

RESEARCH AND PUBLICATION PRODUCTIVITY OF THE INDIAN INSTITUTE OF TECHNOLOGY JODHPUR AND INDIAN INSTITUTE OF TECHNOLOGY ROPAR: A SCIENTOMETRIC STUDY

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Abstract *Measuring research productivity and identifying its impact at national and international level is a continuous process of research institutes. In view of the hyper competition among higher education institutions, most of them are concerned about their research productivity and quality of education. Productivity and quality of publications of an institution not only depict the ongoing research activities but also play a crucial role in differentiation of the institution from other similar institutions in its standing and ranking. The research productivity of the Indian Institute of Technology Jodhpur and Indian Institute of Technology Ropar is portrayed in this paper. The analysis is based on institution's publications output for the period 2010-2018, covered in the Web of Science (WoS) & Scopus of IIT Jodhpur and IIT Ropar. Altogether 1118, 528, publications from the Web of Science, 1604, 957 publications from the Scopus has analysed.*

The finding indicate that the publications output of IIT Jodhpur and IIT Ropar is continuously growing since the year 2010. Data analysis reveals a greater level of collaborative work in these institutes. The collaborative work is not only confined within IIT Jodhpur and IIT Ropar but also with other institutions in the country and abroad. Majority of the publications are Research articles, followed by papers published in conference proceedings and Review journals. The Extent of publication in open access form were also analysed. Collaboration with top countries also analyzed and interpreted.

Keywords: *Research Productivity, Publication of Productivity, Research Output, Research in IIT Jodhpur, Research in IIT Ropar, Scientometric Study, CFTI, Bibliometrics, Citation Analysis*

ROLE OF IITs IN INDIA

IITs are regarded as institutions of national importance having great importance to the country. Students studying in these institutions having greater carrier opportunity and access to quality of education. These institutes provide state-of-art facilities for total quality improvement of students i.e. by making accessible quality research labs, central library were equipped with rich collections of information resources, hostel faculty, Gym, playground, computer labs. etc. The Ministry of Education, Government of India provides great autonomy for these institutes in terms of giving funds for establishing hub for quality of education and provide an opportunity to contribute for solving regional and national problems. Agencies of all over the world giving great credit for research productivity because of its importance

and contribution to their global ranking. As per the report published in NIRF, Ministry of Education, Government of India, IITs have been getting top rank in engineering fields in India. As per the report published in 2016, in sequence IIT Ropar & IIT Jodhpur ranked 9th, 25th in the engineering institutions of India” but “slipped to the 21th, 65th position in the NIRF report of 2017, ranked 22nd, 54th in 2018” ranked 29th (2018), 50th in 2019, ranked 25th, 53th in 2020, 19th, 43th in 2021.

INTRODUCTION

The Indian Institute of Technology, Jodhpur, Ropar established in the year 2008 and 2009 as an autonomous institute under the Ministry of Education, Government of India. It is committed to multidisciplinary research approach

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of technology development to foster technology education and research in India for the benefit of the economic development of India.

IIT Ropar and IIT Jodhpur offers Bachelor of Technology (B. Tech.) in several disciplines. The institutes also offer M.Tech programme in several disciplines and M.Sc programme in the several disciplines. The institute also offers several doctoral programmes in the major areas of engineering. These institutes also running several inter-disciplinary research programmes:

As these Institutions are more focused towards research output because of its contribution to their ranking and brand. They often keep track of their research output, measure and evaluate it because whatever can be measured and correctly assessed, can be improved. Productivity and quality of publications of an institution not only depict the ongoing research activities but also reflect the differentiation of an institution from similar other institutions in terms of performance and stature achieved.

REVIEW OF LITERATURE

There are good number of studies pertaining to the scientometric analysis of research output of research institutions in India and abroad. Henk F. Moed, Valentina Markusova and Mark Akoev (2018) analyze the Trends in Russian research covered in Web of Science and Scopus database study concluded that Russian publication counts strongly depend upon the database used. Daniel Torres-Salinas, Emilio Delgado Lopez-Cózar and Evaristo Jiménez-Contreras (2009) the study analyzed citations of University of Navarra Spain in the area of health sciences, the result of study indicated that 14.7% more citation in Scopus compare to Web of Science.

