

Impact Analysis of Shodhganga ETD Repository through the Lens of Scopus Citing Documents

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Abstract

Shodhganga: a reservoir of Indian theses, a repository developed and maintained by the INFLIBNET Centre, Gandhinagar, hosts and makes accessible thousands of Indian Electronic Theses & Dissertations (ETDs) (PhD theses, including a few thousand MPhil theses). Are those PhD research works used or impacting scholarly communication and academic research in general, and if so, how? To investigate, Elsevier's Scopus database was searched through its references search feature using search terms/links, i.e., shodhganga, shodhganga.inflibnet.ac.in, sg.inflibnet.ac.in, retrievedfromshodhganga.inflibnet.ac.in, and baadalsg.inflibnet.ac.in. It was pre-convinced by the researchers that the references list of any citing documents in which the searched terms/links will appear must have referred to or cited Shodhganga or any of its theses available. A total of 2042 references with the terms mentioned above/links were extracted for further analysis from a total of 1764 citing documents that were retrieved from Scopus. However, the analysis and findings of the study are based on the details of only 1764 handles/theses after removing duplicates, handles those details were either not found or withdrawn from Shodhganga. This article attempts to analyse the impact of India's national ETD repository, Shodhganga, and its theses through reference analysis, finding the top theses. These top universities are cited, and so on.

Keywords: Citing Documents, Electronic Theses and Dissertations (ETD), Impact Analysis, Reference Analysis, Scopus, Shodhganga

1. Introduction

The world of libraries and information services now includes information technology as a crucial component. Worldwide, people and organizations are producing enormous amounts of digital data, information, and documents. Considering both the current and future needs, it is becoming very much essential for libraries to manage and preserve that data/information. When we talk about preserving data/information & documents, we think about IT applications in libraries. And when we talk about open access, we talk about the preservation

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and access of it through IT applications. There is no better example than IRs, which is a landmark achievement in library and information science for preserving research and enabling broader access. (Lynch, 2003) asserted that IRs are now an essential infrastructure for any library or institution for enhancing scholarly communication and accessing educational knowledge content effectively.

Electronic Theses & Dissertations (ETDs) repositories and IRs are the most prominent developments/channels that have uncovered the true potential of hidden and mostly locked/closed grey literature, i.e., theses and dissertations by bringing them forth to the forefront of the research and academic world. The corpus of ETDs is steadily growing worldwide and is expected to continue in the future as well. ETDs provide various benefits, such as research being free, open, and accessible everywhere, not require physical space, being more widely disseminated, and being more widely visible. Academia is now genuinely aware and truly realizing the benefits of ETDs. ETD repositories have been hailed as a major success in providing open access to academic, scientific, and unpublished hidden grey literature. Building and enriching an ETD repository full of full-text theses is a vast undertaking that requires a lot of human effort, planning, funding, technology, and marketing. However, content usage and impact analysis of an ETD repository is much more crucial for it to sustain and to understand its true essence as a service. Further, the unavailability of an agreed set of parameters for assessing and evaluating ETD repositories that demonstrate their overall impact on research and scholarly communications is a significant point of discussion worldwide. Most of the time, evaluation and impact assessments of ETD repositories are conducted using perception analysis based on scant information, webometric studies, usage statistics analysis employing counting the number of file downloads from Google Analytics or in-house tools integrated with the repository, Google citation analysis, altmetrics analysis or other available research tools.

This article is an attempt by the authors to analyse the impact of the Indian national ETD repository, Shodhganga and its theses over the more significant aspect of scholarly communication and academic research. The present study has adopted the reference analysis of citing documents retrieved from Scopus, further filtering and limiting to only references associated with any Shodhganga's thesis or having linked with Shodhganga ETD Repository.

2. Literature Review

The authors found that the impact analysis or impact assessment of IRs, ETDs, etc. has been the subject of several prior research studies that have been undertaken and published. The authors also discovered a small number of research on the evaluation of Shodhganga its impact using different methods and analysis. Thus, the current study completely differs from those earlier works.

