

# Discovering Invisible Scholarship of Electronic Theses and Dissertations (ETDs): A Critical Analysis

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## ABSTRACT

Electronic Theses and Dissertations (ETDs) are a relatively new mode of research and scholarly communication. ETDs contain the results of at least three years of scientific work, accomplished within a laboratory, a research team or an institute, university or school. These are considered the most invisible form of useful literature and the most useful from the literature. The invisible scholarship in ETDs refers to the valuable research and insights contained within these electronic documents that might not be readily accessible or visible to a broader audience due to various factors, such as limited indexing, restricted access, or lack of awareness. Therefore, it is important to highlight the scholarly impact created by ETDs over the period. This paper attempts to identify the growth and development of ETDs as cited references, growth of ETD repositories, national and international initiatives on ETDs and the role of open-access databases and scholarly search engines in the dissemination and accessibility of ETDs. It found that both Web of Science and Scopus index a good number of theses and dissertations as cited references in their documents. Over 3586 ETD repositories have been established worldwide and Global ETD Search, DiVA Academic Archive On-line, DART-Europe E-Theses Portal and Cybertesis are major international ETD repositories. Including India, 22 countries have active access to national-level ETD repositories. Open Access ETD databases such as OATD, EBSCO Open Dissertations and PQDT OPEN have covered a worthy number of theses and dissertations. Scholarly search engines, including Google Scholar, CORE: Connecting Repositories and BASE (Bielefeld Academic Search Engine) assist researchers in retrieving the details of theses and dissertations from the registered repositories.

**Keywords:** ETD repository, Cited references of ETD, Web of Science, Scopus, National ETDs repositories, International ETD repositories.

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## INTRODUCTION

Theses and dissertations are the most useful kinds of invisible scholarship because of their high quality and low visibility. ETDs are primary, rich, unique and valuable sources of scholarly information. ETDs focus on a specific area or problem and involve the collaborative work of researchers, supervisors and others to find a solution to the problem. This adds new knowledge to the pool of primary sources. The emergence of electronic sources, developments in Open Access (OA) and the creation of digital repositories all make possible the best use of scholarly information sources, including theses and dissertations. Individual institutes, national and international organizations have initiated the establishment of ETD repositories at the institutional, national and international levels (Jain, 2011). These repositories have showcased the intellectual achievements of scholars and their

institutions by making their research output available globally in various forms, including ETDs. Since, ETDs are the most valuable scholarly documents and have been cited for a notable time as per the Scopus and Web of Science. Union catalogues (IndCat: Online Catalogue of Theses, 4,49,847; WorldCat, 1,12,25,898) of theses covers the metadata information of millions of theses and dissertations and provides access to metadata and large number of full-text theses (Park and Richard, 2011). Professional organizations, networks and working groups around the world have contributed to the development of ETD repositories. Theses and dissertation documents are critical components of academic research and education. It is important in research collaboration, advanced academic research, research skills and professional development, etc. Therefore, the researchers must fully utilize the available access of theses and dissertations to advance their career growth.

Though several ETD repositories have been established worldwide, they have come up with many strengths, weaknesses, opportunities and challenges for the researchers. ETD repositories have been enabled with OAI-PMH harvesting services supporting



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all the major file formats and content types (Hey and Hey, 2006; Dobratz and Scholze, 2006). Institutional ETD repositories have registered with national and international ETD and ETD directories. Professional associations have been organizing training programs and international conference workshops to increase ETD participation and awareness creation.

Invisible scholarship in ETDs refers to the valuable research and insights contained within theses and dissertations that are not readily accessible or visible to a broader audience due to various factors, such as limited indexing, restricted access, or lack of awareness. It is important to highlight the scholarly impact created by ETDs over the period.

## OBJECTIVES

This study aims to discover the invisible scholarly impact of the Electronic Theses and Dissertations (ETDs) globally. The focused objectives are as follows.

To identify the growth and development of ETDs as cited references in research articles, conference papers chapters, etc.,

To identify the growth and development of ETD repositories.

To study the national international and institutional initiatives on ETDs.