Sanjay Kumar Maurya, Akhandanand Shukla and R. K. Ngurtinkhuma (2018) analyzed the quantitative research performance of in terms of terms of total documents, citable documents, and non-citable documents of OPEC member countries.

I. V. Zibarevaa and N. S. Soloshenkoc, the study analyze Russian publications covered in Science Citation Index, Scopus, and Chemical Abstracts Databases from 2005 to 2009. The result shown that While a gradual decrease in the number of peer-reviewed Russian-language journals constitutes a general trend for all three databases, the Chemical Abstracts database leads in terms of the coverage of these journals.

Alireza Noruzi Mohammadhiwa Abdekhoda, (2014) the paper analyzed the publications of Iraqi-Kurdistan universities from 1970 to 2012 in terms of Scopus database

publication started in 1972, but since 2004 the result shown that publication are steadily increasing in this study. The co-authorship patten shown that 52% of Iraqi-Kurdistan publications were co-authored with foreign countries.

I. V. Malhan and B. M. Gupta (2011) did analysis of publication output of the University of Jammu and analysed the standing of faculty besides assessing research output of the University. Nabi Hasan and Mukhtiar Singh (2015) analyze and evaluated the five top ranking Indian Institute of Technology (IITs) research output by using scientometric parameters which are indexed in Web of Science database for the period of 2009-13 (five years). A total of 215,019 records were retrieved for India which are 2.72% of the global records in five year. Subhodip Bid (2016) did analysis of publications for the period 2000 to 2015 of Indian Institute of Technology Kharagpur and studied research growth by using scientometric parameters. K. J. Jeevan and B. M. Gupta (2002) analysed the research data of IIT Kharagpur and compare of research impact of various departments by scientometric measurement. Tasleem Arif (2015) did analyze the publications of IIT Delhi, IIT Kanpur, IIT Kharagpur and IIT Madras. A total of 1082 research publications of 111 faculty members working in Computer Science Engineering departments for the period from 2011 to 2015 analysed the research productivity of four top ranked Indian Institutes of Technology were extracted from their websites and DBLP. This study reveals that there are much differences in research productivity in terms number of publications, per capita productivity, etc. The IIT Madras has outperformed amongst all of them. Vimlesh Patel and N. S. Thakur (2018) analysed covered Web of Science database from 2012-16 of the research productivity of National Environmental Engineering Research Institute, Nagpur analyzed the various parameters. Vimlesh Patel (2017) did analysis of publications of NIT Kurukshetra from 2012 to 2016, data taken from Web of Science database. This study included the year wise growth of publications, presented the analysis of publication types, and mirrored the top institutions collaborating with National Institute of Technology Kurukshetra for research and publication. Ahmad Darmadji et al. (2018) did analysis of publications of the Islamic University of Indonesia data obtained from scopus database and analysis using various bibliometric indicators. Meera and Surendra Kumar Sahu (2014) studied of research performance of researchers of the University College of Medical Science, University of Delhi. By using bibliometric analysis such as degree of collaboration, author productivity, authorship pattern, rank distribution etc.

OBJECTIVES OF THE STUDY

- To draw a detailed picture of database-wise coverage of publications of IIT Jodhpur and IIT Ropar.

- To study the year-wise growth of publications of both IITs in Web of Science and Scopus.
- To find out the type of publications preferred by researchers to report their research findings in Web of Science and Scopus.
- To analyse the Extent of publications in open access in journals indexed in Web of Science and Scopus.
- To ascertain the research publications collaboratively published with authors of other countries in Web of Science and Scopus.

SCOPE AND METHODOLOGY

The data included for this study are derived from Clarivate Analytics Web of Science. © Copyright Clarivate Analytics” (2020), and Scopus Copyright (2020), bibliographic and citation database. The data of has been categorized in year wise form for the period 2010-2018. The nine years period is a good representative sample to study research productivity. The data about publications was downloaded using the following search strategy: *Organization-Enhanced*: (Indian Institute of Technology (IIT) - Jodhpur) Timespan: 2010-2018. “Indexes: SCI-Expanded, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-Expanded, IC, in 06 November 2020. AF-ID (“Indian Institute of Technology Jodhpur”) and Limit-To (Pubyear, 2018) or Limit-To (Pubyear, 2017) Or Limit-To (Pubyear, 2016) Or Limit-To (Pubyear, 2015) Or Limit-To (Pubyear, 2014) Or Limit-To (Pubyear, 2013) Or Limit-To (Pubyear, 2012) Or Limit-To (Pubyear, 2011)