(Ferrerias-Fernández et al., 2013) studied the relationship between the open access PhD theses (2008-2009, 2009-2010 and 2010-2011 academic years) and non-open access PhD theses (2006-2007 and 2007-2008 academic years) of the Salamanca University deposited in its institutional repository, called GREDOS. Their main objective was to compare theses with and without open access to see which type received more

citations and impact. In his poster (Coates, 2013) presented the use of Google Analytics usage data to investigate the use of a collection of ETDs. Page views were correlated with page type, user location, and source (referring link), and their effects were examined to determine how users found the ETDs collection. (MacIntyre, 2014) discussed IRUS-UK, the Jisc-funded service created to help institutions understand the usage of their institutional repositories and their items, in his presentation on “IRUS-UK: Improving understanding of the value and impact of institutional repositories.” Additionally, he demonstrated the multiple uses of the COUNTER-compliant article-level usage statistics collected and consolidated from participating publishers and institutional repositories. The platform enables individual institutions to run reports at the repository level (e.g., total download figures) and at the item level where all item usage is consistently mapped and compared based on a taxonomy of 25 item types. The transition rate of the 97 doctoral theses completed in the various fields of education in South Africa in 2008 into peer-reviewed articles and chapters in scholarly books, as well as the citation impact of these theses, were studied by (2015) in an investigation into the scholarly impact of knowledge produced as part of doctoral studies in the field of education. It was discovered that both the transition rates and citation impact of these theses to journal articles and book chapters were modest. Among the 97 theses, 83 did not result in any publishing, 70 did not result in any citations, and 65 theses did not result in either an article or book chapter or any citations. (Bennett & Flanagan, 2016) investigated the impact of the LSE Theses Online (LSETO) thesis collection on scholarly activity. They discussed the various metrics that an institution can use to measure the impact of its corpus of digitized dissertations and how these metrics may be generated using Usage statistics – measuring full-text PDF downloads both from the LSE’s institutional repository as well the ProQuest PQDT (ProQuest Dissertations and Theses) database and citation statistics where available. (Ferrerias-Fernández et al., 2016) examined the visibility and impact of the type of grey literature in their study, which included a random sample of 125 PhD e-theses deposited in the IR of the University of Salamanca (Gredos). They studied the visits and downloads statistics of the e-theses collected from the repository’s statistics module the data citation offered by Google Scholar Citation on those e-theses on the other side. (Bangani, 2018) investigated the academic and societal impacts of the engineering ETDs at the North-West University based on Google Scholar (GS) citation counts and Dspace altmetrics data obtained from the University IR. The results showed that the 612 theses and dissertations attracted 931 citations with an average of 1.52 citations per thesis, and 41.2% theses and dissertations received at least one citation. The study found a weak correlation between academic and societal impacts and some positive trends when looking at the origin of PDF views and citations by country. (Kousha & Thelwall, 2019) assessed the scholarly impacts of dissertations by extracting Google Scholar citation counts for 77,884 American doctoral dissertations from 2013-2017 using ProQuest and comparing them to Mendeley reader counts. They found that one-fifth of the dissertations had at least one Google Scholar citation, and slightly fewer had at least one Mendeley reader. Further, Mendeley reader counts seem more useful for impact assessment purposes for dissertations under two years old. Google Scholar citations seem to be more useful for older dissertations, especially in social sciences, arts and humanities. (Chakravarty, 2019) used Web Analyzer Test Score (WATS)

and evaluated the performance of the online portal of India's national ETD repository, Shodhganga, and discovered that the overall score of the webometric analysis was 6.4. (Aguillo, 2020) explored the presence of IRs contents in 28 social tools using a webometric approach, collecting the link mentions of 2185 IRs in the cited tools from Google selected data Centers during July 2017. The findings revealed that most IRs do not have a strong presence in the most specialized tools, and even for the most popular services, the figures are not sufficient. He opined that the low number of altmetric mentions is due the lack of strategy in promotion IRs contents, as well as certain wrong practices, most notably URL naming. (Kousha & Thelwall, 2020) analysed the dissertation impact of 150,740 UK doctorate dissertations from 2009 to 2018 using data from Google Books, Scopus, Microsoft Academic, and Mendeley. They discovered that fewer than one in every eight UK doctoral dissertations had at least one Scopus (12%), Microsoft Academic (11%), Google Books (9%), or Mendeley reader (5%), and these numbers varied significantly by topic area and publication year. (Coral et al., 2020) used altmetric data to measure the impact of grey literature, i.e., 2870 Theses of Universidad Nacional de San Martin – Tarapoto institutional repository, and proposed strategies for increasing repository visibility. (Wheeler et al., 2022) conducted a bibliometric analysis to investigate relationships between search engine performance of items in IR, OA availability from different types of repositories, and citations. Their study made use an open dataset of IR access and usage collected from five months of Google search engine results pages (SERP) data aggregated by the Repository Analytics and Metrics Portal (RAMP) web service. The results showed that making open access copies of manuscripts available in self-archiving or “green” repositories had a positive citation effect. And the number of citations increased when a single manuscript is available in multiple open access venues.

