

Water-related Technology Research in India: Insights from Four Core Journals

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ABSTRACT

Over the last decade, several scientometric and bibliometric studies have been carried out in different areas to measure the trend of research in the specific fields of science and technology, such as nanotechnology, neuroscience, medicines, etc. With the advent of the United Nations' Sustainable Development Goals (UN-SDGs), water-related research has gained impetus. In the last five years, the Government of India has launched several water missions and has funded several scientific projects to come out with innovative solutions. However, Indian scholarship has been silent in the evaluation of research performance in the area of Water. This study, therefore, tries to identify the publication trends in the four most cited journals in the area of water-related research in the last ten years. On identifying India among the leading four countries, in terms of publications in water-related research, the paper also tries to identify its publication trend by major Indian research institutions in these journals.

Keywords: Water Technology, Clean Water and Sanitation, SDG6, Water Mission, Scientometrics, India.

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INTRODUCTION

Water is considered most essential for life form on earth. Nevertheless, today, reports concerning water scarcity, clean and drinkable water, waterborne diseases have become more prominent. According to European Commission^[1] we have already exhausted more than 60 percent of our natural resources and if we continue on the same path, we would end up consuming five times more resources by 2050, leading to havoc in air and water quality. In order to tackle the environmental threats, management of natural resources have become an utmost concern. In order to prevent further environmental damages, innovative environmental technologies are gaining focus and countries are investing more in these research and development. Organizations and communities across the world had extended cooperation and emphasized on capacity building through water and sanitation-related activities and programs to achieve equitable access to safe drinking water. Water quality and availability are few of the major challenges in India.^[1,2] Besides this safe drinking water is a corner in several states.^[3,4] In India agriculture is highly dependent

on groundwater and over time has resulted in depletion of groundwater.^[5,6] This study analyzes India's research performance in many of these water-related technological solutions over the last ten years.

H.Z. Fu *et al.*^[7] argue that bibliometric studies enable to capture the distribution pattern of articles in a given field, topic, institution and country. It has been argued that the number of publications of a country in a specific field or subject area reflects its 'commitment' to the state of science and technology or research efforts in that field. Several scientometric and bibliometric studies have been carried out to analyze the trends of publication reflecting the research in areas related to water.^[7-23] Ruaro and Gubiani (2013). However, no study has been carried out so far to identify the research trend in India specific to the area of water technology. This study, therefore, aims at evaluating the research performance in the last ten years (2006-17) in the area of water technology in India as compared to other countries through scientometric tools.

We gather data from databases of Scopus and Scimago. The paper then proceeds with analyzing the contribution made by Indian scientists and researchers in Environmental Monitoring and Assessment (Springer), Journal of Hazardous Materials (Elsevier), Pollution Research and RSC Advances (The Royal Society of Chemistry) the four most prominent journals in the area of water-related research in India.

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Many of these scientific researches are now available online through publications in academic journals. These academic journals publish volumes of articles at regular intervals and facilitate dissemination of research findings in the academic platform. No study so far has been carried out to assess Indian scholarship in the area of water and their trend of publication in the leading journals. This paper analyzes the four journals engaged in publishing in the area of water. Such study also gives us an opportunity to evaluate the research trend of leading Indian Institutions researching in the area of water technology. For our study, the paper has been divided into four sections. Section 2, we discuss the methodology adopted in this study. In section 3 we discuss the findings. Here we discuss the research trend in the area of India as compared to other leading countries and India's publication trend in the four core journals in the area of water-related technology research. In section 4 we draw our conclusions.

MATERIALS AND METHODS

Methodology

Keeping in mind the objective of the study, we adopted scientometric methods. Data were obtained from the website of Scopus on November 2018. A total 69,566 documents were found within the period of 2006–2017, using the keywords results. The period was divided into two parts 2006–2011 and 2011–2017 to draw a comparison. The searches were carried out in the title and keywords. Top 10 countries were identified initially to analyze their contribution and publication trend. Also, four of these journals identified as the most prominent publishing venue in the area of water technology-related fields and taken up for further in-depth analysis. Environmental Monitoring and Assessment is the most sought journal for publication India. The journal dates back to the year 1981. The second most sought journal is Journal of Hazardous Materials and the journal dates back to 1975. The third most prominent journal is Pollution Research, an Indian journal publishing since 1982. The fourth most prominent journal is RSC Advances, launched in the year 2011 but has managed to emerge as a leading journal in the area of water-related technology.