Or Limit-To *Organization-Enhanced*: (Indian Institute of Technology (IIT) - Ropar) Timespan: 2010-2018. “Indexes: SCI-Expanded, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-Expanded, IC, in 06 November 2020. AF-ID (“Indian Institute of Technology Ropar”) and Limit-To (Pubyear, 2018) or Limit-To (Pubyear, 2017) or Limit-To (Pubyear, 2016) or Limit-To (Pubyear, 2015) or Limit-To (Pubyear, 2014) Or Limit-To (Pubyear, 2013) Or Limit-To (Pubyear, 2012) Or Limit-To (Pubyear, 2011) Or Limit-To (Pubyear, 2010)”.

The full records were downloaded to Excel format and categorised into articles, proceedings papers, editorial material, titles, author records, affiliation of authors etc. For Scientometric study of publications data of IIT Jodhpur and IIT Ropar was analysed with various parameters like year wise growth rate of papers, distribution of publications according to their types, collaboration in publications beyond IIT Jodhpur and IIT Ropar. The most collaborating countries have been recognized using extraction of information from the affiliations text and extent of open access publication identified and analysed.

DATA ANALYSIS AND INTERPRETATION

The Fig. 1 & The Table 1 analysis of Publications of IIT Ropar and IIT Jodhpur reflect that the coverage of publications in both the database is as follows: 1604, 957 in Scopus and 1118, 528 in Web of Science respectively.

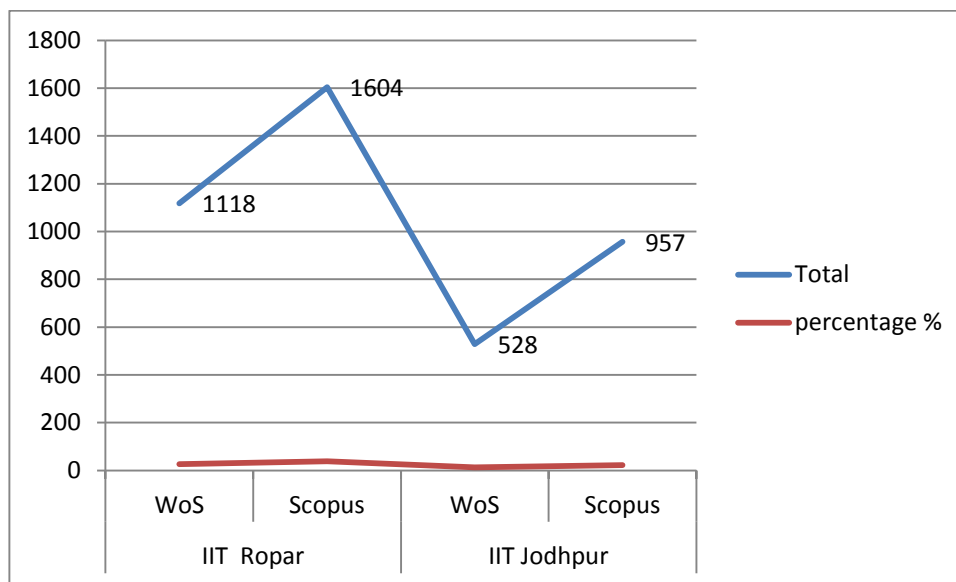


Fig. 1: Database-Wise Coverage of Publications

Table 1: Database-Wise Coverage of Publications

Institute	Source of Data	Total	Percentage %
IIT Ropar	WoS	1118	26.57
	Scopus	1604	38.13
IIT Jodhpur	WoS	528	12.55
	Scopus	957	22.75
Total		4207	100.00

Combined Year Wise Growth of Publications

Table 1 reveals the combined year-wise growth of publications of IIT Ropar and IIT Jodhpur. In the year 2010 IIT Ropar had 17 publications in WoS and 21 publications in Scopus and IIT Jodhpur has one publication in WoS, 8 publications Scopus. As per Table there is an increasing growth of publications from 2010 to 2018. IIT Ropar 239 publications in Web of Science and 353 publications in Scopus during the year 2018. IIT Jodhpur 528 publications in WoS and 262 publications in Scopus.