3. Shodhganga: A Reservoir of Indian Theses

Shodhganga: a reservoir of Indian theses, launched in 2010, is India's national-level ETD repository, developed and maintained by the INFLIBNET Centre, Gandhinagar (An Autonomous Inter-University Centre of the University Grants Commission, New Delhi). Under the supervision and mandate of UGC, it provides a platform for research students and institutions to deposit their PhD theses and make them open access to the entire academic community. Shodhganga hosted a total of 4,10,691 full-text theses contributed by 627 Indian institutions till the end of 2022 (INFLIBNET Newsletter, October-December 2022).

4. Objectives

The present study has adopted the reference analysis of citing documents retrieved from Scopus with the main aim of conducting an impact analysis of Shodhganga, India's national ETD repository, for which the following objectives were framed:

- a) To assess the impact of the national ETD repository of India, Shodhganga, and its theses,
- b) To know the top theses from Shodhganga that are referred to or cited,
- c) To identify the top Universities from Shodhganga whose theses are referred to or cited,
- d) Comparing total thesis views and citations to theses, etc.,

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- f) For overall analysis of guides/supervisors of whom more theses are cited, from which years' awarded theses are cited maximum, keywords, etc.

5. Methodology

5.1 Sources of Data

In this study, the impact analysis of Shodhganga and its theses has been done through reference analysis of citing documents retrieved from Elsevier's Scopus database till 2022. Further, theses' metadata details were extracted from the Shodhganga repository itself.

5.2 Data Collection

The study is limited to the citing documents in Scopus published globally till 2022. To investigate, Scopus database was searched through its references search feature using search terms/links such as shodhganga, shodhganga.inflibnet.ac.in, baadalsg.inflibnet.ac.in, sg.inflibnet.ac.in, retrieved from shodhganga.inflibnet.ac.in. The researchers were pre-convinced that the references list of any citing documents in which the searched terms/links will appear must have referred to or cited Shodhganga or any of its theses available. On June 6 2023, the data was collected, exported in a .csv file, cleaned, and manually verified to match the handles with theses details of Shodhganga for further analysis.

5.3 Data Analysis

From a total of 1764 retrieved citing documents, 2042 references with the aforementioned terms/links were extracted for further analysis. A total of 1467 unique handles linked/used for Theses in Shodhganga were manually extracted, searched & verified with duplication of 304 handles from those references, making it a total of 1771 Theses cited. Out of the total of 2042 references, 271 references were not taken into consideration; 25 references were of Theses whose handles could not be extracted or verified with the information available, so links to theses could not be established; the details of 127 references were of publications (of which, 85 were actually of publications having 'Shodhganga' word in their title itself and 42 were of conference proceedings from PLANNER and CALIBER having Shodhganga word in their titles available in IR@inflibnet but wrongly mentioned the source as Shodhganga and thus appeared in Scopus search results. And 119 references were of publications that had cited or referred to Shodhganga in general for their research work, citing sources as only Shodhganga, or the terms mentioned above/links, not specific to any handle or thesis titles. Further, from the total of 1771 handles, the details of 6 handles were not found and 1 thesis has been withdrawn hence details were not in Shodhganga. Thus, the analysis and results of this study are based on the details of only 1764 handles/theses.

