

Analysis of PhDs awarded by Indian Institute of Technology (IITs) and Electronic Thesis available in Shodhganga Repository

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Abstract

The Indian Institutes of Technology (IITs) are renowned engineering and technology institutions in India known for research excellence. This study highlights INFLIBNET's efforts to promote Open Access by including IIT theses in the Shodhganga repository. It analyzes Ph.D. degrees awarded by IITs from 2012 to 2022, with IIT Kharagpur, IIT Delhi, and IIT Bombay leading with 2977, 2724, and 2642 awards, respectively. The rising number of Ph.D. degrees is attributed to expanded research programs and the demand for research professionals in India. Notably, there's variation in awards among IITs.

The study examines electronic theses in the Shodhganga Repository to identify top IITs in Ph.D. awards and growth rates. It also assesses contributions to the repository. Findings show 18,422 research degrees were granted by IITs during this time, with Ph.D. awards reaching 3,003 in 2021-2022. Predictions suggest over 65,000 research degrees will be conferred by IITs in the next decade, averaging 6,500 yearly. Ph.D. thesis submissions grew from 1441 in 2019 to 7207 in 2023, indicating substantial growth. This trend reflects IITs' commitment to research excellence and open knowledge dissemination. The study aids policymakers, academics, and potential Ph.D. students in evaluating research output and reputations of IITs in India.

Keywords: Digital libraries, E-publishing, Electronic Theses and Dissertations (ETD), Open Access, Scholarly Communication

1. Introduction

The development and implementation of Electronic Theses and Dissertations (ETD) systems have gained significant attention in the academic landscape, with numerous studies highlighting the benefits of these systems for universities. The adoption of ETD systems has enhanced efficiency, reduced costs, improved access to scholarly work, and increased the visibility and impact of research outputs. This article presents

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a literature review on the research productivity and growth of different Indian Institutes of Technology (IITs) regarding Ph.D. degree awards and thesis contributions to the Shodhganga repository.

Electronic theses and dissertations (ETDs) are digital versions of traditional theses and dissertations submitted electronically rather than in print. They offer several advantages over traditional print versions, including increased accessibility, searchability, and preservation. ETDs also provide a platform for incorporating multimedia elements, such as images, audio, and video, that can enhance the research and presentation of information.

The Indian Institutes of Technology (IITs) are a group of top engineering and technology institutions in India that provide undergraduate, graduate, and doctoral degrees in various engineering, science, and technology fields. IITs in India conduct extensive research in various areas, including engineering, technology, fundamental sciences, social sciences, and humanities.

Researchers can create innovative theses with improved features, including spreadsheets, databases, simulations, linkages, sound, video, 3D animation, and better visuals, thanks to the advancement of technology, which has several advantages. These capabilities, absent from the theses and dissertations in print form, enable scientists to more effectively convey their scholarly work and even to incorporate the more in-depth data that the research is based on.

2. Literature Review

Several studies have been carried out on developing and implementing ETD systems, highlighting the benefits of these systems for universities. A study (Greig, 2005) described the strategies adopted by staff at Glasgow University Library in trying to implement electronic theses and the challenge faced. (Vijaykumar & Murthy, 2004) suggested an ETD model to improve the efficiency and effectiveness of the thesis and dissertation process, reduce costs associated with printing and storage, and enhance access to scholarly work for researchers worldwide. Another study (Urs, 2001) reported the Vidyanidhi ETD system, the first electronic thesis and dissertation initiative in India, that ETD systems can improve the quality of research and increase the visibility and impact of research outputs, leading to global access and greater recognition for universities and researchers.

3. Objective of the Study

The need for this objective arises from understanding the trends and patterns in Ph.D. degree awards, which can provide valuable insights into the research and academic landscape of different IITs. By comparing the number of PhDs awarded by each institution over time, it becomes possible to assess their research productivity and growth in the field of higher education; furthermore, studying the contribution of theses to the Shodhganga repository helps gauge the dissemination of research findings and the level of engagement of universities in sharing scholarly knowledge. This study would be valuable for policymakers, academics, and prospective Ph.D. students in evaluating the reputation and research output of different IITs. The main objectives of the study are:

- ❖ Analyze and compare the trends in Ph.D. degrees awarded by different IITs.
- ❖ Identify the top IITs based on the number of Ph.D. degrees awarded.
- ❖ Evaluate the contribution of each IIT's theses to the Shodhganga repository and identify the leading IITs in terms of their contributions.