Table 2: Combined Year-Wise Growth of Publications

Institute	Source of Data	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	Percentage %
IIT Ropar	WoS	17	38	66	83	140	167	158	210	239	1118	26.57
	Scopus	21	53	114	131	189	236	229	278	353	1604	38.13
IIT Jodhpur	WoS	1	10	18	31	37	67	86	120	158	528	12.55
	Scopus	8	26	57	50	83	119	140	212	262	957	22.75
Total publication		47	127	255	295	449	589	613	820	1012	4207	100.00
Combined Percentage %		1.12	3.02	6.06	7.01	10.67	14.00	14.57	19.49	24.06	100.00	

Year-Wise Growth of Publications

The year-wise research growth in terms of total publications is given in Fig. 2 and Table 3. It shows that number of publication output of IIT Jodhpur and IIT Ropar in Scopus, WoS of science is continuously increasing since 2010 except there was a dip in 2013 (50 publications) in Scopus of IIT

Jodhpur and in WoS 2013 (158) and Scopus 2016 (229) of IIT Ropar. The data reflects that highest number of publications found in Scopus i.e. 957 (IIT Jodhpur) and 1604 (IIT Ropar) followed 528 (IIT Jodhpur) in WoS database and 1118 (IIT Ropar) in Scopus. A consistent trend of increase in the publication's productivity reflects a continuous increase in the research activities at the IIT Jodhpur and IIT Jodhpur.

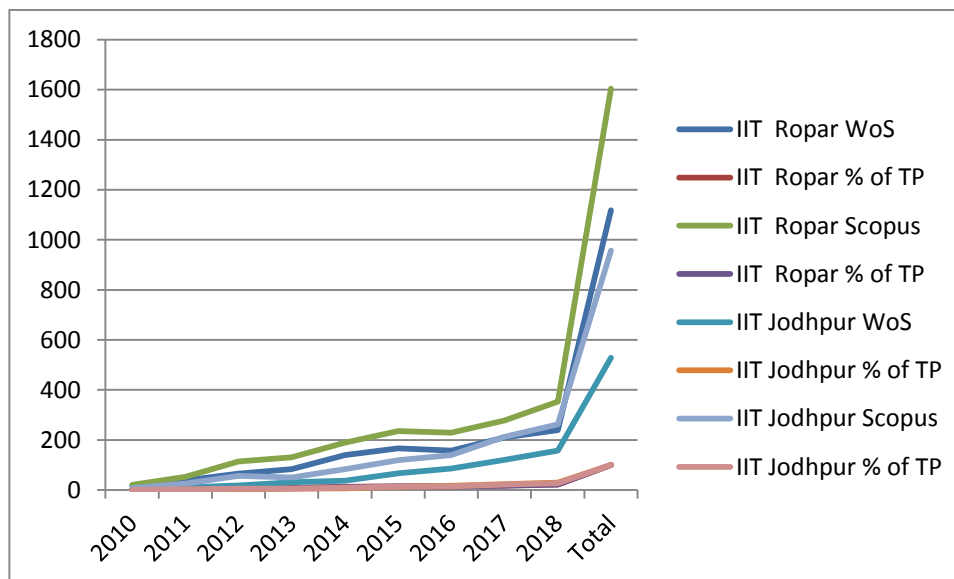
**Fig. 2: Year-Wise Growth of Publications**

Table 3: Year-Wise Growth of Publications

Institute	Source of Data	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
IIT Ropar	WoS	17	38	66	83	140	167	158	210	239	1118
	% of TP	1.52	3.40	5.90	7.42	12.52	14.94	14.13	18.78	21.38	100.00
	Scopus	21	53	114	131	189	236	229	278	353	1604
	% of TP	1.31	3.30	7.11	8.17	11.78	14.71	14.28	17.33	22.01	100.00
IIT Jodhpur	WoS	1	10	18	31	37	67	86	120	158	528
	% of TP	0.19	1.89	3.41	5.87	7.01	12.69	16.29	22.73	29.92	100
	Scopus	8	26	57	50	83	119	140	212	262	957
	% of TP	0.84	2.72	5.96	5.22	8.67	12.43	14.63	22.15	27.38	100

