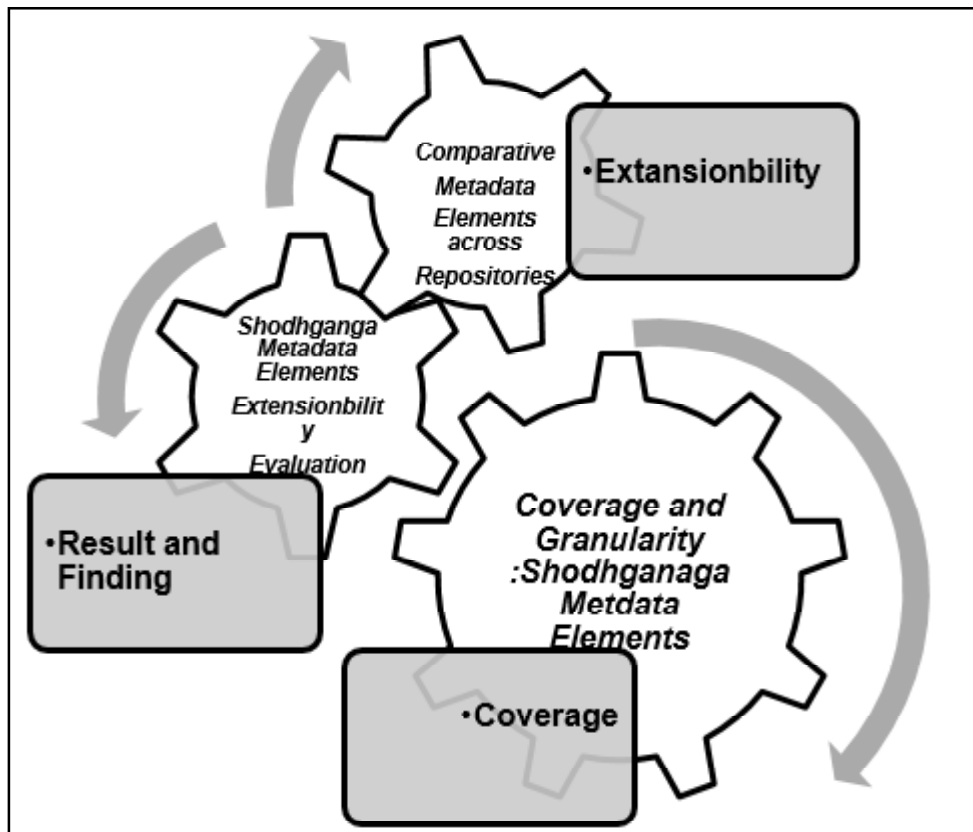
6 Data Analysis

Figure 3: Data Analysis Steps

The collected publications were subjected to thorough analysis to extract key insights regarding Shodhganga metadata standards and their comparison with other Electronic Theses and Dissertations (ETD) standards.

A qualitative approach was employed to identify similarities and differences between the metadata practices of Shodhganga and other ETD repositories.

The strengths and weaknesses of Shodhganga metadata standards were evaluated based on the compliance with international standards and best practices. The analysis involved a comprehensive examination of the literature to identify common themes, emerging trends, and recommendations for improving Shodhganga metadata standards. The findings were synthesized to provide a comprehensive understanding of the current state of Shodhganga metadata standards and their alignment with Global ETD standards.

6.1. Evaluating Shodhganga ETD Metadata Standards

6.1.1. Coverage

The following table presents a comprehensive comparison of metadata elements used in Shodhganga, an Electronic Theses and Dissertation (ETD) repository, focusing on coverage and granularity. These metadata elements are examined in relation to their counterparts from various facets of research, including titles, creators, subjects, dates, institutions, and more. This comparison not only provides insights into Shodhganga's metadata practices but also offers a broader perspective on the repository's alignment with the scholarly ecosystem.