4. Methodology

The present study conducted a comprehensive analysis across 23 IITs, with a sample size spanning a decade from 2012 to 2022 by employing an observational and case study approach, the study aimed to delve into the analysis of PhD degrees awarded by each IITs and thesis data available at shodhganga repository during the specified period. To gather pertinent data, the researchers meticulously collected information from each IIT's annual reports, which were available online, and sourced thesis submission data from the Shodhganga repository, each IIT's thesis submission details were collected by extensively browsing through the Shodhganga repository, ensuring a thorough examination of their research output over the ten-year period. By utilizing this robust dataset, the study endeavors to provide valuable insights into the PhD degree award trends and advancements within the higher education landscape and shed light on the growth and challenges faced by these institutions over the past ten years. A detailed study and analysis of the IITs thesis in the Shodhganga repository has been done to map the contributions of theses by each IIT using a data analysis and visualization techniques. The collected data has been assessed and presented.

Numerical data analysis techniques play a crucial role in modern research across various disciplines; these techniques involve the systematic exploration, interpretation, and inference from numerical data to draw meaningful conclusions and make informed decisions use ; we used statistics to summarize and present data in a concise and meaningful way, providing insights into variability, for drawing conclusions and making predictions; by leveraging sophisticated numerical data analysis techniques, researchers extracted valuable insights from the collected data, enriching the body of knowledge and contributing to evidence-based decision-making.

5. Data Analysis

The data shows (Table 1) the number of Ph.D. degrees awarded by the Indian Institutes of Technology (IITs) from 2012–2013 to 2021–2022. We can observe trends and patterns in each IIT's research output over time by comparing the number of PhDs awarded in different years. There are 23 IITs, and the data shows that the number of Ph.D. degrees awarded has increased over time. The total number of research degrees awarded by all IITs in the 10-year period from 2012-2022 is 18,422, and the number of PhD degrees awarded increased to 3003 in 2021–2022.

The data also shows a variation in the number of Ph.D. degrees awarded by each IIT. The IITs with the highest number of Ph.D. degrees awarded in 2012-2022 were IIT Kharagpur (2977), IIT Delhi (2724), and IIT Bombay (2642).

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There are a few possible reasons for the increase in the number of Ph.D. degrees awarded by the IITs over time. One reason is that the IITs have been expanding their research programs. In recent years, the IITs have invested in new research facilities and hired more faculty members, which has led to an increase in the number of research projects being conducted at the IITs.

Another reason for the increase in the number of Ph.D. degrees awarded by the IITs is the growing demand for research-trained professionals in India. The Government of India is investing heavily in research and development, creating new opportunities for research-trained professionals. As a result, there is a growing demand for Ph.D. degrees from the IITs. The data shows that the number of Ph.D. degrees awarded by the IITs has increased over time. This increase is due to several factors, such as expanding research programs at the IITs and the growing demand for research-trained professionals in India. The IITs are increasingly important in research and development in India.

There is a significant variation in the number of research degrees awarded among different IITs. The variation can be attributed to factors such as the size of the institution, the number of research programs offered, faculty strength, IITs established over a span of several years, research funding, and the popularity of research areas in each IIT.

The data also reveals the growth and expansion of the IIT system over the years. Newer IITs, established after 2008, have comparatively lower numbers of research degrees awarded, which is expected as they are relatively recent additions to the IIT network. It is important to note that the data includes “NA” values, indicating missing or unavailable data for specific years or Ph.D. degrees yet to be awarded by new IITs.

By observing the current data and assuming a constant growth rate, more than 65,000 research degrees would be awarded by IITs by the end of the next decade, with an average of 6500 Ph.D. degrees being awarded annually by all IITs; this estimate is based on an average growth rate of 13.58% and contribution of Ph.D. degrees by new IITs.

Table 1: Details of Ph.D. degree awarded by each IIT years for the period 2012-2013 to 2021-2022

