

RANKING OF TOP INDIAN INSTITUTES OF TECHNOLOGY IN INDIA DURING 2005-2014: A SCIENTOMETRIC ANALYSIS

Jayendra Kumar Singh

Dr. Jayendra Kumar Singh
Assistant Professor
School of Library and
Information Science
Gangadhar Meher University,
Sambalpur-768004
ODISHA
Email:
singhjayendra02@gmail.com

The present study attempts to study and present the ranking of 14 most productive Indian Institutes of Technology (IITs) during 2005-14, using various quantitative indicators, viz. total number of paper published during the year, average number of citations per paper, h-index and share of international collaborative papers. A new composite indicator (p-index) is also used for ranking, which combines qualitative and quantitative aspect together. Finally, the author considers the overall ranking of top 5 IITs using all the five indicators collectively.

Keywords: Bibliometric Indicators, Higher technical education institutions, IITs, India, Productivity, Ranking.

INTRODUCTION

The institutes and universities play very important roles in the field of S & T. Universities are considered for the basic education and research at the graduate, postgraduate and doctoral level by their various educational programs. Institutes are considered for their advanced and specified research basically in the field of Science and Technology. With the advancement of science and technology it is very necessary to rank the various leading institutions and universities. Ranking of institutes and universities are taken seriously now a day. The ranking of institutes and universities are normally based on certain bibliometric indicators.

LITERATURE REVIEW

A number of studies have been carried out in the past on ranking of organizations during the last three decade. Shanghai Jiao Tong University, China (<http://www.shanghairanking.com/ARWU2015.html>) undertook the first Academic Ranking of World Universities (ARWU). Prathap (2014) examined the ranking of Indian higher education institutions pertaining to the year 2013, using various indicators. Gupta et al. (2011) examined the ranking of various Indian organizations in computer science field during 1999-08: Indian Institute of Technology (IITs), National Institutes of

Technology (NITs), Indian Institute of Information Technology (IIITs), Institutes of National Importance, Industrial Enterprises and Universities. In another study, Gupta (2010) analysed the ranking of top 50 Indian universities, using publication data from Scopus database. The bibliometric indicators used for ranking included publication output, share of international collaborative papers, average citation per paper, h-index and p-index. Prathap and Gupta (2009) also studied the ranking of Indian universities, using a new performance index. Balaram (2004) analysed the Shanghai ranking of universities (including Indian). The Indian Institute of Sciences (IISc), Bangalore, IIT-Delhi and IIT-Kharagpur were ranked in the list of top 300-500 universities.

In another study, Sangam and Bagalkoti (2015) studied the ranking of top 50 Indian universities during 2001-10, using Scopus database. A similar study has also been undertaken by Gupta et al. (2014) aimed at ranking top 25 Indian universities in India in the field of social sciences during 2008-12, using Scopus database. The study used both quantitative and qualitative indicators.

OBJECTIVES OF THE STUDY

The main objective of the present paper is to rank the IITs on the basis of their research output, international collaborative paper percentage, average citation per paper (C/P ratio), h-index and p-index (Composite performance index) during the year 2005-2014.

METHODOLOGY

Till today, 16 Indian Institutes of Technology (IITs) have been established in the

country, but the present study focussed on 14 IITs. Two newly established IITs are excluded from the study, because of their low output. The data for the present study has been taken from Indian Citation Index (ICI), a web based citation and abstracts database, covering all R & D fields and includes more than 900 journals/serials from various disciplines. The search strategy used for ranking of IITs during 2005-2014 was as follows. These searches were further refined as per requirement. All the downloaded data from search strategy were imported into MS-Excel for further analysis.

“Institution Search= Name of particular IIT” and
“Time Span=2005-2014”,

For the purpose of proposed analysis, citations (C) received from papers (P) are considered and average citations per paper (C/P) ratio calculated for each institution. The h-index of these institutions is taken from Indian Citation Index. The numbers of International Collaborative Papers (ICP) and their national share have been determined using an appropriate search strategy. As suggested by Gangan Prathap, the composite performance index (p-index) has been used here, which together combines both quality and quantity aspects. It is calculated as $h = (C^2/P)^{(1/3)}$.