Type of Publications

Fig. 3 and Table 4 shows that distribution of publications according to their types. From the analysis it is evident that research articles comprised of the highest number of publications in IIT Jodhpur i.e. 482 (91.29%) in WoS, 549 (57.37) in Scopus and IIT Ropar i.e. 1039 (92.93%) in WoS

and 1143 (71.76%) in Scopus followed by proceedings papers IIT Jodhpur 361 (37.72%), in Scopus, 7 (1.33%) in WoS and IIT Ropar in Scopus 383 (23.88%), WoS 25 (2.24%) and review papers 28 (5.30%) in WoS, Review Papers 30 (3.13%) in Scopus of IIT Jodhpur and 30 (1.87) in Scopus, 26 (2.33) in WoS of IIT Ropar.

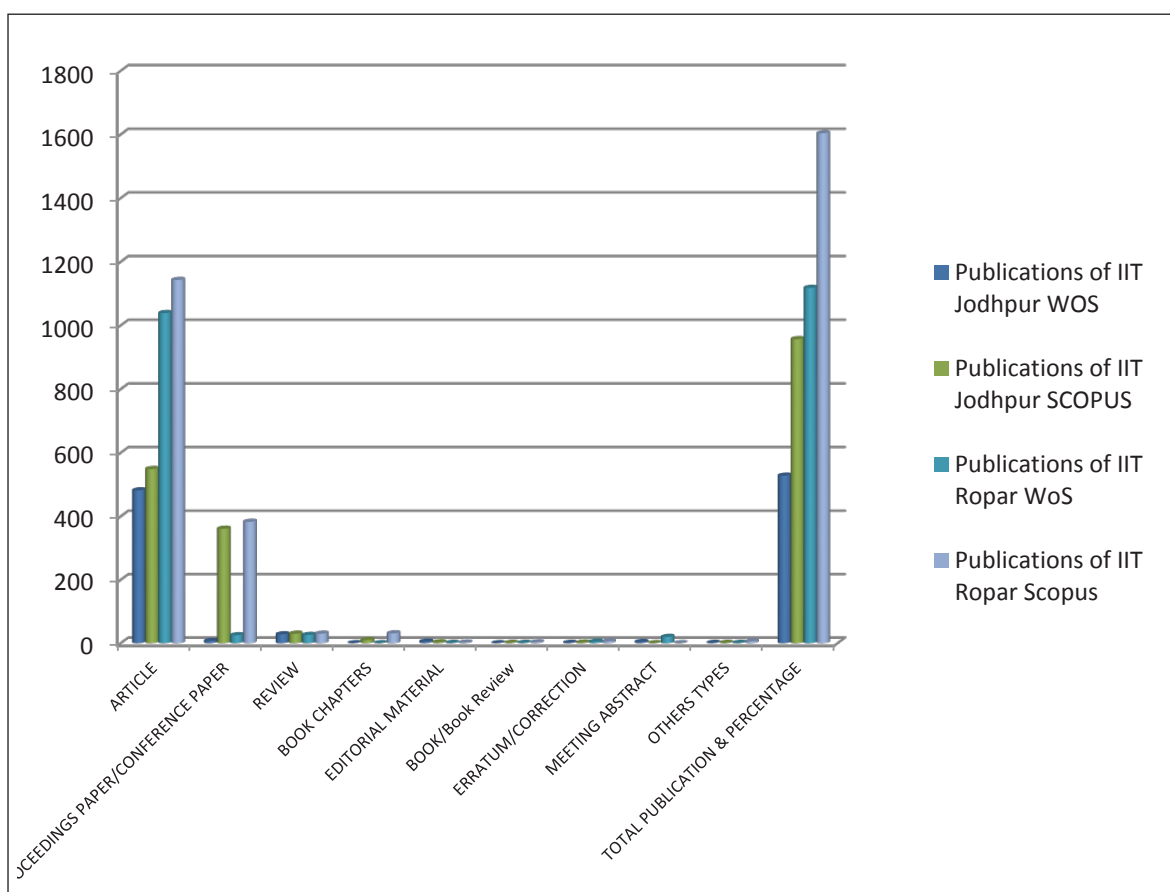
**Fig. 3: Distributions of Publications According to Type**