SL No	IIT Name	Estb Year	Degree	2021-2022	2020-2021	2019-2020	2018-2019	2017-2018	2016-2017	2015-2016	2014-2015	2013-2014	2012-2013	Total
1	IIT Kharagpur	1951	Ph.D.	315	442	387	372	295	247	298	255	204	162	2977
2	IIT Bombay	1958	Ph.D.	449	178	381	181	308	357	208	230	175	175	2642
3	IIT Kanpur	1959	Ph.D.	126	185	221	208	186	160	151	136	121	132	1626
4	IIT Madras	1959	PhD	157	243	243	445	247	226	212	475	180	156	2584
5	IIT Delhi	1961	PhD	288	298	331	331	378	306	264	162	178	188	2724
6	IIT Guwahati	1995	PhD	175	172	285	230	230	115	128	124	106	65	1630
7	IIT Roorkee	2001	PhD	379	207	269	308	292	227	292	161	180	122	2437
8	IIT Bhubaneswar	2008	PhD	41	40	96	99	77	83	76	62	9	2	585
9	IIT Gandhinagar	2008	PhD	86	76	51	23	14	22	22	6	2	0	302
10	IIT Hyderabad	2008	PhD	119	96	69	58	40	42	34	5	3	0	466
11	IIT Jodhpur	2008	PhD	27	31	28	19	NA	6	0	0	0	0	111

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12	IIT Patna	2008	PhD	102	54	40	41	14	28	25	5	3		312
13	IIT Ropar	2008	PhD	52	32	32	28	15	9	18	2	0	0	188
14	IIT Indore	2009	PhD	109	58	83	83	33	32	20	18	6	0	442
15	IIT Mandi	2009	PhD	231	39	22	22	29	24	3	3	0	0	373
16	(IIT BHU), Varanasi	2012	PhD	95	192	153	84	119	81	64	52	47	21	908
17	IIT Palakkad	2015	PhD	1	1	NA	NA	NA	NA	NA	NA	NA	NA	2
18	IIT Tirupati	2015	PhD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
19	IIT (ISM), Dhanbad	2016	PhD	250	229	142	107	220	167	NA	NA	NA	NA	1115
20	IIT Bhilai	2016	PhD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
21	IIT Dharwad	2016	PhD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
22	IIT Goa	2016	PhD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
23	IIT Jammu	2016	PhD	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
		Total		3003	2573	2833	2639	2497	2132	1815	1696	1214	1023	18422

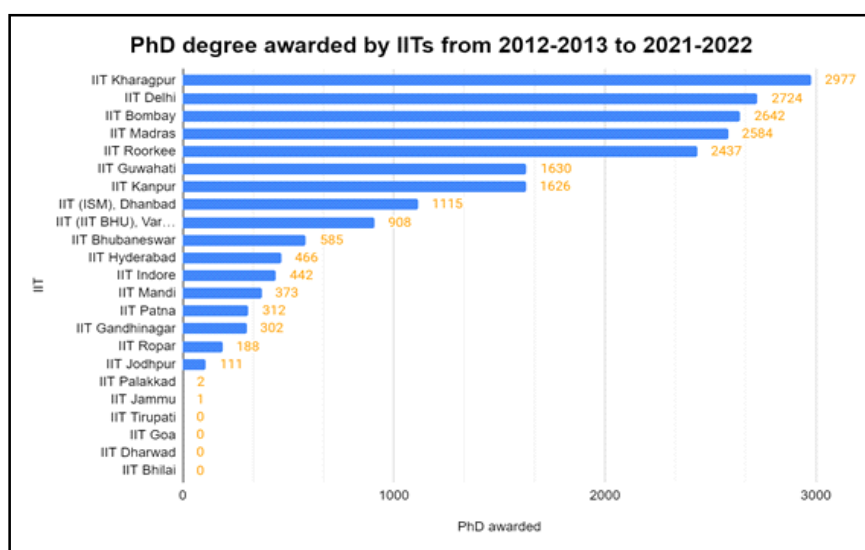


Figure 1: Number of PhD degree awarded by each IIT

5.1 IITs and Shodhganga

Indian Institutes of Technology (IITs), have initiated a commendable practice of submitting their theses to the Shodhganga national repository of Indian theses. Shodhganga is an Indian national repository of theses and dissertations. It was established by INFLIBNET in 2008 to make Indian research more accessible to the global community. Currently, it hosts over 400,000 theses from over 1,000 universities and institutions in India. This development is set to revolutionize the discovery of high-quality theses produced by IITs, providing a significant boost to researchers and scholars alike; this decision to submit IIT theses to the government's research repository is undoubtedly a boon for the research community with open access to these valuable resources, researchers will have unrestricted access to the wealth of knowledge generated by IIT scholars, this move is expected to foster collaboration, innovation, and interdisciplinary research, as experts across various fields will now have access to a broader range of information. As of May 2023, a total

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of 7,207 theses have been submitted by the IITs to Shodhganga; these numbers are expected to grow in the coming years, as the government has linked the submission of theses to the NIRF ranking system it will incentivize the IITs to submit more theses to the repository, which will in turn make their research more accessible to the global community.