5.4 Results and Findings

The study's major goal was to investigate how Shodhganga PhD research works were used or had an impact on scholarly communication and academic research in general. The number of citations to each thesis is

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calculated as the sum of its occurrences in the citing documents' references list collected from Scopus. According to the investigation results, citations to Shodhganga theses are very few in Scopus publications. Only 1492 (1467+25) unique handles/works of the total 4,10,691 theses works maintained in the Shodhganga repository till 2022 have been cited by publications indexed in Scopus as of the data collection date, representing only a fraction of the total theses with a total of 1796 (1771+25) citations and an average of 0.0044 citations per theses. Approximately only 0.36% of all theses works hosted in the Shodhganga repository had been cited, with some being cited up to 09 times in Scopus publications. (Angelo et al., 2016) had reported in their poster that just 1068 unique items that constituted about only 2% of all items in New Zealand Institutional Repositories at NZresearch.org.nz, had been cited 1902 times in articles indexed by Scopus. As a result of these 2 studies, it can be concluded that although at a very modest rate, theses from ETDs are getting cited and becoming part of mainstream scholarly communication.

Table 1 shows the top 15 cited theses details with a number of times they have been cited in Scopus publications. But, when compared the listed theses with Shodhganga's top 10 viewed theses list taken from the last three FYs: 2022-23, 2021-22 & 2020-21 INFLIBNET Annual Reports, no relation was found between both. No thesis from the top 10 viewed theses appears in the top 15 cited theses list.

Table 1: Top 15 Cited Theses Details with Number of Citations

unique handle	publisher. university	publisher.inst itution/dept/f ac.	thesis title	contributor .guide	creator. research er	year.co mpleted	nos. time cited
https://hdl.handle.net/10603/1221	Pondicherry Univ.	Pondicherry Engineering College	Optimal, power dispatch and pricing for deregulated power industry	Palanivelu, T G	Gnanadass, R	2005	9
https://hdl.handle.net/10603/3534	Punjabi Univ.	Dept. of Economics	Unorganised manufacturing sector in India during postliberalisation period	Anupama	Gupta, Neeru	2010	9
https://hdl.handle.net/10603/5247	Pondicherry Univ.	Pondicherry Engineering College	Investigations on power system operation and management in restructured market	Manivannan, K; Gnanadass, R	Rajathy, R	2011	9
https://hdl.handle.net/10603/24460	Anna Univ.	Faculty of Information and Communication Engineering	Efficient analysis of satellite image denoising and resolution enhancement for improving classification accuracy	Ramar, K	Sree Sharmila, T	2012	8
https://hdl.handle.net/10603/43041	Univ. of Lucknow	Dept. of Botany	Application of multi proxy tree ring parameters in the reconstruction of climate vis a vis glacial fluctuation from the eastern Himalaya	Bhattacharya, Amalava	Shekhar, Mayank	2013	7
https://hdl.handle.net/10603/154792	Univ. of Calcutta	Dept. of Technology	Computer studies of silicon carbide gallium nitride and indium phosphide based IMPATT devices operating in MM wave and terahertz region and corresponding studies on the photo sensitivity of the devices	Roy, Sitesh Kumar	Mukherjee, Moumita	2009	6

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https://hdl.handle.net/10603/31769	Univ. of Delhi	Dept. of Library & Information Science	Use of library classification schemes in the ICT environment in selected libraries in national capital region a study	Singh, K P	Gulati, Dipti	2013	6
https://hdl.handle.net/10603/37614	Anna Univ.	Faculty of Science and Humanities	Development of titanium nanotube Arrays for orthopaedic applications	Rajenen, N	Indira, K	2014	6
https://hdl.handle.net/10603/4267	Punjabi Univ.	Dept. of Commerce	Pilgrimage tourism in North Indian evaluation	Arora, R S	Tomer, Padmini	2011	6
https://hdl.handle.net/10603/6102	Kannur Univ.	Dept. of Information Technology	Analysis and design of tamperproof and contrast-enhanced secret sharing based on visual cryptography schemes	Babu Anto, P	Thomas, Monoth	2011	6
https://hdl.handle.net/10603/705	Saurashtra Univ.	Dept. of Business Management	An analysis of financial performance of state road transport corporation in Gujarat	Chauhan, Pratap Sinh L	Trivedi, Shilpa M	2010	6
https://hdl.handle.net/10603/1271	Pondicherry Univ.	Pondicherry Engineering College	Performance evaluation of swarm intelligence-based power system Optimization strategies	Palanivelu, T G	Raj, P Ajay D Vimal	2008	5
https://hdl.handle.net/10603/23970	Tata Institute of Social Sciences	School of Social Work	Study of institutions of social work education and role of social work educators in developing indigenous knowledge	Lata, Narayan	Tirmare, Prabha	2013	5
https://hdl.handle.net/10603/4566	Jawaharlal Nehru Technological Univ.	Dept. of Electrical and Electronics Engineering	Design and development of cluster algorithms for power system problems	Ramana, N V	Amarnath, R V	2012	5
https://hdl.handle.net/10603/96820	Assam Univ.	Dept. of Ecology and Environmental Science	Studies on Litter Production Decomposition and Nutrient Recycling in Tea Agro Ecosystem of Cachar District Southern Assam	Dutta, B.K ; Ray, D.C	Singha, Deepti Mala	2015	5