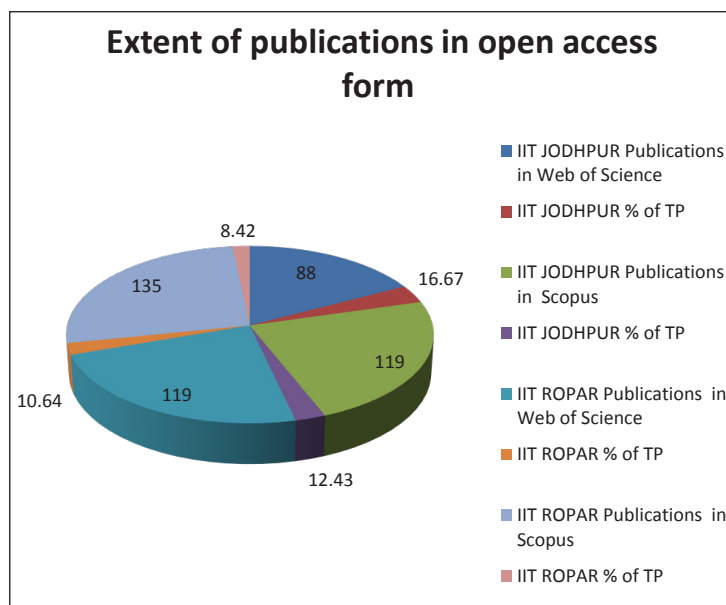
Table 4: Distributions of Publications According to Type

Type of Documents	Publications of IIT Jodhpur				Publications of IIT Ropar			
	WOS	% of TP	SCOPUS	% of TP	WoS	% of TP	Scopus	% of TP
Article	482	91.29	549	57.37	1039	92.93	1143	71.26
Proceedings Paper/Conference Paper	7	1.33	361	37.72	25	2.24	383	23.88
Review	28	5.30	30	3.13	26	2.33	30	1.87
Book Chapters	0	0.00	10	1.04	0	0.00	31	1.93
Editorial Material	5	0.95	3	0.31	1	0.09	2	0.12
Book/Book Review	0	0.00	1	0.10	1	0.09	3	0.19
Erratum/Correction	1	0.19	2	0.21	5	0.45	6	0.37
Meeting Abstract	4	0.76	0	0.00	20	1.79	0	0.00
Others Types	1	0.19	1	0.10	1	0.09	6	0.37
Total Publication & Percentage	528	100.00	957	100.00	1118	100.00	1604	100.00

Extent of Publications in Open Access Form in Journals Indexed in WoS and Scopus

Fig. 4 and Table 5 shows the distribution of publications in open access form. It is found that highest number of open

access publications found in Scopus i.e. 135 (8.42%) of IIT Ropar, 119 (12.43%) of IIT Jodhpur of total publications followed by in WoS 119 (10.64%) of IIT Ropar & Web of Science open access publications i.e. 88 (16.67%) of IIT Jodhpur of total publications.

**Fig. 4: Extent of Publications in Open Access Form****Table 5: Extent of Publications in Open Access Form**

Type of Access	IIT Jodhpur				IIT Ropar			
	Publications in Web of Science	% of TP	Publications in Scopus	% of TP	Publications in Web of Science	% of TP	Publications in Scopus	% of TP
Open Access	88	16.67	119	12.43	119	10.64	135	8.42
Subscription based Access	440	83.33	838	87.57	999	89.36	1469	91.58
Total publication & Percentage	528.00	100	957	100	1118	100	1604	100

Collaboration of Research Publications with Other Countries

Table 6 shows the collaboration of the IIT Jodhpur and IIT Ropar in research and publishing with other countries. As per the analysis, the USA is at the top with 75 publications in Scopus and 58 publications in Web of Science of IIT Jodhpur and USA is at the top with 142 publications in Scopus and 97 Publication in Web of Science of IIT Ropar with cumulative average 66.5% of IIT Jodhpur and 119.5% of IIT Ropar which is placed at 1st Rank. Followed by Germany with

31 publications in Scopus and 15 publications in Web of Science with cumulative average 23% which is placed at 2nd Rank in IIT Jodhpur and South Korea with 74 publications in Scopus and 65 publications in Web of Science with cumulative average 69.5% which is placed at 2nd Rank for the IIT Ropar and Japan with 22 publications in Scopus and 19 publications in Web of Science at the third rank of IIT Jodhpur and Mexico with 49 publications in Scopus and 43 Publication in Web of Science at the third rank. Author collaboration with outside countries fairly reflects the global reach of the IITs and its exposure and visibility of their faculty.

