

Research Trends in Central Funded Technical Institutes (CFTIs) in India during 2011-2020

Mr. Shankar B. Chavan

Assistant Librarian

Indian Institute of Technology Delhi

E-mail: shankar.chavan@library.iitd.ac.in

Prof. Keshava

Professor

Department of Studies and Research in Library

and Information Science,

Tumkur University, Tumkur

E-mail: keshtut@gmail.com

Abstract

Centrally Funded Technical Institutes (CFTIs) in India are the Institutions of National Importance under the Ministry of Education, Govt. of India. This study analyzes the research trends in Engineering, Science and Technology in CFTIs in India for the period from 2011 to 2020 of the publications indexed in the Scopus Citation Database. The study is limited to IITs and NITs and elaborates the trends, strengths, dynamics of research across institutions, and international collaborations. The paper analyzes 249543 publications, indexed in Scopus database using scientometrics and MS Excel, with a total of 48113 (19.28%) of publications collaborated across different countries. The research growth trend was found to be continuously increasing, with three times in the year 2020 comparing the publications of 2011. Based on the number of publications, IIT Kharagpur is on the top with a maximum of 23776 publications, and IIT Bombay is on the top in the number of internationally collaborated publications with 6502 papers. IIT Hyderabad is at the tenth position by the number of publications, and at fifth, based in international collaboration. It has been found that more than 50% of research publications have international collaboration. The paper also analyzes sponsors of funding and subject areas of research. The study could be useful to those interested in exploring the research trends in Science, Technology, Engineering, etc., especially in the CFTIs.

Keywords: *Scientometrics; Bibliometrics; CFTIs; Indian Institutes of Technology; National Institutes of Technology; Mapping Research.*

1. Introduction

India has an impressive history of higher education, dating back to ancient times. The Nalanda, Takshashila and Vikramashila universities were world-famous centres of learning, attracting scholars from around the globe. Since independence from the British colonization, the country has witnessed astonishing growth in the infrastructure in higher education. In 1947, India had only 20 universities and 500 colleges, which have now increased to over 993 universities, 39931 colleges and 10725 stand-alone institutions.

Prior to independence, the country had very few engineering colleges, where only the graduate-level education in the field of basic engineering was popular, i.e. Civil, Electrical and Mechanical Engineering. After 1950, India entered in the era of establishing the engineering and technological institutes at national, state and regional levels. Early four decades of engineering education were on the pattern of Americans and Britishers. After 1990, the boom of engineering education took place throughout the county. Currently, more than 6793 colleges and institutes are affiliated to AICTE in the field of Architecture and Town Planning, Architecture and Planning, Architecture, Planning, Design, Town Planning, Engineering and Technology, MCA with intake capacity of 2.6 million students and 0.47 million faculty members and with about 97 CFTIs, i.e., IISc, IITs, NITs, IISERs etc.

Bibliometric analyses of academic and research output can be used as a yardstick for measuring the trends and challenges in a subject. This provides an insight into the dynamics of the subject leading to better information handling and management. This study analyzes the research trends in Engineering, Science and Technology in CFTIs in India during the period from 2011 to 2020 using quantitative and qualitative analysis of the publications indexed in Scopus Citation Database. The study elaborates on the trends in Engineering, Science and Technology, strengths, dynamics of research across institutions, and international collaborations.

The analysis may help gain a better understanding of collaborative trends, subject area with the highest research concentration, and other scientometric aspects of literature based on co-occurrence of terms. The findings of the study will be useful to the teachers, researchers, planners, policy-makers and funding agencies

for gaining macro insights into the research output in Engineering, Science and Technology, and also the trends in the CFTIs in India and will assist them in strategy formulation to fill the gaps.