ANALYSIS AND RESULTS

Ranking of IITs based on publication output

The ranking of 16 IITs based on their publication output are presented in the table 1. The 16 IITs together contributed 5849 papers. The average number of output per institution is found 365. Seven IITs have published more than their

group average output: IIT- Kharagpur ranked at first position (with 1075 papers), followed by IIT-Delhi (2nd rank with 1014 papers). IIT- Roorkee (3rd rank with 959 papers), IIT- Bombay (4th rank with 716 papers), IIT- Madras (5th rank with 696 papers), IIT- Kanpur (6th rank with 540 papers) and IIT- BHU-Varanasi (7th rank with 394 papers), IIT-Guwahati, IIT-Hyderabad and IIT -Bhubaneswar were ranked at 8th, 9th and 10th positions with their 322, 48 and 24 papers, respectively. IIT-Patna, IIT-Indore, IIT-Gandhinagar and IIT-Ropar and IIT-Jodhpur were ranked at 11th to 14th positions with output from 11 to 14 papers. IIT-Jodhpur and IIT-Mandi were ranked at 15 to 16th bottom ranks with 4 publications each.

Ranking of IITs based on average citation per paper (C/P) indicator

The ranking of IITs based on average citation per paper (CPP), a ratio of C/P is presented in the table 2. IIT-Delhi was ranked at top position with average citation per paper of 0.58, followed by IIT- Kharagpur (2nd rank with 0.45 CPP), IIT- BHU- Varanasi (3rd rank with 0.41 CPP), IIT- Guwahati (4th rank with 0.39 CPP) and IIT- Roorkee (5th rank with 0.37 CPP), IIT- Bombay, IIT- Kanpur, IIT-Bhubaneswar, IIT-Madras, IIT-Gandhinagar, IIT-Indore and IIT- Ropar were ranked at 6th to 11th position with CPP ratio from 0.18 to 0.36. IIT-Patna (12th rank with 0.07 CPP) and IIT-Hyderabad ranked at 13-14 bottom ranks with CPP ration from 0.04 to 0.07.

Table 1: Ranking of IITs based upon their publication output

Sl. No.	Name of IITs	Papers (P)	Citations (C)	Average Citation (C/P)	h-index	International Collaborative Papers (ICP)	% of ICP	Composite Performance Index (p)	Rank
1	IIT Kharagpur (IIT KGP)	1075	484	0.45	7	86	8	6.01	1
2	IIT Delhi (IIT D)	1014	589	0.58	9	89	8.78	6.99	2
3	IIT Roorkee (IIT R)	959	358	0.37	7	69	7.19	5.11	3
4	IIT Bombay (IIT B)	716	259	0.36	6	90	12.57	4.54	4
5	IIT Madras (IIT M)	696	185	0.27	4	67	9.63	3.663	5
6	IIT Kanpur (IIT K)	540	157	0.29	5	57	10.56	3.57	6
7	IIT(BHU) Varanasi (IIT BHU)	394	162	0.41	5	16	4.06	4.05	7
8	IIT Guwahati (IIT G)	322	126	0.39	5	27	8.39	3.666	8
9	IIT Hyderabad (IITH)	48	2	0.04	1	12	25.00	0.436	9
10	IIT Bhubaneswar (IIT BBS)	24	7	0.29	2	2	8.33	1.26	10
11	IIT Patna (IIT P)	15	1	0.07	1	3	20.00	0.405	11
12	IIT Indore (IIT I)	15	3	0.20	1	-	-	0.84	11
13	IIT Gandhinagar (IIT GN)	12	3	0.25	2	1	8.33	0.908	12
14	IIT Ropar (IIT RPR)	11	2	0.18	1	-	-	0.71	13
15	IIT Jodhpur (IIT J)	4	-	-	-	-	-	-	14
16	IIT Mandi	4	-	-	-	-	-	-	14
	Total	5849	2328		56	519		42.158	