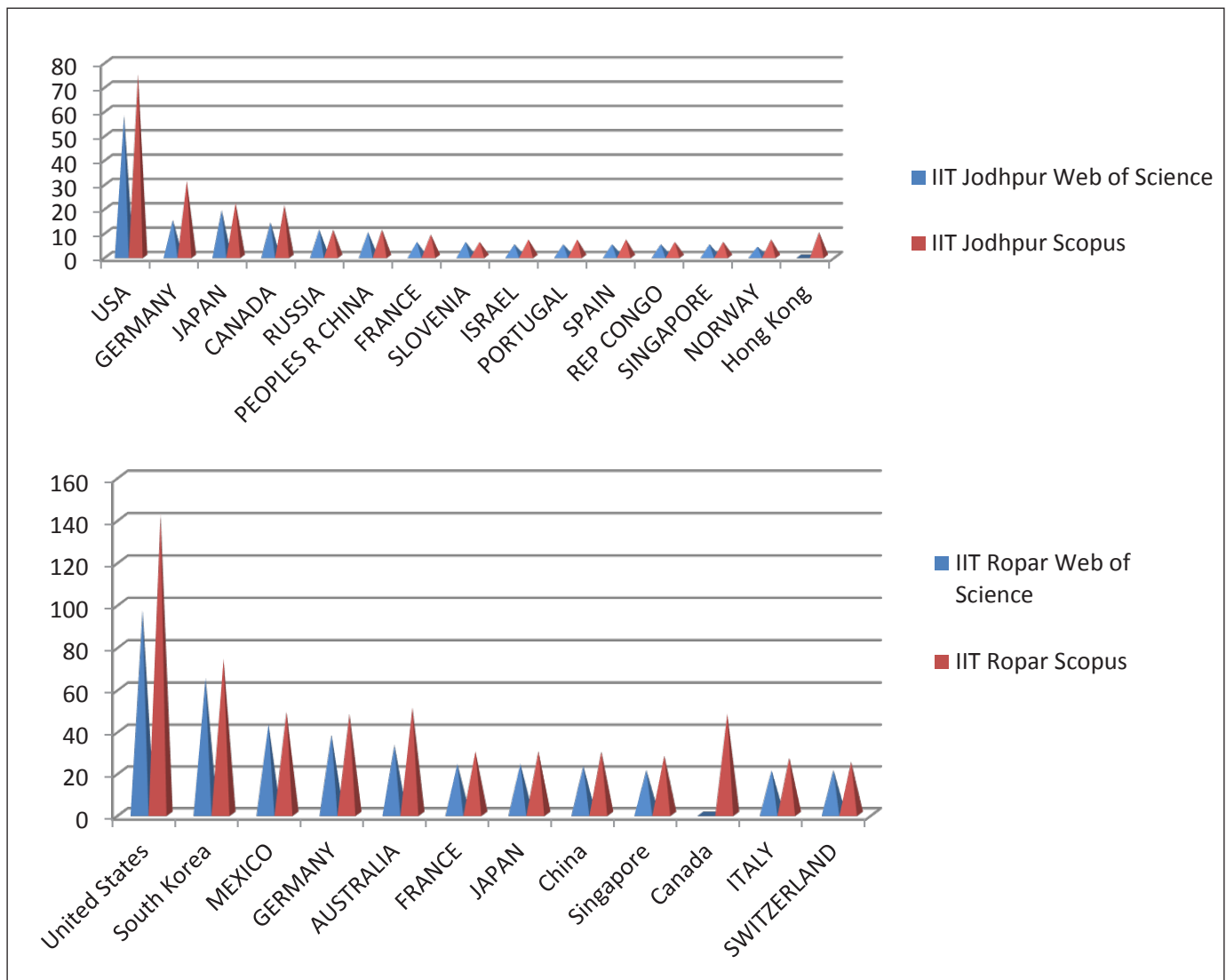


Fig. 5: Collaboration of Research Publications with Other Countries of IIT Jodhpur and IIT Ropar