Accessibility of IIT theses through the Shodhganga national thesis repository will have a significant impact on minimizing plagiarism and avoiding duplication of research efforts in India and worldwide; with a centralized platform for accessing and referencing these theses, researchers can easily verify the originality of their work and ensure they are contributing unique insights to their respective areas of study, it will not only enhance the credibility and authenticity of research but also streamline the academic publishing process.

Table 2: Details of Thesis submission to Shodhganga by each IIT year wise

SL No	Institute Name	Degree	2019	2020	2021	2022	2023	Total
1	IIT Bhilai	Ph.D	0	1	2	5	0	8
2	IIT Bhubaneswar	Ph.D	0	1	32	43	0	76
3	IIT Bombay	Ph.D	283	2	67	341	0	693
4	IIT Delhi	Ph.D	337	299	283	336	0	1255
5	IIT Dharwad	Ph.D	0	0	1	1	1	3
6	IIT Gandhinagar	Ph.D	0	1	36	2	0	39
7	IIT Guwahati	Ph.D	203	172	237	248	74	934
8	IIT Hyderabad	Ph.D	15	70	113	62	0	260
9	IIT Varanasi	Ph.D	121	119	162	72	0	474
10	IIT Indore	Ph.D	73	67	108	83	4	335
11	IIT Dhanbad	Ph.D	0	0	187	425	129	741
12	IIT Jammu	Ph.D	0	0	0	1	4	5
13	IIT Jodhpur	Ph.D	0	0	4	12	0	16
14	IIT Kharagpur	Ph.D	2	5	317	238	0	562
15	IIT Madras	Ph.D	369	346	342	201	0	1258
16	IIT Mandi	Ph.D	22	39	47	65	0	173
17	IIT Palakkad	Ph.D	0	0	1	2	0	3
18	IIT Patna	Ph.D	16	10	28	29	0	83
19	IIT Roorkee	Ph.D	0	21	158	1	0	180
20	IIT Ropar	Ph.D	0	0	53	60	0	113
21	IIT Tirupati	Ph.D	0	0	0	4	0	4
22	IIT Goa	Ph.D	0	0	0	0	0	0
23	IIT Kanpur	Ph.D	0	0	0	0	0	0
		Total	1441	1152	2176	2226	212	7207

The total number of Ph.D. thesis submissions across all the institutes in 2019 was 1441, which increased to 7207 by 2023. This indicates a significant overall growth in Ph.D. theses submission over the years.

The Indian Institute of Technology (IIT) Delhi has the highest number of Ph.D. theses with 1255, followed by IIT Madras with 1258 and IIT Bombay with 693. These institutes have consistently maintained a high number of Ph.D. students. Some institutes have shown substantial growth in Ph.D. thesis submissions over the years. For example, IIT Bombay significantly increased from 283 in 2019 to 693 in 2023. Similarly, IIT Guwahati increased from 203 in 2019 to 934 in 2023.

While some institutes experienced consistent growth, others showed fluctuations in Ph.D. submissions. For instance, IIT Bhubaneswar had a steep rise in 2021 but dropped to 0 in 2022 and 2023. It's important to investigate the reasons behind such fluctuations. Some institutes, such as IIT Goa and IIT Kanpur, have not submitted any Ph.D. thesis data. These insights provide an overview of the Ph.D. thesis submission trends among the Indian Institutes of Technology based on the given data.