To identify which university's awarded theses have received the most citations, the name of the university that awarded the studied theses was taken from Shodhganga ETD repository. 94 different universities awarded 1764 One thousand seven hundred sixty-four theses. Table 2 lists the names of the top 20 universities with more than 20 citations each based on the total number of citations received. With 150 citations, Theses awarded by Anna University have been cited most, followed by those awarded by Mahatma Gandhi University (64 citations) and Pondicherry University (51 citations) respectively. Fifty-three universities' awarded theses have been cited more than ten times each.

Table-2: Top 20 Universities with more than 20 Citations Each

publisher. University	nos. time cited	publisher. university	nos. time cited
Anna University	150	Manonmaniam Sundaranar University	35
Mahatma Gandhi University	64	Jawaharlal Nehru University	35
Pondicherry University	51	Karnatak University	31
Cochin University of Science and Technology	48	Manipal University	30
University of Calcutta	46	Shivaji University	26

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Aligarh Muslim University	45	Gujarat University	26
Punjabi University	44	Maharaja Sayajirao University of Baroda	25
Gauhati University	41	Maharshi Dayanand University	21
Savitribai Phule Pune University	40	University of Calicut	21
University of Mysore	40	Jawaharlal Nehru Technological University	21

In order to identify the guides/supervisors' name whose supervised theses were cited most, the names of each guide were taken from the theses. However, the name of the guides or supervisors could not be identified in 1 of the 1764 Shodhganga theses that were investigated. With a total occurrence of 1953 times, 1764 theses were guided by 1562 guides/ names filtered with the department and university names. Table 3 lists the top 17 names of guides/supervisors with more than 5 citations each based on the total number of citations their guided theses have received. Theses guided by Palanivelu, T G from Pondicherry Engineering College, Pondicherry University have been cited most with 14 citations, followed by theses guided by both Gnanadass, R and Manivannan, K, also from the same university, and Anupama, Department of Economics, Punjabi University (9 citations each) and Ramar, K from Faculty of ICE, Anna University (8 citations) respectively.

Table 3: Top 17 Guides/Supervisors' Names with more than 5 Citations Each

contributor. guide	publisher. university	publisher. institution	nos. time cited
		/dept/faculty/college	
Palanivelu, T G	Pondicherry University	Pondicherry Engineering College	14
Gnanadass, R	Pondicherry University	Pondicherry Engineering College	9
Manivannan, K	Pondicherry University	Pondicherry Engineering College	9
Anupama	Punjabi University	Department of Economics	9
Ramar, K	Anna University	Faculty of Information and Communication Engineering	8
Rajenen, N	Anna University	Faculty of Science and Humanities	7
Bhattacharyya, Amalava	University of Lucknow	Department of Botany	7
Babu Anto, P	Kannur University	Department of Information Technology	6
Arora, R S	Punjabi University	Department of Commerce	6
Chauhan, Pratap Sinh L	Saurashtra University	Department of Business Management	6
Roy, Sitesh Kumar	University of Calcutta	Department of Technology	6
Singh, K P	University of Delhi	Department of Library & Information Science	6
Ramachana, V	Anna University	Faculty of Electrical and Electronics Engineering	5

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Dutta, B.K	Assam University	Department of Ecology and Environmental Science	5
Ray, D.C	Assam University	Department of Ecology and Environmental Science	5
Ramana, N V	Jawaharlal Nehru Technological University	Department of Electrical and Electronics Engineering	5
Lata, Narayan	Tata Institute of Social Sciences	School of Social Work	5

To determine which year's completed theses have received the most citations, the year of completion of cited theses was taken from Shodhganga ETD repository. However, the year of completion was not found in 11 of the 1764 Shodhganga theses examined. 1753 theses were completed in 47 different years. Table 4 and Figure 1 present the top 15 years with more than 25 citations each based on the total number of citations received. Theses that were completed in 2013 have been cited most with 220 citations, followed by those completed in 2011 (212 citations) and 2012 (209 citations), respectively. Twenty-two theses have been cited more than 10 times each.