Table 6: Collaboration of Research Publications with Other Countries

Name of Institution	Countries/Regions	Web of Science	Scopus	Cumulative Average	Rank
IIT Jodhpur	USA	58	75	66.5	1st
	GERMANY	15	31	23	2nd
	JAPAN	19	22	20.5	3rd
	CANADA	14	21	17.5	4th
	RUSSIA	11	11	11	5th
	PEOPLES R CHINA	10	11	10.5	6th
	FRANCE	6	9	7.5	7th
	SLOVENIA	6	6	6	8th
	ISRAEL	5	7	6	8th
	PORTUGAL	5	7	6	8th
	SPAIN	5	7	6	8th
	REP CONGO	5	6	5.5	9th
	SINGAPORE	5	6	5.5	9th
	NORWAY	4	7	5.5	9th
	Hong Kong	0	10	5	10th
IIT Ropar	United States	97	142	119.5	1st
	South Korea	65	74	69.5	2nd
	MEXICO	43	49	46	3rd
	GERMANY	38	48	43	4th
	AUSTRALIA	33	51	42	5th
	FRANCE	24	30	27	6th
	JAPAN	24	30	27	6th
	China	23	30	26.5	7th
	Singapore	21	28	24.5	8th
	Canada	0	48	24	9th
	ITALY	21	27	24	9th
	SWITZERLAND	21	25	23	10th

CONCLUSIONS AND FINDINGS

In the WoS IIT Jodhpur and Ropar has contributed 528, 1118 publications respectively during the period 2010-2018. On other hand Scopus 957 publications from IIT Jodhpur and 1604 publications by the IIT Ropar during 2010 to 2018 and the number of publications has consistently grown as IIT Jodhpur published 8 publications in Scopus, 01 publication in Web of Science in the year 2010 and is gone up to 262 and 158 respectively in the year 2018. During the year 2010 IIT Ropar had published 21 publications in Scopus, 17 publications in Web of Science and in 2010 this number increased to 353, 239 in 2018 respectively.

The data reflects that highest number of publications contributed by the IIT Ropar (1604 in Scopus and 957 in Web of Science) followed by IIT Jodhpur (1118 in Scopus, 528 in Web of Science).

The study of distribution of publications according to their types. shows that research articles comprised of the highest number of publications in IIT Jodhpur and IIT Ropar i.e. 482 (91.29%) in WoS and 549 (57.37) in Scopus of IIT Jodhpur and IIT Ropar i.e. 1039 (92.93%) in WoS and 1143 (71.76%) in Scopus followed by proceedings papers of IIT Jodhpur 361 (37.72%), in Scopus, 7 (1.33%) in WoS and IIT Ropar in Scopus 383 (23.88%), WoS 25(2.24%) and review papers 28 (5.30%) in WoS, Review Papers 30 (3.13%) in Scopus of IIT Jodhpur and 30(1.87) in Scopus, 26(2.33) in WoS of IIT Ropar.

Data analysis on the availability of publications in open access form. reflects that highest number of open access publication found in Scopus i.e. 135 (8.42%) of IIT Ropar, 119 (12.43%) of IIT Jodhpur of total publication followed by in WoS 119 (10.64%) of IIT Ropar & 88 (16.67%) of IIT Jodhpur of total publication.

As far as collaboration of research with other countries researchers is concerned the IIT Jodhpur and IIT Ropar, has a global outreach for collaborative work. Analysis of collaboration with researchers of other countries reveals that the USA is at the top with 75 publications in Scopus and 58 publications in Web of Science of IIT Jodhpur and USA is at the top with 142 publications in Scopus and 97 publications in Web of Science of IIT Ropar with cumulative average 66.5% of IIT Jodhpur and 119.5% of IIT Ropar which is placed at 1st Rank. Followed by Germany with 31 publications in Scopus and 15 publications in Web of Science with cumulative average 23% which is placed at 2nd Rank in IIT Jodhpur and South Korea with 74 publications in Scopus and 65 publications in Web of Science with cumulative average 69.5% which is placed at 2nd Rank in IIT Ropar and Japan with 22 publications in Scopus and 19 Publication in Web of Science at the third rank of IIT Jodhpur and Mexico with 49 publications in Scopus and 43 Publication in Web of Science at the third rank. Collaboration with authors of other countries fairly reflects the global reach of the IIT Jodhpur and IIT Ropar exposure and visibility of its faculty.

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