2. Review of Literature

Raghuraman, Chander, & Madras (2010) in their study while comparing the research performance of Indian institutions based on the h-index and p-index with other international institutions and ranked, found that the institutions of national importance contributed the highest in terms of publications and citations per institution. Prathap (2013) in his paper, “benchmarking research performance of the IITs using web of science and Scopus bibliometric databases” tried to showcase the performance of IITs. Hasan and Singh (2015) evaluated the research output of five top-ranked IITs based on data extracted using Web of Science for a period of five years from 2009 to 2013. A total of 2,15,019 records were retrieved for India, which is 2.72% of the global records for the period 2009-2013. Siddaiah et al. (2016) analyzed the publications of eight new IITs as covered in Scopus for the period 2010-2014, which show the growth of the average publication with 38.78% and average citations as 4.63. Pradhan and Ramesh (2018) analysed the publications of six old IITs as indexed in Scopus, which indicates the relative citation impact of IIT Roorkee and Bombay. Shettar & Hadagali (2020) analysed the research productivity of the National Institutes of Technology for the period from 2009 to 2018 which ranks the NITs based on TP, TC, ACPP, h-index, Impact of Collaboration, Impact of Internationally collaborated publications, authorship pattern, etc.

3. Objectives

The main objective of the paper is to analyse the research productivity of NITs and IITs for the period from 2011 to 2020, i.e. to identify the growth of publications, most productive institutes, funding sponsor bodies and international collaboration pattern of the CFTIs.

4. Methodology

Scopus is the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings, etc. Delivering a comprehensive overview of the world's research output in the fields of science, technology, medicine, social sciences, and arts and humanities; Scopus features smart tools to track, analyse and visualise research. The study elaborates on the trends in Engineering, Science and Technology, its strengths, dynamics of research across institutions, and international collaborations. A list of CFTIs was Collected from the Ministry of Education, Government of India portal for the purpose. However, the scope is limited to NITs and IITs only. The data was collected from the affiliations using the Scopus database with the publication years from 2011 to 2020 only. A total of 249543 publications were analyzed using excel and scientometric techniques.

5. Analysis and Findings

5.1. Growth of publications in CFTIs

The publication trend has been found continuously increasing each year by more than 1%. In the year 2016 and 2018, it is more than 1.5% and 2%. The research growth in a span of 10 years increased by almost three times from 13568 (5.44%) in 2011 to 38496 (15.43%) in the year 2020. This is due to the increasing number of newly established CFTIs and more research publications are due to international ranking and collaborated research. Based on this growth study, it can be predicted that research publications of CFTIs may grow four times in the next decade.

S.No	Year of Publication	No. of Publications	Percentage
1	2011	13568	5.44
2	2012	14925	5.98
3	2013	16576	6.64
4	2014	19307	7.74

5	2015	21338	8.55
6	2016	25107	10.06
7	2017	28823	11.55
8	2018	34083	13.66
9	2019	37320	14.96
10	2020	38496	15.43

5.2. Most prolific institutions

Table 2 lists the top 10 most prolific institutes based on the number of publications. It is found that, Indian Institute of Technology Kharagpur published the highest number of papers, 23776 (9.55%), followed by Indian Institute of Technology Bombay, 23009 (9.22%), Indian Institute of Technology Madras, 22667(9.08%), Indian Institute of Technology Delhi, 21706 (8.70%) and Indian Institute of Technology Roorkee 17447 (6.99%). Other institutes those are in the top ten positions have been given in Table 2. Table 2 also ranks the institutes based on the number of internationally collaborated publications, and publications collaborated with authors affiliated to the institute/university across countries. Indian Institute of Technology Bombay has the highest collaborated publications, 6502 (28.26%), followed by Indian Institute of Technology Madras 5959 (26.29%) and Indian Institute of Technology Kharagpur 5050 (21.11%). Under the top ten positions of CFTIs, there are 10 IITs and 1 NIT. Indian Institute of Technology Hyderabad is in the tenth rank based on a total number of publications and fifth in position based on internationally collaborated publications.

S.No	Name of Institute	Total			International Collaboration		
		No. of Publications	%	Rank	No. of Publications	%	Rank
1.	Indian Institute of Technology Kharagpur	23776	9.53	1	5020	21.1	3
2.	Indian Institute of Technology Bombay	23009	9.22	2	6502	28.3	1
3.	Indian Institute of Technology Madras	22667	9.08	3	5959	26.3	2
4.	Indian Institute of Technology Delhi	21706	8.7	4	4618	21.3	4
5.	Indian Institute of Technology Roorkee	17447	6.99	5	3292	18.9	7
6.	Indian Institute of Technology Kanpur	15373	6.16	6	3966	25.8	6
7.	Indian Institute of Technology Guwahati	13324	5.34	7	2527	19	9
8.	Indian Institute of Technology - ISM	9933	3.98	8	1230	12.4	10
9.	Indian Institute of Technology - BHU	9313	3.73	9	3064	32.9	8
10.	National Institute of Technology Rourkela	9313	3.73	9	1157	12.4	11
11.	Indian Institute of Technology Hyderabad	7685	3.08	10	4029	52.4	5