To study the dissemination and accessibility of ETDs through open-access databases and scholarly search engines.

## METHODOLOGY

The researchers have used mixed research methods to identify the impact created by the ETDs. The Scopus and Web of Science databases were used to identify the growth and development of ETDs as cited references. Researchers used the 'Reference Source Title' in Scopus advanced search and 'Cited references' in Web of Science to retrieve the cited references of ETDs as of October 16, 2023. The extracted data were analyzed and presented in tabular and graphical presentation. OpenDOAR is used to identify the growth and development of ETD repositories worldwide. REST API used to retrieve the data from the OpenDOAR using the content types that match any of the "Theses and Dissertations". Further researchers undertook a web survey of national and international ETD initiatives, open-access databases and scholarly search engines to identify their significant impact on academic and research communities. The available data collected as of October 17, 2023.

## RESULTS

The result of this research study has been presented in a sequence and divided into four parts to fulfill the stated objectives. To beginning with identified the impact of invisible ETDs scholarship through cited reference in both Web of Science and

Scopus, the development of ETD repositories and ETD initiatives at national, international and institutional level and finally, highlighted the contribution of open access databases or sources on dissemination and accessibility of ETDs.

## Growth and development of ETDs as cited references

Theses and dissertations are unique sources of valuable research information that contains innovative ideas and novel solutions. These add new knowledge to the pool of primary sources and involve the collaborative work of the researchers, supervisors and others. Therefore, ETDs are the most citable documents in academic and research work. Figures 1 and 2 present the ETDs cited references indexed in the Web of Science and Scopus, respectively. Web of Science covers 891,381 cited references of ETD documents since 1938. It is constantly growing year by year. As presented below in Figure 1, the most cited ETDs are the published/awarded in the year 2017 (34974 ETDs), followed by the 2018 (25136 ETDs) and 2016 (17224 ETDs).

Scopus covers the 1,013,770 ETDs' cited references in their documents. As per the Scopus and presented in Figure 2, the most cited ETD references were published/awarded in the year 2012 (31,891 ETDs), followed by 2013 (31,842 ETDs) and 2014 (31,592 ETDs).

As presented in Figure 3, the Scopus also covers the various types of theses including Ph.D. (2,42,606), Master theses (96,108), Dissertation theses (83,611) and 18,613 unpublished theses and dissertations. It also covered the 43,011 undefined theses references in their indexed documents.

## Growth of ETD Repositories

The growth of the ETD repository has constantly increased since 2006. There are a total of 3586 global repositories indexing the Theses and Dissertations content as per OpenDOAR directory (Figure 4). This number includes 59 Indian repositories, including theses and dissertations in science and technology, humanities, natural science, life science and multidisciplinary subjects. These repositories cover over 2,58,21,500 ETD records.

The maximum growth of ETD repositories was found in 2019 (957), followed by 2015 (194), 2013 (184) and 2022 (175). The repository developer used the DSpace, EPrints, Digital Commons, OPUS, WEKO and other open-source software used to create the ETD repositories and disseminate their ETD content worldwide. The research result presented subsequently to fulfill the research objectives of the study. The maximum of the theses covers social sciences, science and technology, humanities and medicine disciplines. Over 121 countries have contributed to the development of ETD repositories and the USA, Japan and Germany are the top countries. These repositories are distributed among 95.27% are institutional, 2.34% are disciplinary, 1.56% are aggregating and 0.81 governmental ETD repositories.

### ETD Initiatives: National, International and Institutional

The emergence of electronic sources, developments in Open Access (OA) and the creation of digital repositories all make possible the best use of scholarly information sources including theses and dissertations. Academic institutions, professional associations and networking bodies have been involved in creating and developing ETDs to disseminate and create the visibilities of hidden ETD contents. Access ETDs have the most significant advantages in collaboration, ensuring quick information retrieval, promoting resource sharing and helping in avoiding duplication in research work. ETDs growing part of available open content in the institutions' repositories, where it contributes to the institutions' overall impact and ranking.