6.1.1.1. Coverage and Granularity: Shodhganga Metadata Elements

Table 2: Shodhganga Metadata elements in context of Coverage and Granularity

(Shodhganaga,2023)[4]

Shodhganga Metadata	Coverage	Granularity
dc.format.accompanying	DVD/PDF/RTF/Doc	**Title**
dc.date.completed	Awarded,Completed	subtitle
dc.creator.researcher	Creator/Researcher	**Creator**
dc.date.issued	Registration date	Researcher
dc.publisher.university	Institutions,Publishers	**Subject**
dc.source.inflibnet	INFLIBNET/University	keyword
dc.language	Language,Eng,Hindi,Support Unicode.	**Description**
Department	Department of Research Scholar	Note
dc.subject.keyword	Data Warehouse,ETL,DSG,Data Extractor,Data Sharehouse,Testing	Release
dc.publisher.place	Place of Institution,University,Inflibnet	**Contributor**
dc.format.extent	Pege Number	Guide
dc.right	University	**Publisher**

dc.description.note	Notes	University
dc.publisher.institution	Name of University	Institution
dc.title	Title,subtitle	**Date**
dc.Identifier.uri	URI/Handel Num.	Registered
dc.description.abstract	Abstract	Completed
dc.type.degree	PHD	Awarded
dc.contributor.guide	Guide	**Type**
dc.Date.acessioned	Acessioned Date	Dcm.type
dc.date.available	Uploaded Date	Format
		medium
		extent
		dimensions
		accompanying material
		Identifier
		URI
		Thesis Number
		Handle
		Source
		University
		Selfsubmissiom
		guidesupervisor
		Inflibnet
		Language
		Relation
		Coverage
		Spatial
		Rights

This table offers a holistic view of Shodhganga's metadata practices in terms of coverage and granularity. The listed metadata elements encompass a wide spectrum of information, aiding in comprehensive documentation and enhanced accessibility within the academic community. The alignment of these elements with international standards further underscores Shodhganga's commitment to facilitating global scholarly collaboration.

6.1.2. Interoperability

6.1.2.1. Comparative Analysis of Metadata Elements

The table provided below presents a comparative analysis of metadata elements across several established standards, including MODS, METS, Dublin Core, ETD-MS, VRA Core, and Shodhganga's unique set of elements. This comparison offers insights into the diverse ways in which these standards capture essential information about titles, creators, subjects, dates, and other critical aspects of research and documentation. The alignment and variations among these standards shed light on the nuances of metadata practices within different contexts.

6.1.2.2. Comparative Analysis of Metadata Elements

Tables 3: Sets of elements for the ETD repositories provided by world-wide used Metadata Standard in compared to Shodhganga Metadata Elements

Metadata Element	MODS Set Elements	METS Set of Elements	Dublin Core Set of Elements	ETD-MS Set of Elements	VRA Core Set of Elements	Shodhganga Set Elements
Title Information	Title	Title	dc.title	Title	Title	Title
METS Header	Na	Na	Na	Na	Na	Na
Title	dc.title	dc.coverage.spatial	dc.title	dc.identifier.uri		Name Na
Descriptive Metadata	Na	Na	Na	Na	Na	Na
Creator	dc.creator	dc.date. accessioned	dc.creator	dc.contributor. guide		dc.creator. researcher
Agent	Na	Na	Na	Na	Na	Na
Genre	Na	Na	Na	Na	Na	Na
Structural Map	Na	Na	Na	Na	Na	Na
Subject	dc.subject	dc.identifier.uri	dc.subject	dc.subject.keyword		dc.subject
Date	dc.date	dc.identifier.uri	dc.date	dc.date	Na	dc.identifier.uri
Language	Na	Na	dc.language	Na	Na	Na
Behavior	Na	Na	Na	Na	Na	Na
Description	dc.description	dc.format.extent	dc.description	dc.description	Na	dc.description
Inscription	dc.format.extent	Na	Na	Na	Na	Na
Abstract	Na	Na	Na	Na	Na	Na
Publisher	dc.publisher	dc.relation	dc.publisher	dc.publisher	Na	dc.publisher
Material	dc.relation	Na	Na	Na	Na	Na
Target Audience	Na	Na	Na	Na	Na	Na
Contributor	dc.contributor	Na	dc.contributor	dc.contributor		dc.contributor