5.3. Preferred language for research publications

There are a total of 249543 research publications, out of that 249502 (99.98%) were published in English language and a very small fraction of 41 (0.02%) in other languages, like French, Polish, German, etc. This clearly indicates that the authors of CFTIs prefer the English language to showcase their research works.

5.4. Document type of publications

Figure 1 presents the researchers with various type of documents during the last one decade from CFTIs. The study shows that there are 249543 publications during the period from 2011 to 2020. It indicates that the research articles are 162345 (65.06%), followed by conference papers 70854 (28.39%), book chapters 6601 (2.65%), reviews 6021(2.41%), other types of documents, i.e editorial, erratum, book, letter, note, data paper, short survey etc. are just 1.49%. The study shows that the highest number of documents were published as research articles as preferred by the authors.

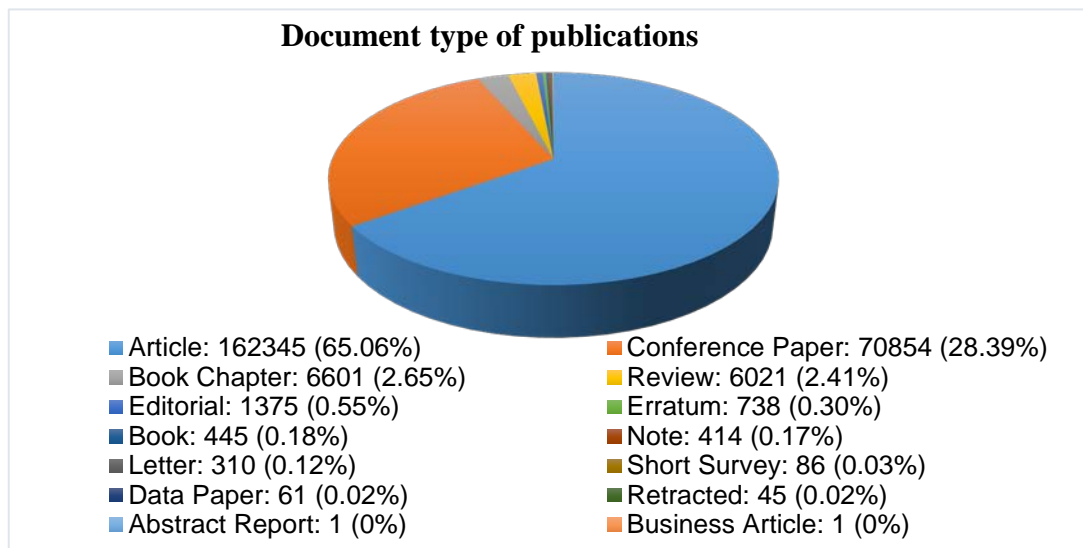


Fig.1. Graphical representation of document type of publications

5.5. Geographical distribution of International Collaborations

A total of 249543 publications were contributed by the authors affiliated to CFTIs. Out of 249543 publications, 48113 (19.28%) were collaborated by the authors affiliated to the institutes/universities/organizations from 158 countries worldwide. Top Countries with the highest collaborated publications are given in Table 3. The USA is in the first rank with 15217 (6.10%), followed by Germany with 5875 (2.35%), the United Kingdom with 5676 (2.27%), China with 3971 (1.59%), South Korea with 3869 (1.55%), and other countries in top ten list are given in Table 3. The study clearly shows that 1/5th of the publications of CFTIs have international collaboration. The research trend in Indian is attracting more global collaborations.