Table 1 presents the national and international ETD Repositories and the number of records of theses and dissertations covered by them. India is at the forefront in this area. INFLIBNET (Information Library Network) has established the Shodhganga, a digital repository of Indian electronic theses and dissertations. The sources of theses submitted to Indian Universities and science and Technology institutes, including IITs, IISERs and IIMs. The 21 IITs have contributed over 10000+ theses, 10 IIMs have contributed over 400+ theses, A IISc has contributed over 1216+ theses, 4 IISERs has contributed over 850+ theses to Shodhganga repository. INFLIBNET has also established another platform, Shodhgangotri, a repository for research in progress/synopses. Shodhganga has been playing a vital role in providing centralized access to the vast collection of these and dissertations submitted from the various academic and research universities/institutions

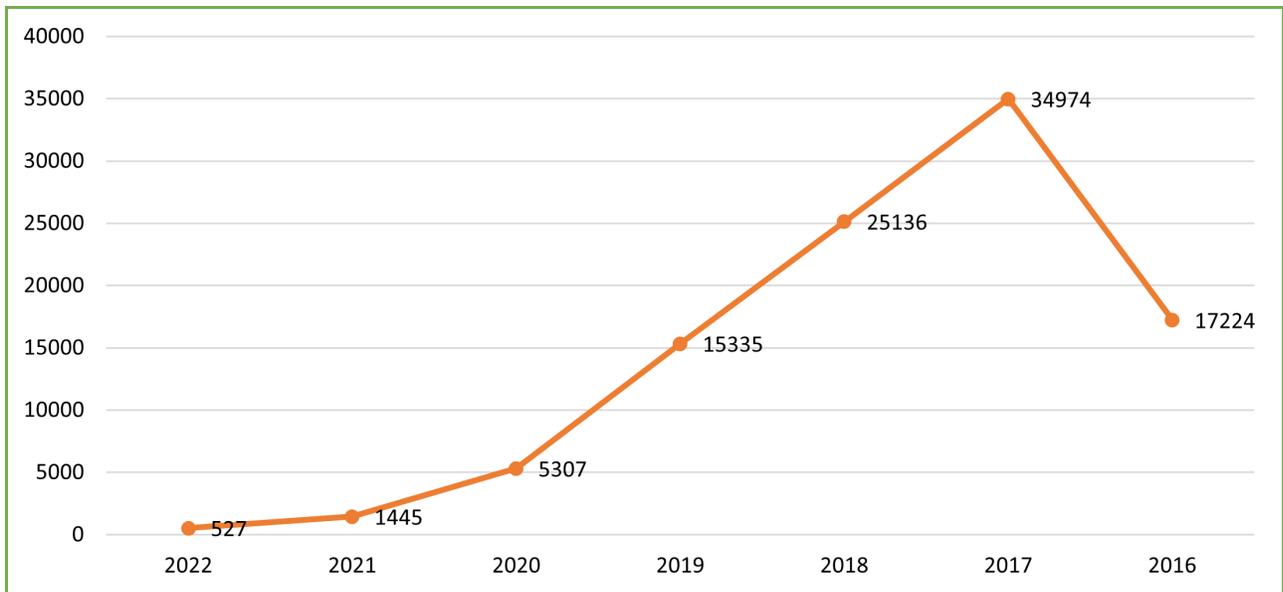


Figure 1: Last Five-year Theses and dissertations cited in the Web of Science.