Relation	Na	Na	Na	Na	Na	Na
Subject	Na	Na	dc.subject	dc.subject.keyword		dc.subject
Coverage	Na	Na	dc.coverage	Na	Na	Na
Date	Na	Na	dc.date	Na	Na	dc.date
Source	dc.creator.researcher	Na	Na	Na	Na	Na
Related Item	Na	Na	Na	Na	Na	Na
Date	Na	Na	Na	Na	Na	Na
Type	dc.type	Na	Na	dc.type	Na	Na
Style Period	dc.subject.keyword	Na	Na	Na	Na	Na
Location	Na	Na	Na	Na	Na	Na
Type	dc.format	Na	Na	dc.format	Na	Na
Technique	dc.subject.keyword	Na	Na	Na	Na	Na
Part	Na	Na	Na	Na	Na	Na
Format		Na	Na		Na	
Identifier	dc.identifier	Na	Na	dc.identifier		dc.Identifier.uri
Title	dc.contributor.guide	Na	Na	Na	Na	dc.contributor. guide
Record Info	Na	Na	Na	Na	Na	Na
Rights	Na	Na	dc.right	Na	Na	Na
Language	dc.language	Na	dc.language	dc.language		dc.language
Publisher University	Na	Na	Na	Na	Na	dc.publisher. university
Coverage	Na	Na	Na	Na	Na	dc.coverage
Publisher Institution	Na	Na	Na	Na	Na	dc.publisher. institution
Language	Na	Na		Na	Na	Na
Rights	Na	Na	dc.right	Na	Na	dc.rights
Date Completed	Na	Na	Na	dc.date.completed	Na	dc.date.completed
Relation	dc.title	Na	Na	dc.title	Na	Na
Thesis Degree	Na	Na	Na	dc.thesis.degree	Na	Na
Format Dimensions	Na	Na	Na	Na	Na	dc.format. dimensions
Identifier	Na	Na	Na	Na	Na	dc.Identifier.uri
Source University	Na	Na	Na	Na	Na	dc.source. university
Digree	Na	Na	Na	Na	Na	dc.type.degree

This table provides an intricate comparison of metadata elements across different standards, reflecting their nuances and commonalities. The analysis highlights the diverse approaches taken by these standards in capturing essential research attributes. This comparison is instrumental in understanding the landscape of metadata practices and their role in facilitating efficient scholarly communication.

6.1.3 Extansionbility

6.1.3.1. Comparative Metadata Elements across Repositories

Below is a comparative overview of metadata elements found in MARCXML records from ProQuest Dissertations, DART, NDLT, and Shodhganga. The analysis provides insights into how these repositories capture crucial attributes like author names, titles, subjects, qualification levels, and more. This comparison sheds light on the diverse approaches these repositories adopt for metadata representation.

Table 4: Metadata elements used by worldwide ETD repository in context to Shodhganga metadata Set of elements)

Metadata Element	Shodhganga	NDLTD	ProQuest Dissertations (MARCXML)	DART
Author Name	Author Name	Na	\<datafield tag="100"> \<subfield code="a"> (Author Name)	Na
Title	dc.title	dc.title	\<datafield tag="245"> \<subfield code="a"> (Title)	Na
Qualification Level	Na	Na	Na	Qualification Level:
Additional Author Names	Na	Na	\<datafield tag="700"> \<subfield code="a"> (Additional Author Names)	Na
Subjects	dc.subject	dc.subject	Na	Subjects:
Colleges/Schools	Na	Na	Na	Na
General Note - Advisor	General Note -	Na	\<datafield Advisor tag="500"> \<subfield code="a"> (General Note - Advisor)	Na
Supervisor's Name	-	Na	Na	Supervisor's Name:
Date of Award	Date of Award	dc.date	\<datafield tag="720"> \<subfield code="a"> (Date of Award)	Date of Award:
Embargo Date	Embargo Date:	Na	\<datafield tag="210"> \<subfield code="a"> (Embargo Date)	Embargo Date:

Depositing User	Na	Na	Na	Depositing User:
Unique ID	Na	Na	Na	Unique ID:
Copyright	Na	Copyright:	Na	Copyright:
Date Deposited	Na	Date Deposited:	Na	Date Deposited:
Last Modified	Na	Last Modified:	Na	Last Modified:
Thesis DOI	Na	Thesis DOI:	Na	Thesis DOI:
URI	dc.identifier.uri	Na	Na	Na
dc.coverage.spatial	dc.coverage.spatial	Na	Na	Na
dc.date.accessioned	dc.date.accessioned	Na	Na	Na
dc.format.extent	dc.format.extent	Na	Na	Na
dc.relation	dc.relation	Na	Na	Na
dc.creator.researcher	dc.creator.researcher	Na	Na	Na
dc.subject.keyword	dc.subject.keyword	Na	Na	Na
dc.contributor.guide	dc.contributor.guide	Na	Na	Na
dc.publisher.university	dc.publisher.university	Na	Na	Na
dc.publisher.institution	dc.publisher.institution	Na	Na	Na
dc.date.completed	dc.date.completed	Na	Na	Na
dc.format.dimensions	dc.format.dimensions	Na	Na	Na
dc.source.university	dc.source.university	Na	Na	Na
dc.type.degree	dc.type.degree	Na	Na	Na