Table 3. Geographical distribution of international collaborations				
S.No	Country	No. of Publications	Percentage	Rank
1.	United States	15217	6.10	1
2.	Germany	5875	2.35	2
3.	United Kingdom	5676	2.27	3
4.	China	3971	1.59	4
5.	South Korea	3869	1.55	5
6.	France	3568	1.43	6
7.	Australia	3538	1.42	7
8.	Japan	3103	1.24	8
9.	Italy	2949	1.18	9
10.	Canada	2906	1.16	10

5.6. Distribution of publications in different subject areas

Table 4 and Figure 2 deals with the pre-dominant subject areas of research as covered in the publications of CFTIs during the last one decade. It has been observed that Engineering was the most preferred area of research with 107617 (43.13%) publications, followed Computer Science with 63771(25.56%), Material Science with 55818 (22.37%), Physics and Astronomy with 53692 (21.52%), Chemistry with 34634 (13.88%), Mathematics with 29133 (11.67%), Chemical Engineering with 25483(10.21%), Energy with 24657 (9.88%) and publications in other subject areas are given in Table 4. It is revealed from the study that Engineering, Computer Science, Material Science, Physics and Astronomy are the major subject areas of research.

Table 4. Distribution of publications in different subject areas		
Subject Area	No. of Publications	Percentage
Engineering	107617	43.13
Computer Science	63771	25.56
Materials Science	55818	22.37
Physics and Astronomy	53692	21.52

Chemistry	34634	13.88
Mathematics	29133	11.67
Chemical Engineering	25483	10.21
Energy	24657	9.88
Environmental Science	17535	7.03
Biochemistry, Genetics and Molecular Biology	13124	5.26
Earth and Planetary Sciences	12012	4.81
Social Sciences	8916	3.57
Medicine	6959	2.79
Business, Management and Accounting	6699	2.68
Agricultural and Biological Sciences	6217	2.49
Decision Sciences	5957	2.39
Multidisciplinary	3504	1.40
Pharmacology, Toxicology and Pharmaceutics	3395	1.36
Economics, Econometrics and Finance	2503	1.00
Immunology and Microbiology	2100	0.84
Arts and Humanities	1648	0.66
Neuroscience	858	0.34
Health Professions	746	0.30
Psychology	584	0.23
Nursing	205	0.08
Veterinary	82	0.03
Dentistry	56	0.02

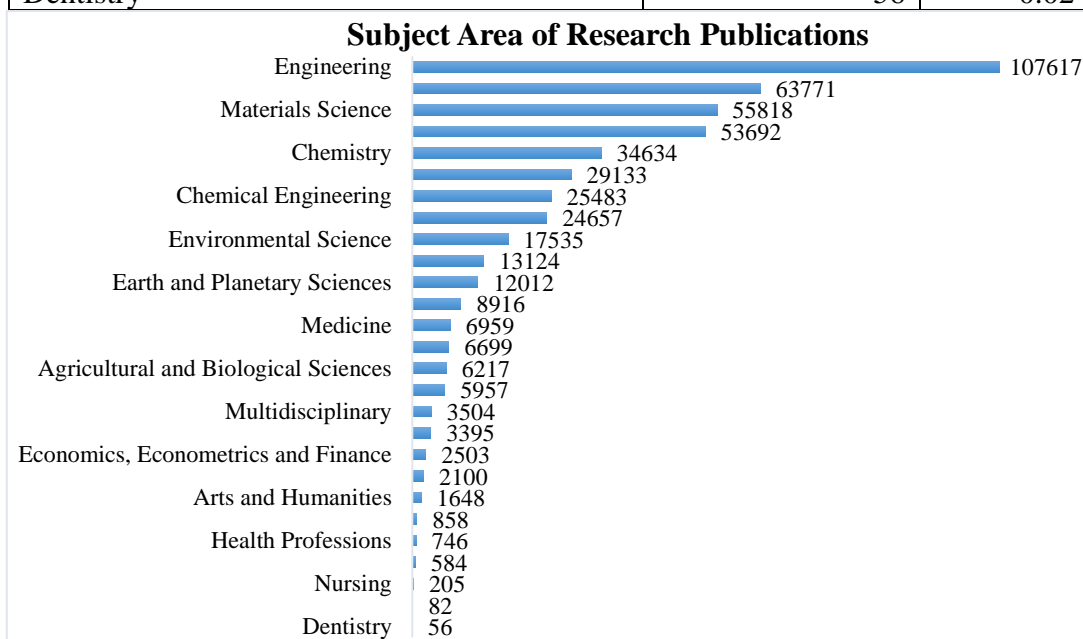


Figure 2. Graphical representation of research publications in the different subject areas

5.7. Top 10 most funding sponsor bodies to research

Table 5 lists the top 10 funding sponsor bodies based on a number of publications. It is found that the Department of Science and Technology, Government of Kerala, India funded project papers are 9199 (3.69%), followed by Science and Engineering Research Board, India with 8233 (3.30%) and Department of Science and Technology, Ministry of Science and Technology, India with 6652(2.67%). Other funding sponsor bodies in the top ten are given in Table 5.