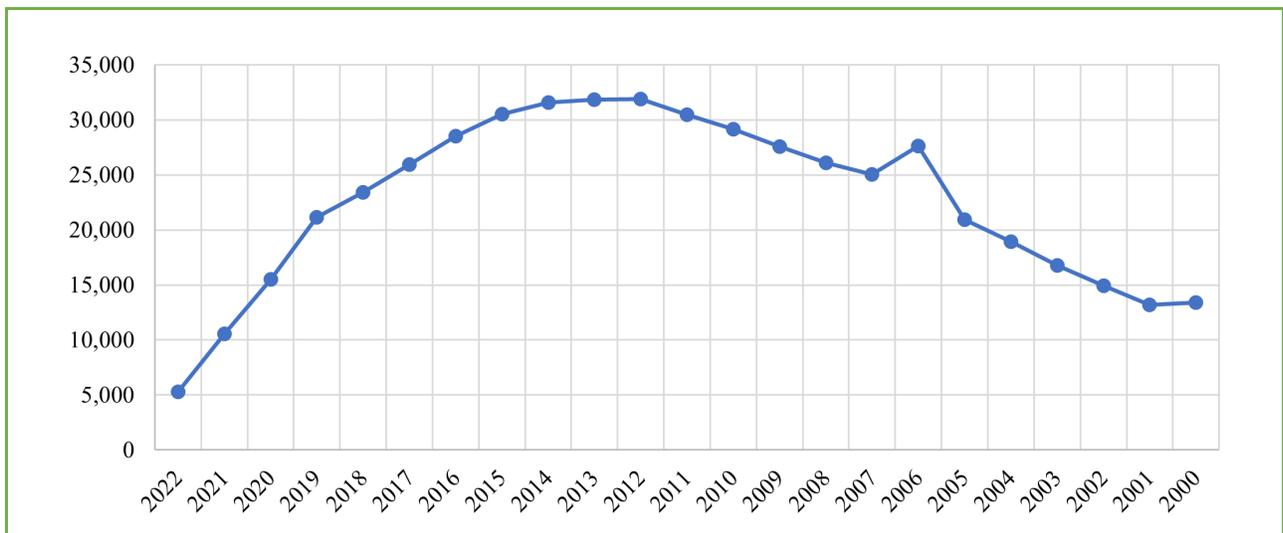


Figure 2: Since 2000 Theses and Dissertations cited as Reference in Scopus.

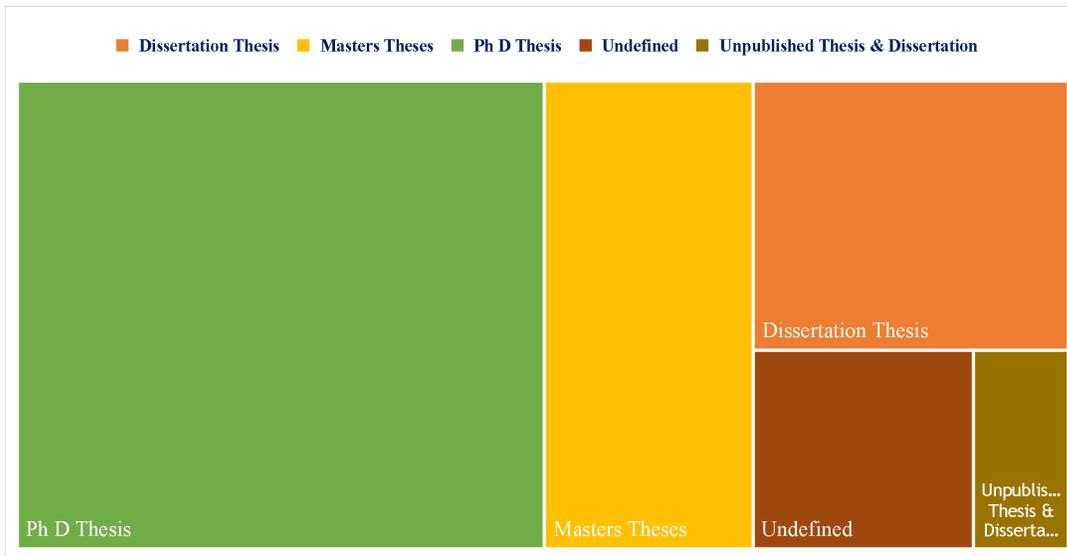


Figure 3: Content-wise theses and dissertations cited as references in Scopus.



Figure 4: Growth of ETD Repositories.