This comparison underscores the diversity in metadata practices among various repositories. Each repository adopts a distinct approach to capturing and representing metadata elements related to authors, titles, subjects, and other essential attributes. The analysis contributes to a broader understanding of how metadata standards are tailored to serve the unique needs and contexts of different scholarly repositories.

7.   Result and Finding

Shodhganga Metadata Elements Extensibility evaluation

Table 5: Metadata Elements Comparison

Metadata Element	Shodhganga	DCMS	ETD-MS	METS	MODS	DART	NDLTD	ProQuest-Etd
dc.title	√	√	√	√	√	√	√	√
dc.subject	√	√	√	x	x	√	√	√
dc.date	√	√	√	x	x	√	√	√
dc.creator	√	–'	x	x	x	√	√	√

dc.publisher	√	x	x	√	√	√	√	√
dc.contributor.guide	√	x	x	√	√	√	√	√
dc.identifier.uri	√	x	x	x	x	√	√	√
dc.language	√	x	x	x	x	√	√	√
dc.subject.keyword	√	x	x	x	x	√	√	√
dc.format.dimensions	√	x	x	x	x	√	√	√
dc.source.university	√	x	x	x	x	√	√	√
dc.type.degree	√	x	x	x	x	√	√	x

The provided table (Table 5) offers a comprehensive insight into the metadata practices employed by several distinguished Electronic Theses and Dissertations (ETD) repositories, including Shodhganga, and how they align with globally recognized standards such as Dublin Core, ETD-MS, METS, and MODS. This detailed analysis not only sheds light on the metadata elements presents within each repository but also underscores the convergence and divergence among these repositories' practices. In the context of coverage and granularity, the table reveals that Shodhganga's metadata elements encompass a wide array of critical information, mirroring the inclusiveness advocated by international standards such as Dublin Core and ETD-MS. This alignment suggests that Shodhganga's focus on capturing essential attributes, such as titles, subjects, and author details, is not only a local practice but also resonates with the broader global ethos of comprehensive documentation.

Interoperability is a vital aspect of modern scholarly communication, and the table underscores Shodhganga's commitment to facilitating cross-repository compatibility. Elements like "dc.identifier.uri," "dc.source.university," and "dc.language" establish a bridge for effective data exchange between Shodhganga and other ETD repositories worldwide. This synchronization enhances the repository's capacity to contribute to the larger academic ecosystem by ensuring seamless accessibility to its stored knowledge.

The aspect of extensibility, as evidenced in the table, demonstrates Shodhganga's readiness to accommodate evolving scholarly needs. The presence of elements like "dc.subject.keyword"and"dc.format.dimensions" signifies Shodhganga's preparedness to embrace specialized metadata requirements, which bodes well for adapting to future research paradigms. This flexibility positions Shodhganga as an adaptable platform, capable of catering to emerging trends in the academic landscape.

When considering the comparison with repositories like DART, NDLTD, and ProQuest, the table illuminates the commonalities and differences in metadata practices. While certain repositories exhibit more detailed elements in specific categories, Shodhganga showcases a balanced approach that aligns with the comprehensive practices of NDLTD and ProQuest. This comparison highlights Shodhganga's engagement with both regional and global metadata norms.

8.   Recommendations for Improving Shodhganga Metadata Standards

These recommendations aim to guide Shodhganga towards a metadata framework that not only embodies extensibility but also positions the repository as a forward-looking entity capable of accommodating emerging scholarly practices and evolving resource representation needs. By implementing these recommendations, Shodhganga can further solidify its role as a dynamic and adaptive platform for scholarly engagement and resource discovery.

❖   Developing comprehensive documentation, user guides, and training resources akin to those provided by platforms like ProQuest Dissertations & Theses Global would empower users to effectively leverage metadata tools and extensions.

❖   Implementing a cyclic review process, for ensure that Shodhganga's metadata schema remains current and adaptable to evolving scholarly practices.