S.No	Funding Sponsor Body	No of Publications	Percentage
1.	Department of Science and Technology, Government of Kerala, India	9199	3.69
2.	Science and Engineering Research Board, India	8233	3.30

3.	Department of Science and Technology, Ministry of Science and Technology, India	6652	2.67
4.	Ministry of Human Resource Development, India	5586	2.24
5.	University Grants Commission, New Delhi, India	4545	1.82
6.	Bangladesh Council of Scientific and Industrial Research, Bangladesh	4015	1.61
7.	Council of Scientific and Industrial Research, India	3735	1.50
8.	National Science Foundation, United States	2371	0.95
9.	Department of Science and Technology, Government of West Bengal, India	2264	0.91
10.	Department of Biotechnology, Government of West Bengal, India	1752	0.70

6. Conclusion

The study provides a landscape of research activities of CFTIs in quantitative terms for the period from 2011 to 2020. The growth of research publications is in continuously increasing order with an average of 1%, and in just one decade, the growth is three times in the year 2020 compared to the year 2011. Based on this growth study, it can be predicted that research publications of CFTIs may grow four times in the next decade. Engineering was the most preferred area of research with 107617 (43.13%) publications, followed Computer Science with 63771(25.56%), Material Science with 55818 (22.37%), Physics and Astronomy with 53692 (21.52%), Chemistry with 34634 (13.88%), Mathematics with 29133 (11.67%), Chemical Engineering with 25483(10.21%) and Energy with 24657 (9.88%). The top ten positions in CFTIs have been occupied by 10 IITs and 1 NIT. Indian Institute of Technology Hyderabad is at tenth rank, based on a total number of publications and at the fifth position based on international collaborated publications with a ratio of more than 50%. The findings of the study will be useful to the teachers, researchers, planners, policy-makers and funding agencies for gaining macro insights into the research output in Engineering, Science and Technology, and also the trends in the CFTIs in India and will assist them in strategy formulation to fill the gaps. The findings can also be advantageous in making judicious use of funds by helping the institutions in the selection of only relevant areas of research.

References

- Raghuraman, K. P., Chander, R., & Madras, G. (2010). Scientometric analysis of some disciplines: Comparison of Indian institutions with other international institutions. *Current Science*, 99(5), 577-587.
- Prathap, G. (2013). Benchmarking research performance of the IITs using Web of Science and Scopus bibliometric databases. *Current Science*, 105(8), 1134-1137.
- Hasan, N., & Singh, M. (2015). Research Output of Indian Institutes of Technology (IITs): A Scientometric Study. *Journal of Knowledge and Communication Management*, 5(2), 147-160. DOI: 10.5958/2277-7946.2015.00012.1
- Siddaiah, D. K., Gupta, B. M., Dhawan, S. M. and Gupta, R. (2016). Contribution and citation impact of eight new IITs: A scientometric assessment of their publications during 2010-14. *Journal of Scientometrics Research*, 5(2), 106-22. DOI: <https://doi.org/10.5530/jscires.5.2.2>.
- Pradhan, B., & Ramesh, D. B. (2018). Scientometric analysis of research publications of six Indian Institutes of Technology. *Annals of Library and Information Studies*, 65(1), 50-56.
- Shettar, I., & Hadagali, G. (2020). Scientometric analysis of research publications of National Institutes of Technology. *SRELS Journal of Information Management*, 57(2), 87-104. DOI: 10.17821/srels/2020/v57i2/146923.
- <https://facilities.aicte-india.org/dashboard/pages/dashboardaicte.php>: Accessed 30 January 2021.
- <https://www.education.gov.in/en/apex-level-bodies>: Accessed 30 January 2021.
- <https://santpublications.com/scopus.php>: Accessed 30 January 2021.