Out of these ten leading journals as shown in Table 1, first four were taken up for analyzing the publication trend in the leading research India.

The keywords used in Scopus search in title and keywords are

“Water effi*” “water resource*” “water govern*” “water challeng*” “Arsenic remov*” “Wastewater” “water poll*” “Desalination” “potable water” “ground water” “Groundwater” “sanitation tech*” “water reuse” “water recycle*” “anaerobic treat*” “aerobic treat*” “irrigat*” “nanofiltration membrane

tech*” “reverse osmosis composite membrane” “water diver*” “water qual*” “water manage*” “water puri*” “indus* effluent” “*fluoridation” “microfiltr*” “activated sludge” “water refine*” “water treat*” “water restor*” “Aquifer” “Water scarc*” “Water for all” “Sanitation for all” “Clean water” “Freshwater” “River water” “Industrial Water” “Agri* Water” “Water soft*” “Hard water” “Water Contamin*” “Sanitation Engin*” “Water Engin*” “Water Techn*” “Water harvest*” “fluoride remov*” “Brackish water” “water monitor*” “water detect*” “ultrafiltrat*” “eutrophicat*” “pervaporat*” “liquid membrane” “water secur*” “water safe*” “Greywater” “black water” “Wetland” “water sustain*” “Hydrodynamics” “Hydrological model” “Estuaries” “Fresh water” “Polywater” “Stormwater” “Ozonation” “Chlorination” “Drink* water” “Vortex flow” “Denitrification” “Salin* - salinity, salination” “Water *distribution” “Water drain*” “Piped water supply” “Water stress” “Sewage water” “Canal water” “Water and revival” “Water flow” “*Water harvest*” “Water infrastructure” “Water system” “Geosynthetics and water” “Geomembrane and water” “Sludge digest*” “Screen* and Wastewater” “Effluent treat*” “*Potable water” “Membrane bioreactor” “Nanofilter* and Water” “Sewage treat*”

This data was then compared with the data produced by Scimago, powered by Scopus, is a database of bibliometric indi-

Table 1: Leading Journals in the Area of Water Technology (Source – Scopus).

Ranks	Name of journal	No. of publications 2006-2017	ISSN NO.	Year of Inception
1	Environmental Monitoring and Assessment	794	1573-2959	1981
2	Journal of Hazardous Materials	692	0304-3894	1975
3	Pollution Research	673	0257-8050	1982
4	RSC Advances	656	2046-2069	2011
5	Bioresource Technology	643	0960-8524	1979
6	International Journal of Chemtech Research	502	2455-9555	2009
7	Ecology Environment and Conservation	499	0971-765X	1995
8	Indian Journal of Environmental Protection	496	0253 – 7141	1981
9	Desalination and Water Treatment	485	1944-3986	2009
10	Current Science	472	0011-3891	1932

Table 2: Top 10 Publishing Countries on the Basis of Documents between 2006-2017 (Scimago).

Ranks	Country	No. of		No. of		Citations per Document	H-index
		Documents	Citable documents	Citations	Self-Citations		
1	United States	69299	66900	989372	518673	14.27	333
2	China	40826	40343	306708	189281	7.51	156
3	Germany	17550	16792	214253	59253	12.2	196
4	United Kingdom	16206	15398	266171	78250	16.42	213
5	Canada	13399	12903	185333	50411	13.83	181
6	India	13253	12730	102607	39478	7.74	125
7	France	12471	12185	175731	50204	14.09	180
8	Australia	11853	11465	169966	47632	14.33	169
9	Spain	9221	8897	123320	37773	13.37	141
10	Japan	8641	8451	107209	25799	12.4	148

Table 3: Top 10 Publishing Countries on the Basis of Documents between 2006-2011 (Scimago).