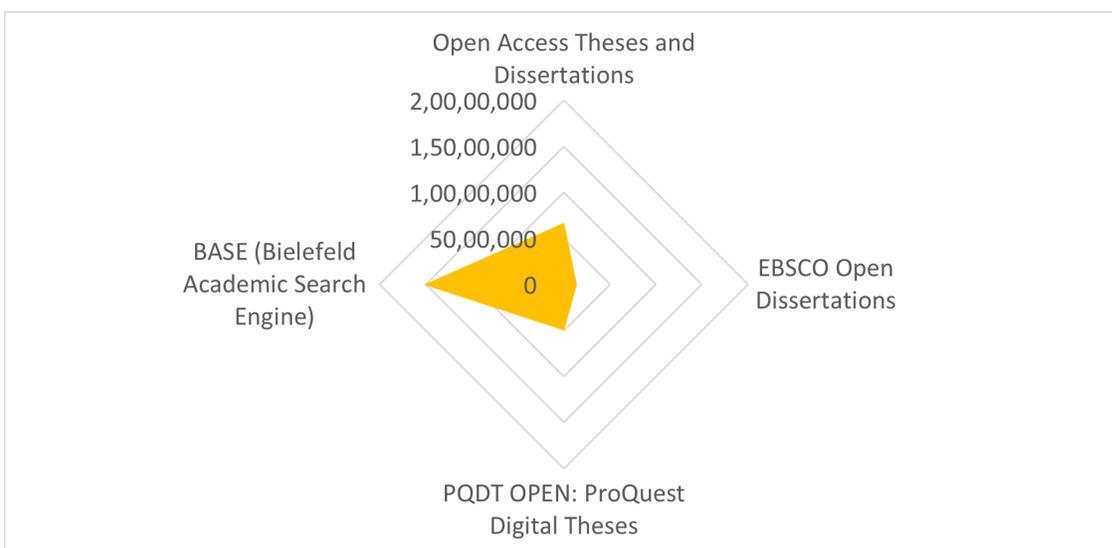


Figure 5: Number of ETD records indexed in the Open Access Databases and Scholarly search engine.

**Table 1: National and International ETD Repositories and Number of Records.**

ETD Initiatives in India		
ETDs	No. of Records	
ShodhGanga	4,90,637	
Shodhgangotri (Research in Progress/Synopses)	12,875	
KrishiKosh	1,93,089	
IndCat: Online Catalogue of Theses (Metadata)	4,50,025	
Database of Theses and Dissertations-DELNET (Metadata)	1,40,195	
National Level Initiatives on ETDs		
ETDs	Country Name	No. of Records
BDTD: Brazilian Digital Theses and Dissertations	Brasil	5,60,000
China Doctoral Dissertations Full-Text Database	China	4,50,000
CiNii Dissertations	Japan	6,00,000
Diss Online	German Universities	2,84,000
Dissertations.se	Sweden	84,004
eLABa ETD	Lithuania	5,78,510
Ethos: Electronic Theses Online Service	United Kingdom	6,00,000
HKU Theses Online	Hong Kong	31,279
Japanese Institutional Repositories Online (JAIRO)	Japan	16,00,000
National Digital Library of Theses and Dissertations in Taiwan	Taiwan	46,997
NZresearch.org.nz	New Zealand	2,50,000
OhioLINK Electronic Theses and Dissertations (ETD) Center	USA	1,20,720
RCAAP-Repositório Científico de Acesso Aberto de Portugal	Portugal	28,78,748
RENATI	Peru	2,57,818
TESEO	Spain	2,92,265
TesiOnline	Italy	3,972
Tesis Doctorales en Red	Spain	40,173
Tez Merkezi	Turkey	8,07,657
Theses	Canada	3,00,000
Theses France	France	5,27,339
Theseus: theses and publications of the Universities of Applied Sciences	Finland	2,59,437
Trove (National Library of Australia)	Australia	6,59,988

**ETD Initiatives in India**

International Level Initiatives on ETDs		
Global ETD Search (NDLTD: Networked Digital Library of Theses and Dissertations)		64,47,277
DiVA-Academic Archive On-line		4,61,460
DART-Europe E-Theses Portal		13,78,597
Cybertesis		50,000
WorldCat (Metadata)		1,12,25,898

in India. In such a way, several countries have established national repositories of electronic theses and dissertations to provide them with comprehensive access (Loan and Shah, 2020). Table 1 has shown such countries with their ETDs collection strengths.