❖   Actively involving the scholarly community in shaping metadata needs and extensibility requirements would allow Shodhganga to incorporate user-driven enhancements, promoting a more inclusive and adaptable repository.

❖   Shodhganga could engage with relevant standards bodies and ETD-focused organizations to adopt best practices, ensuring alignment with recognized metadata standards and fostering collaborative development.

❖   Introducing standardized extension mechanisms, like those utilized in OAI-PMH and Crossref Metadata Schema, can streamline the process of adding new metadata elements while adhering to industry-wide protocols.

❖   Shodhganga could explore implementing the Janson LD framework's modular and extensible approach to metadata. This would empower the repository to adapt to emerging needs and integrate linked data concepts.

❖   Aligning Shodhganga's metadata with the Crossref Metadata Schema can ensure standardized and accurate citation linking, improving resource discoverability and scholarly communication.

❖   Shodhganga could consider integrating OAI-PMH to facilitate seamless metadata exchange with other repositories, thereby enhancing global interoperability and resource discovery.

8.1. Integration of JSON-LD for semantic enrichment

The NewGen metadata standards should provide interlinking of data to create a reusable and shareable Linked Open Data (LOD) which semantically searchable with best practices for publishing structured data on the Web. Creation of linked data with programming tools can be made by JSON-LD. The incorporation of JSON-LD (JavaScript Object Notation for Linked Data) holds great promise for improving metadata practices

and interoperability within Electronic Theses and Dissertations (ETD) repositories. JSON-LD offers a standardized and linked format that facilitates seamless data exchange and integration. Shodhganga, as a leading ETD repository, could benefit from leveraging JSON-LD to enhance its metadata standards and contribute to a more connected scholarly ecosystem.
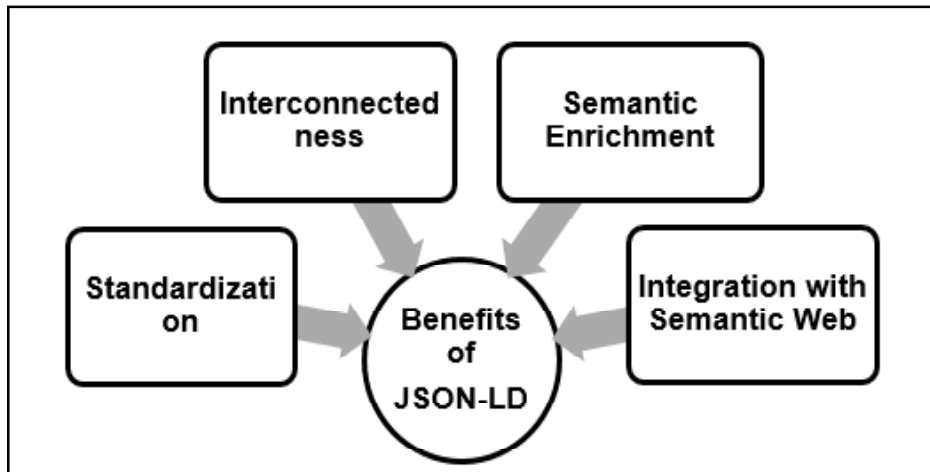
8.2. Benefits of JSON-LD

Figure 5: Benefits of JSON-LD

❖ **Standardization**: JSON-LD ensures consistent representation of metadata, promoting effective communication and collaboration.

❖ **Interconnectedness**: JSON-LD links data to external resources, enriching context and providing a broader perspective to users.

❖ **Semantic Enrichment**: JSON-LD's linked data vocabularies add semantic meaning to metadata, enabling accurate resource discovery.

❖ **Integration with Semantic Web**: JSON-LD aligns with the semantic web, facilitating data linking, querying, and integration.

8.3. Leveraging JSON-LD for Shodhganga

❖ **Improved Interoperability**: JSON-LD's compatibility with the semantic web enhances discoverability across platforms.

❖ **Efficient Data Exchange**: JSON-LD simplifies collaborative initiatives by enabling streamlined data exchange.

❖ **Contextual Information**: Shodhganga can enrich metadata by linking it to relevant external resources, enhancing user understanding.

❖ **Future-Proofing**: Integrating JSON-LD ensures alignment with emerging metadata trends, sustaining relevance.

9. Future Directions

The integration of JSON-LD in Shodhganga's metadata ecosystem opens avenues for further research. Exploring practical implementation, metadata retrieval impact, and standardized JSON-LD profiles for ETD repositories would advance metadata practices and scholarly communication in the digital era.