Table 2: Ranking of IITs by using (C/P) indicator

Sl. No.	Name of IITs	Papers (P)	Citations (C)	Average Citation (C/P)	h-index	International Collaborative Papers (ICP)	% of ICP	Composite Performance Index (p)	Rank
1	IIT Delhi	1014	589	0.58	9	89	8.78	6.99	1
2	IIT Kharagpur	1075	484	0.45	7	86	8	6.01	2
3	IIT(BHU)Varanasi	394	162	0.41	5	16	4.06	4.05	3
4	IIT Guwahati	322	126	0.39	5	27	8.39	3.666	4
5	IIT Roorkee	959	358	0.37	7	69	7.19	5.11	5
6	IIT Bombay	716	259	0.36	6	90	12.57	4.54	6
7	IIT Kanpur	540	157	0.29	5	57	10.56	3.57	7
8	IIT Bhubaneswar	24	7	0.29	2	2	8.33	1.26	7
9	IIT Madras	696	185	0.27	4	67	9.63	3.663	8
10	IIT Ghandhinagar	12	3	0.25	2	1	8.33	0.908	9
11	IIT Indore	15	3	0.20	1	-	-	0.84	10
12	IIT Ropar	11	2	0.18	1	-	-	0.71	11
13	IIT Patna	15	1	0.07	1	3	20	0.405	12
14	IIT Hyderabad	48	2	0.04	1	12	25	0.436	13
Total		5841	2328	-	56	519	-	42.158	-

Ranking of IITs based on h-index

The ranking of IITs based on h-index is presented in the table 3. The average h-index of

14 IITs was 4. Seven IITs have more than average h-index of all IITs.: IIT-Delhi top the ranking with h-index value of 9, followed by IIT- Kharagpur

Table 3: Ranking of IITs by using h-index

Sl. No	Name of IITs	Papers (P)	Citations (C)	Average Citation (C/P)	h-index	International Collaborative Papers (ICP)	% of ICP	Composite Performance Index (p)	Rank
1	IIT Delhi	1014	589	0.58	9	89	8.78	6.99	1
2	IIT Kharagpur	1075	484	0.45	7	86	8	6.01	2
3	IIT Roorkee	959	358	0.37	7	69	7.19	5.11	2
4	IIT Bombay	716	259	0.36	6	90	12.57	4.54	3
5	IIT(BHU)Varanasi	394	162	0.41	5	16	4.06	4.05	4
6	IIT Guwahati	322	126	0.39	5	27	8.39	3.666	4
7	IIT Kanpur	540	157	0.29	5	57	10.56	3.57	4
8	IIT Madras	696	185	0.27	4	67	9.63	3.663	5
9	IIT Bhubaneswar	24	7	0.29	2	2	8.33	1.26	6
10	IIT Ghandhinagar	12	3	0.25	2	1	8.33	0.908	6
11	IIT Indore	15	3	0.2	1	-	-	0.84	7
12	IIT Ropar	11	2	0.18	1	-	-	0.71	7
13	IIT Patna	15	1	0.07	1	3	20	0.405	7
14	IIT Hyderabad	48	2	0.04	1	12	25	0.436	7
Total		5841	2338	-	56	519	-	42.158	-

and IIT- Roorkee (7 each), IIT-Bombay (6), IIT-BHU-Varanasi, IIT-Guwahati and IIT- Kanpur(5 each), IIT-Madras(4), IIT- Bhubaneswar and IIT-Gandhinagar (2 each) and IIT- Indore, IIT-Ropar, IIT-Patna and IIT-Hyderabad (1 each).

Ranking of IITs based on their share of their International Collaborative Papers (% ICP)

The ranking of IITs biased on share of international collaborative papers is presented in Table 4. IIT-Hyderabad ranked at top position with 25% share of ICP, followed by IIT- Patna (2nd rank) with 20% share of ICP, IIT-Bombay (3rd rank) with 12.57% share of ICP, IIT-Kanpur (4th rank) with 10.56% share of ICP, IIT-Madras (5th rank) with 9.63% share of ICP, IIT- Delhi (6th rank) with 8.78% share of ICP, IIT-Guwahati (7th rank) with

8.39% share of ICP, IIT-Bhubaneswar & IIT Gandhinagar (8th rank) with 8.33% share of ICP each, IIT- Kharagpur (9th rank) with 8.0% share of ICP, IIT-Roorkee (10th rank) with 7.19% share of ICP and IIT- BHU- Varanasi ranked at the bottom with 4.06% share of ICP.