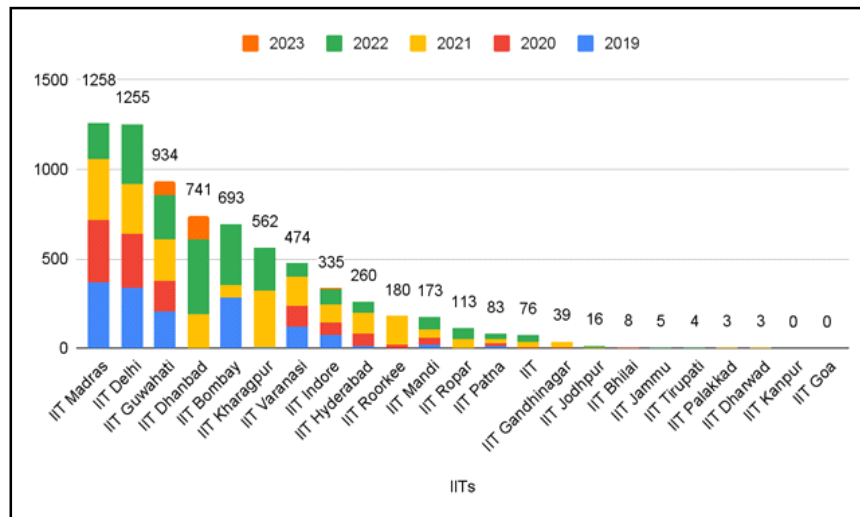


Figure 2: Number of PhD thesis submitted by each IIT

6. Findings

1. The total number of research degrees awarded by all IITs in the 10-year period from 2012-2022 is 18,422, and the number of PhD degrees awarded increased to 3003 in 2021–2022.
2. The IITs with the highest number of Ph.D. degrees awarded in 2012-2022 were IIT Kharagpur (2977), IIT Delhi (2724), and IIT Bombay (2642).
3. The data shows a variation in the number of Ph.D. degrees awarded by each IIT. Factors contributing to this variation include the size of the institution, the number of research programs offered, faculty strength, research funding, and the popularity of research areas in each IIT.

4. Newer IITs, established after 2008, have comparatively lower numbers of research degrees awarded, which is expected as they are relatively recent additions to the IIT network.
5. Assuming a constant growth rate, it is estimated that more than 65,000 research degrees will be awarded by IITs by the end of the next decade, with an average of 6500 Ph.D. degrees being awarded annually by all IITs.
6. The IITs have submitted 7,207 theses to the Shodhganga repository as of May 2023. This submission of theses to the repository is expected to grow in the coming years due to incentives provided by the government.
7. The accessibility of IIT theses through the Shodhganga repository is expected to significantly impact minimizing plagiarism and avoiding duplication of research efforts. It will also enhance the credibility and authenticity of research and streamline the academic publishing process.
8. Submitting theses to the Shodhganga repository is part of the government's efforts to make Indian research more accessible globally. It is expected to foster collaboration, innovation, and interdisciplinary research as experts from various fields will have access to a broader range of information.

The data analysis reveals the growth in the number of Ph.D. degrees awarded by IITs over time, the variation among different IITs, and the increasing contribution of IITs to the Shodhganga repository; this information is valuable for policymakers, academics, and prospective Ph.D. students in evaluating the reputation and research output of different IITs and promoting the accessibility and impact of Indian research.

7. Conclusion

A major advantage of ETDs is their greater accessibility. It can be challenging for researchers who are not connected to the IIT where the work was generated to access traditional print theses and dissertations. ETDs, on the other hand, can be accessed at any time and from any location in the world; for academics who might not have access to physical collections or who are working from remote areas, this makes them a fantastic resource. . The data shows a variation in the number of Ph.D. degrees awarded by each IIT. Factors contributing to this variation include the size of the institution, the number of research programs offered, faculty strength. The accessibility of IIT theses through the Shodhganga repository is expected to significantly impact minimizing plagiarism and avoiding duplication of research efforts. It will also enhance the credibility and authenticity of research and streamline the academic publishing process.

Research students from all around India can access the IITs because they are spread out across the country; the IITs have a solid history of providing top-notch research; the government provides the IITs with generous funding, enabling them to make investments in infrastructure and research facilities, IITs attract some of the best and brightest students from India and around the world.

Overall, the IITs are playing a vital role in the development of India's research and development ecosystem, and IITs are producing high-quality research that is helping to drive innovation and economic growth; IITs are also playing an important role in training the next generation of scientists and engineers who will lead India into the future.

Indian Institutes of Technology awarded a total of 18,422 research degrees in the ten years from 2012-2022; this shows that IITs play a significant role in producing highly skilled researchers in India.

Data analysis suggests that the IITs are increasingly important in India's economic and social development. The IITs are producing highly skilled researchers who contribute to developing new technologies and industries. The IITs are also graduating a more diverse pool of students bringing new perspectives and ideas to the workplace.

This study demonstrates the growth and expansion of the IIT system in terms of research productivity and thesis contributions. The findings provide valuable insights into the research landscape of different IITs and their contributions to the academic community. The increasing number of Ph.D. degrees awarded and submitting theses to the Shodhganga repository reflect the IITs' commitment to research excellence and knowledge dissemination; by evaluating these trends, policymakers, academics, and prospective Ph.D. students can make informed decisions regarding different IITs' reputations and research output.

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