9.1 Code representation the Shodhganga Elements by using JSON-LD

The provided JSON code represents a structured overview of metadata fields used within the context of Shodhganga's Electronic Theses and Dissertations (ETD) repository. Each metadata field is associated with specific attributes including "DC Field," "Value," and "Language." The "DC Field" corresponds to the particular metadata element within the ETD's record. The "Value" field, which is currently empty, is where the specific content for that metadata element would be inserted. The "Language" field indicates the language in which the content is provided. Each metadata field serves a crucial purpose in describing various aspects of the ETD, such as its title, author information, abstract, date of completion, and more. This structured representation not only ensures standardized metadata categorization but also allows for cross-referencing and integration with external resources, contributing to enhanced discoverability and accessibility of the ETDs within the repository. It should be noted that the "Value" and "Language" fields will be populated with actual content and language information as per the specific ETD records.

```
[
  {
    "DC Field": "dc.coverage.spatial",
    "Value": "",
    "Language": ""
    "DC Field":"dc.date.accessioned",
    "DC Field": "dc.date.available",
    "DC Field": "dc.identifier.uri",
    "DC Field":"dc.description.abstract",
    "DC Field": "dc.format.extent",
    "DC Field": "dc.language",
    "DC Field": "dc.relation",
    "DC Field": "dc.rights",
    "DC Field": "dc.title",
    "DC Field": "dc.title.alternative",
    "DC Field": "dc.creator.researcher",
    "DC Field": "dc.subject.keyword",
    "DC Field": "dc.subject.keyword",
    "DC Field": "dc.subject.keyword",
    "DC Field": "dc.subject.keyword",
    "DC Field": "dc.description.note",
    "DC Field": "dc.contributor.guide",
    "DC Field": "dc.publisher.place",
  "DC Field":"dc.publisher.university",
    "DCField":"dc.publisher.institution",
    "DC Field": "dc.date.registered",
    "DC Field": "dc.date.completed"
    "DC Field":"dc.date.awarded",
    "DC.Language": "dc.language.awarded"
    "DC Field":"dc.format.dimensions",
  "DCField":"dc.format.accompanyingmaterial"
    "DC Field":"dc.source.university"
    "DC Field":"dc.type.degree",
    "DC Field": "Appears in Departments:" }
                                        ]
```

10. Conclusion

The comprehensive analysis of metadata practices across various Electronic Theses and Dissertations (ETD) repositories and established standards provides valuable insights into the intricacies of scholarly documentation. Each repository's approach to capturing critical attributes like titles, authors, subjects, and more reflects its unique context and goals within the academic landscape.

The evaluation of Shodhganga's metadata standards against global benchmarks highlighted its commitment to robust documentation practices. Shodhganga's alignment with internationally recognized standards such as Dublin Core, ETD-MS, METS, and MODS emphasizes its dedication to facilitating seamless collaboration and interoperability on a global scale. The repository's emphasis on elements like titles, creators, subjects, and dates ensures comprehensive coverage, enhancing the discoverability and accessibility of research content.

Comparing Shodhganga with repositories like ProQuest E-Dissertations, DART, and NDLTD revealed both shared practices and distinct approaches. While certain repositories demonstrated more detailed elements in specific categories, Shodhganga exhibited a balanced granularity that effectively captures essential information without overwhelming users. This positioning signifies Shodhganga's intent to cater to diverse audiences while adhering to established global norms.

The analysis also underscored Shodhganga's extensibility, with its readiness to incorporate specialized metadata requirements such as keywords and format dimensions. This flexibility enables the repository to adapt to evolving scholarly trends, ensuring its relevance in an ever-changing research landscape.

The comparative analysis of metadata practices from different repositories and standards enhances our understanding of how metadata serves as a cornerstone for effective scholarly communication. It reinforces the importance of aligning metadata practices with global standards to foster interoperability and collaboration across repositories.

In conclusion, this comprehensive study illuminates Shodhganga's commitment to robust metadata practices and its place within the broader ecosystem of ETD repositories. The findings underscore the repository's strengths, such as comprehensive coverage and interoperability, while also highlighting areas for potential improvement. This analysis contributes to the ongoing refinement of metadata standards, facilitating enhanced access, sharing, and discovery of scholarly research.

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