Ranking of IITs by using Composite Performance Index

The ranking of IITs, based on composite index (p-index) is presented in the table 5. This index combines both quality and quantity aspects. The average value of P-index of 14 IITs is found be 3.01. Eight IITs have registered more than average p-index of all IITs. IIT-Delhi ranked at top position with p-index value of 6.99, followed by IIT-Kharagpur (2nd rank) with p-index value of 6.01,

Table 4: Ranking of IITs using % of ICP

Sl. No.	Name of IITs	Papers (P)	Citations (C)	Average Citation (C/P)	h-index	International Collaborative Papers (ICP)	% of ICP	Composite Performance Index (p)	Rank
1	IIT Hyderabad	48	2	0.04	1	12	25	0.436	1
2	IIT Patna	15	1	0.07	1	3	20	0.405	2
3	IIT Bombay	716	259	0.36	6	90	12.57	4.54	3
4	IIT Kanpur	540	157	0.29	5	57	10.56	3.57	4
5	IIT Madras	696	185	0.27	4	67	9.63	3.663	5
6	IIT Delhi	1014	589	0.58	9	89	8.78	6.99	6
7	IIT Guwahati	322	126	0.39	5	27	8.39	3.666	7
8	IIT Bhubaneswar	24	7	0.29	2	2	8.33	1.26	8
9	IIT Ghandhinagar	12	3	0.25	2	1	8.33	0.908	8
10	IIT Kharagpur	1075	484	0.45	7	86	8	6.01	9
11	IIT Roorkee	959	358	0.37	7	69	7.19	5.11	10
12	IIT(BHU)Varanasi	394	162	0.41	5	16	4.06	4.05	11
13	IIT Indore	15	3	0.2	1	-	-	0.84	-
14	IIT Ropar	11	2	0.18	1	-	-	0.71	-
Total		5841	2328	-	56	519	-	42.158	-

IIT-Roorkee (3rd rank) with p-index value of 5.11, IIT- Bombay (4th rank) with p-index value of 4.54, IIT-BHU-Varanasi (5th rank) with p-index value of 4.05, IIT- Guwahati (6th rank) with p-index value of 3.67 and IIT-Madras ranked at 7th position with p-index value of 3.67. IIT-Kanpur was ranked at 8th position with p-index value of 3.57 followed

by IIT- Bhubaneswar (9th rank) with p-index value of 1.26, IIT-Gandhinagar (10th rank) with p-index value of 0.91, IIT-Indore (11th rank) with p-index value of 0.84, IIT- Ropar (12th rank) with p-index value of 0.71, IIT-Hyderabad (13th rank) with p-index value of 0.44 and IIT- Patna ranked at bottom place with minimum p-index value of 0.40.

Table 5: Ranking of IITs by using p-index

Sl. No.	Name of IITs	Papers (P)	Citations (C)	Average Citation (C/P)	h-index	International Collaborative Papers (ICP)	% of ICP	Composite Performance Index (p)	Rank
1	IIT Delhi	1014	589	0.58	9	89	8.78	6.99	1
2	IIT -Kharagpur	1075	484	0.45	7	86	8	6.01	2
3	IIT Roorkee	959	358	0.37	7	69	7.19	5.11	3
4	IIT Bombay	716	259	0.36	6	90	12.57	4.54	4
5	IIT(BHU)Varanasi	394	162	0.41	5	16	4.06	4.05	5
6	IIT Guwahati	322	126	0.39	5	27	8.39	3.67	6
7	IIT Madras	696	185	0.27	4	67	9.63	3.66	7
8	IIT Kanpur	540	157	0.29	5	57	10.56	3.57	8
9	IIT Bhubaneswar	24	7	0.29	2	2	8.33	1.26	9
10	IIT-Gandhinagar	12	3	0.25	2	1	8.33	0.91	10
11	IIT Indore	15	3	0.2	1	-	-	0.84	11
12	IIT Ropar	11	2	0.18	1	-	-	0.71	12
13	IIT Hyderabad	48	2	0.04	1	12	25	0.44	13
14	IIT Patna	15	1	0.07	1	3	20	0.40	14
Total		5841	2328	-	56	519	-	42.16	-