Ranks	Country	No. of		No. of		Citations per Document	H-index
		Documents	Citable documents	Citations	Self-Citations		
1	United States	33752	32573	722028	372620	21.39	333
2	China	11060	10939	175994	105465	15.91	156
3	Germany	8198	7904	150172	38586	18.31	196
4	United Kingdom	7527	7173	188337	53782	25.02	213
5	Canada	6161	5901	132151	34864	21.44	181
6	France	5969	5858	127341	35310	21.33	180
7	India	5114	4950	67685	25645	13.23	125
8	Australia	4994	4842	112580	30170	22.54	169
9	Japan	4270	4183	80878	19022	18.94	148
10	Spain	4213	4118	87930	26515	20.87	141

Table 4: Top 10 Publishing Countries on the basis of Documents between 2012-2017 (Scimago).

Ranks	Country	No. of		No. of		Citations per Document	H-index
		Documents	Citable documents	Citations	Self-Citations		
1	United States	35547	34327	267344	146053	7.52	333
2	China	29766	29404	130714	83816	4.39	156
3	Germany	9352	8888	64081	20667	6.85	196
4	United Kingdom	8679	8225	77834	24468	8.96	213
5	India	8139	7780	34922	13833	4.29	125
6	Canada	7238	7002	53182	15547	7.34	181
7	Australia	6859	6623	57386	17462	8.36	169
8	France	6502	6327	48390	14894	7.44	180
9	Spain	5008	4779	35390	11258	7.06	141
10	Japan	4371	4268	26331	6777	6.02	148

cators. For this study, we collected data from the Scimago database for water-related technologies for the year 2006-2017 (Table 2). To draw proper comparison data was collected for the period of 2006-2011 (Table 3) and 2012-2017 (Table 4).

FINDINGS

Keeping the objectives of the research in mind, this section has been divided into two parts. Section 3.1 discusses India's research performance in the area of water-related technologies as compared to other countries. In section 3.2 we discuss the research performance in the core water-related journals.

Research Trend in Water Related Technology

We begin our analysis by comparing India's research performance with other countries leading in research in the area of water. Table 2 shows the overall trend within the duration 2006–2017, whereas Table 3 and Table 4 represent two breakups for the years 2006–2011 and 2012–2017 respectively. The data for these Tables has been retrieved from Scimago (<https://www.scimagojr.com/>). From Table 2 we can observe that the U.S. ranks first with 6929 documents followed by China (40826) and Germany (17550). Within this period, India ranks sixth with 13253 documents, followed by France (12471), Australia (11853), Japan (8641) and Spain (9221). Scimago Journal Ranking (hereafter SJR) offers details of citable documents, citation as well as the self-citation. We can observe that China has the highest percentage of self-citation (61.71 percent) followed by US (52.42 percent). We can observe that the United States (333) has the highest *h*-index followed by United Kingdom (213), Germany (196), Canada (181), France (180), Australia (169), China (156), Japan (148), Spain (141) and India (125). We can also observe that citation per document is highest in the UK, whereas the US, France and Australia have somewhat similar citations per document.

Table 3 represents the data for the top ten countries in terms of publication for the period 2006–2011. We can observe that the United States is the top-ranking country with 33752 documents published followed by China (11060) and Germany (8198). India ranks seventh, contributing 5114 documents during the period. From the Table we can also observe that citation per document is highest in the United Kingdom, followed by that of Australia, France, Canada, Spain and the United States.

In the period of 2006–2011, for the United States, the self-citation has been 51.60 percent, 59.92% for China, 25.69 for Germany, 28.55 for the UK, 26.38 for Canada, 27.72 for France, 37.88 for India, 26.79 for Australia, 23.51 for Japan and 30.15 for Spain. For the period of 2013–2017, self-citation for the United States is highest for the United States (54.63), 64.12 for China, 32.25 for Germany, 31.43 for the UK, 29.23 for Canada, 30.77 for France, 39.61 for India, 30.42 for Australia, 25.73 for Japan and 31.81 for Spain.

If we compare Tables 3 and 4 with Table 2, we can observe that the United States continues to hold the highest number of publications across the year. We can observe that for the US the self-citation is 54.63 percent, for China, it is 64.12, Germany 32.25, UK 31.43, India 39.61, Canada 29.23, Australia 30.42, France 30.77, Spain 31.81 and Japan 25.73. From Table 4 we observe that for the period of 2012–2017, the United Kingdom has the highest citation per paper followed by Australia, the US, France and Canada. Also, we observe a change in the ranking of countries in terms of documents published in the two periods. India rises to rank 5 in terms of publication in 2012–2017, Canada moves to the 6th position, Australia to the 7th position, France to 8th positions, Spain rises to 9th position and Japan shifts to the 10th position. The two tables depict that the percentage of self-citation remains highest for China, while the self-citation percentage is lowest for Japan. We observe from the Table 3, even when India ranks seventh

Table 5: (a) Publication Trend in the Leading Water Technology-Related Journals. (Source -Scopus).