year. completed	nos. time cited
2013	220
2011	212
2012	209
2014	163
2010	139
2015	121
2016	100
2009	67
2017	64
2008	57
2007	53
2018	42
2005	36
2004	29
2006	29

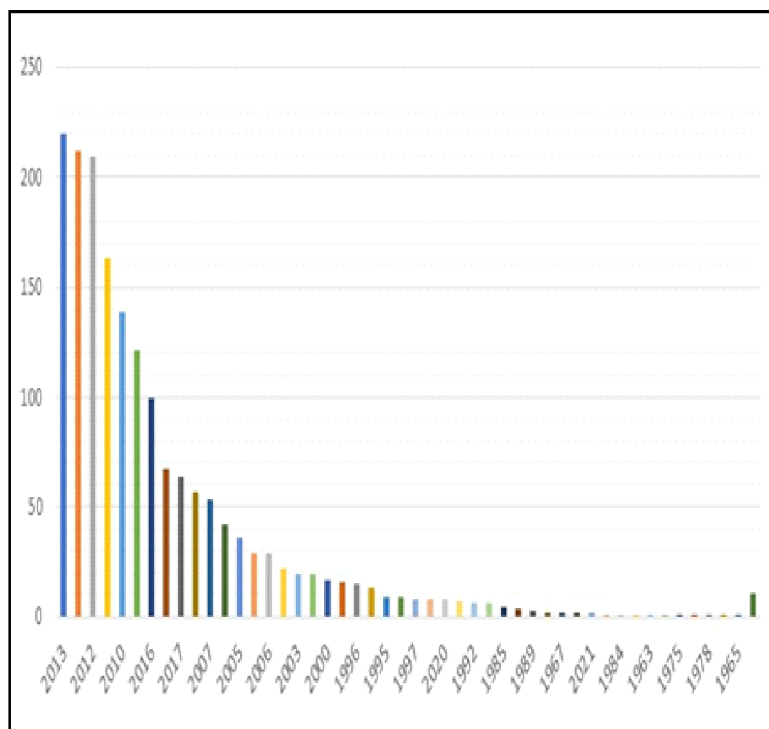


Table 4: Top 15 Years with more than 25 Citations Each, and Figure 1: Years with Citations

6. Conclusions

ETDs are of great importance. Building an ETD repository is not the end of its work, it is just the beginning. Populating contents and enriching ETD repositories are much necessary with value additions to it and facilitating better access through technology. Additionally, administrators, librarians, repository managers must make evaluating and assessing ETDs a primary goal if they are to comprehend the value of ETDs as a service fully.

The analysis and findings of this study are based on the details of only 1764 handles/theses retrieved from the reference list of Scopus citing documents. Although its much less as of date in comparison to the total theses hosted in Shodhganga, the study reveals that Shodhganga and its theses collection are being used and impacting scholarly publications. According to the findings, only 1492 unique thesis works (0.36%), out of a total of 4,10,691 theses works maintained in the Shodhganga repository till 2022, are cited in Scopus-indexed publications. The average number of citations per thesis is 0.0044, while some have received up to 09 citations in Scopus publications. There is no correlation between top cited theses and top viewed theses list reported on Shodhganga. Anna University theses have received the most citations overall, followed by those from Mahatma Gandhi University and Pondicherry University. The most often cited theses were those guided/supervised by Palanivelu, T. G., from Pondicherry Engineering College of Pondicherry University, followed by Gnanadass, R. and Manivannan, K., also from that institution, Anupama from the Department of Economics of Punjabi University, and Ramar, K., from the Faculty of ICE of Anna University. Theses completed in 2013 have received the most citations, followed by 2011 and 2012 theses. 22 theses out of the 1764 theses have received more than ten citations each in Scopus publications. Management and Economics are the top two keywords mentioned in the theses metadata in the Shodhganga ETD repository, with an occurrence of 53 & 46 times, respectively.

This article is a brief analysis of thesis citations limited to only the citing documents indexed in the Scopus database. For the same objective, further large-scale research can be carried out using Altmetrics or Google citations analysis.

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