Several national and international initiatives have been taken to disseminate and provide easy and wide access to ETD content. National level initiatives are aimed at improving the accessibility and visibility of academic research. They provide single-point access to theses, submitted to most higher education institutions (in both full text and metadata levels. Most of the repositories allow harvesting of metadata by harvesters compliant with the Open Archives Initiative (OAI) Protocol for Metadata Harvesting (OAI-PMH). National-level repositories have also contributed the metadata to the global-level repository (NDLTD global search). The institutional institutions and national and international organizations have established ETD repositories and policy documents that subject the ETDs to open access repositories. NDLTD: Networked Digital Library of Theses and Dissertations (<https://ndltd.org/>) and international organizations have been promoting the adoption, creation, use and preservation of ETDs (Cocciolo, 2010). NDLTD global ETD search indexes the 64,47,277 theses and dissertations produced/awarded worldwide. DiVA-Academic Archive Online covers over 4,61,460 records of over 30 universities from the Nordic countries. DART- Europe E-Theses Portal covers the 13,78,597 theses from the 653 universities in 27 European countries.

Dissemination and accessibility of ETDs through open-access databases and scholarly search engines.

The open-access databases and scholarly search engines play a significant role in disseminating and accessing the ETDs. These platforms significantly enhance accessibility, visibility and discoverability, research collaboration and inter-disciplinary research, avoid duplication of research and enable a broader audience to benefit from academic research. Figure 5 presents the number of ETD documents indexed by the open access ETD databases and scholarly search engines. Open Access Theses and Dissertations (OATD) provides open access to graduate theses and dissertations published worldwide. It covers 1100 colleges, universities and research institutions. EBSCO open dissertations is a platform that is offered to institutions and students to make

their ETDs freely available to researchers everywhere. PQDT Open provides the full text of open-access dissertations and theses free of charge. PQDT Open is the world's most comprehensive curated collection of multi-disciplinary dissertations and theses worldwide, offering over 5 million citations and 3 million full-text works from thousands of universities. Thesis and dissertation search tools harvest theses and dissertations from all registered open-access repositories. The Google Scholar, CORE: Connecting Repositories and BASE (Bielefeld Academic Search Engine) which provides the maximum of theses and dissertations. By indexing and providing access to ETDs, scholarly search engines promote the open access principles, collaboration and dissemination of academic knowledge.

## CONCLUSION

This paper attempted to discover the invisible scholarship of electronic theses and dissertations through cited references and visibilities created through institutional, national and international ETD repositories worldwide. Nowadays, ETD represents a significant part of references in academic publications. Free access to ETDs has the most significant advantages in avoiding duplication in research work, ensuring quick information retrieval and promoting resource sharing, etc., (Dobratz and Scholze, 2006). However, compared to articles published in academic journals, theses and dissertations are considered second-level information because they do not undergo peer review and are produced early in the academic career. Yet, these and dissertations had productive research results on specific research problems. ETDs also represent the growing part of available open content in the institutions' repositories of ETD, where you contribute to their institutions' overall impact and ranking (Schöpfel, 2013). ETDs are innovative research methods that uncover hidden treasures globally. Theses and Dissertations are valuable intellectual assets, contributing to national growth and development in specific fields or disciplines (Jan and Khazer, 2020). ETDs are revolutionizing the scholarly communication landscape by fostering knowledge creation and

sharing for industrialization and modernization. Academic institutions are developing ETDs linked with innovation hubs, while academic libraries are exploring emerging genres like linked data to improve discoverability (Chisita, *et al.*, 2021). ETDs are transforming the scholarly communication landscape through knowledge creation and sharing for industrialization and modernization. ETDs represent a significant part of references in academic publications and have productive research results on specific research problems. Therefore, Scopus and Web of Science may consider theses and dissertations to index as document types like journal articles, chapters, conference papers, reviews etc. in their databases. So, it creates wider visibility of theses and dissertations and also helps in attracting more citations.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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