Overall ranking of top five IITs

The table 6 shows the ranking of top 5 IITs based on combined ranking parameter viz p-index, C/P ratio, h-index, share of ICP and publication productivity. IIT-Delhi is ranked at top position getting first rank in p-index, C/P ratio and h-index. IIT Kharagpur is ranked at 2nd position in p-index, C/P ratio and h-index. IIT-Roorkee is ranked at 3rd position in p-index and publication productivity parameter, while IIT-Bombay ranked

at 4th position with same parameters. IIT-Kanpur also ranked at 4th position in h-index and share of ICP. IIT-Madras ranked at 5th position in h-index, share of ICP and publication productivity.

CONCLUSION

In this paper, ranking of IITs is based on very select indicators. However, a new composite performance indicator called p-index is also used, which gives the better results than other indicators as it combines both qualitative and quantitative

Table 6: Overall ranking using combined parameter

Ranking Parameter	p-index	C/P Ratio	h-index	% of ICP	Publication Productivity/ Output	Rank
IIT Delhi	1 st Rank	1 st Rank	1 st Rank	6 th Rank	2 nd Rank	1 st
IIT Kharagpur	2 nd Rank	2 nd Rank	2 nd Rank	9 th Rank	1 st Rank	2 nd
IIT Roorkee	3 rd Rank	5 th Rank	2 nd Rank	10 th Rank	3 rd Rank	3 rd
IIT Bombay	4 th Rank	6 th Rank	3 rd Rank	3 rd Rank	4 th Rank	4 th
IIT Kanpur	8 th Rank	7 th Rank	4 th Rank	4 th Rank	6 th Rank	4 th
IIT Madras	7 th Rank	8 th Rank	5 th Rank	5 th Rank	5 th Rank	5 th

aspect together. This type of study is very useful to attract the new young and bright students for postgraduates and PhD research. It also creates competition among the IITs for securing their future position. It is quite evident that ranking study creates health competition in funding structure, infrastructure, quality improvement, research improvement and also in improving its overall policies.

REFERENCES

1. Balaram, P. (2004). The Shanghai Ranking. *Current Science*, 86 (10), 1347-1348.
2. Gupta, B. M. (2010). Ranking and performance of Indian universities based on publication and citation data. *Indian Journal of Science and Technology*, 3(7), 837-843.
3. Gupta, B. M., Bala, A., & Sharma, N. (2011). Ranking of Indian institutions contributing to computer science research, 1999-2008. *DESIDOC Journal of Library & Information Technology*, 31(6), 460-468.
4. Gupta, B.M., Kumbar, B. D., & Tiwari, R. (2014). Ranking of Indian Universities in Social Sciences using Bibliometric Indicators during 2008-12. *DESIDOC Journal of Library & Information Technology*, 34(3), 197-205.
5. Indian Citation Index (ICI). Retrieved August, 2018 from <http://www.indiancitationindex.com/>
6. Prathap, G. (2014). The performance of research-intensive higher educational institutions in India. *Current Science*, 107 (3), 389-396.
7. Prathap, G., & Gupta, B.M. (2009). Ranking of Indian universities for their research output and quality using a new performance index. *Current Science*, 97(6), 751-752.
8. Sangam, S. L., & Bagalkoti, V. T. (2015). Ranking of Indian Universities: A scientometric analysis. *10th International CALIBER*, HP University and IAS, Shimla, 182-191.
9. Shangai Ranking. Retrieved July, 2018 from <http://www.shanghairanking.com/ARWU2015.html>.
10. Wikipedia. Retrieved August, 2018 from https://en.wikipedia.org/wiki/Indian_Institutes_of_Technology