Environmental Monitoring and Assessment					
Country	2006-2017	2006-2011	Total Citation	2012-2017	Total Citation
China	608	230	6042	378	4029
United States	718	353	6113	365	2782
India	794	365	8855	429	3566
Germany	102	27	649	75	638
United Kingdom	89	37	700	52	382
Canada	160	84	1800	76	640
Australia	119	34	635	85	742
Japan	100	47	944	53	547
France	82	20	468	62	432
Spain	105	44	853	61	473
Total					
Journal of Hazardous Materials					
Country	2008-2017	2008-2012	Total Citation	2013-2017	Total Citation
China	2611	1363	83223	1248	38705
United States	797	365	19480	432	11705
India	692	539	26023	153	3620
Germany	142	72	3056	70	1465
United Kingdom	185	99	5224	86	2612
Canada	168	86	4607	82	1845
Australia	201	86	4930	115	3675
Japan	218	134	5978	84	2462
France	235	157	10469	78	1848
Spain	504	299	15712	205	5290

Table 5: (b) Publication Trend in the Leading Water Technology-Related Journals. (Source – Scopus).

Pollution Research	Country	2006-2017	2006-2011	Total Citation	2012-2017	Total Citation
	China	0	0	0	0	0
	United States	1	1	2	1	0 0
	India	674	408	436	266	209
	Germany	0	0	0	0	0
	United Kingdom	0	0	0	0	0
	Canada	0	0	0	0	0
	Australia	0	0	0	0	0
	Japan	1	0	0	1	0
	France	0	0	0	0	0
	Spain	0	0	0	0	0
RSC Advances	Country	2006-20117	2006-2011	Total Citation	2012-2017	Total Citation
	China	2405	8	222	2397	22990
	United States	342	3	59	339	4428
	India	656	2	13	654	9566
	Germany	93	0	0	93	929
	United Kingdom	117	1	2	116	1578
	Canada	89	0	0	89	1084
	Australia	106	1	66	105	1247
	Japan	161	0	0	161	1376
	France	111	3	71	108	985
	Spain	101	0	0	101	949

in terms of publication in Scimago database, the *h*-index for India remains the lowest.

Research Performance in the Major Water-Related Journals

Major Journals in the area of water science and technology as listed under Scimago on the basis of SJR indicator^[1] are Advance in Optics and Photonics (9.187), Cryosphere (3.034), Water Research (2.601), Water Resource Research (2.296), Critical review of Environmental Science and technology (2.212), Hydrology and Earth System Sciences (2.023), Desalination (1.955), Journal of Hydrology (1.832) Marine Chemistry (1.830) and Journal of Geophysical research (1.823).

Whereas for India, there are only five journals listed in the SJR for the year 2017 – Water and Energy International (0.140), Pollution Research (0.135), Transactions of the Institute of Indian Geographers (0.117), Journal of Industrial Pollution Control (0.117) and Journal of Indian Water Works Association. However, for the year 2008, the SJR for India were –Water and Energy International (0.100), Pollution Research (0.328), Transactions of the Institute of Indian Geographers (0.102), Journal of Industrial Pollution Control (0.337) and Journal of Indian Water Works Association (0.101).

According to the Scopus database, China (160168) has the highest number of publications followed by United States (125957). We found that India (36,952) ranks 3rd in terms of publications in the area related to water technology. The top 10 Journals depicting efforts related to water technology are Environmental Science and Technology (8060) Desalination and Water Treatment (7480), Journal of Hazardous Material (7219), Advanced Material Research (7118), Science of the Total Environment (6835), Chemosphere (6283), Water Research (5934), Water Science and Technology (5672), Biore-source Technology (5387) and Chemical Engineering Journal (5015). Table 1, however, lists the most sought journals for publication in the case of water research in India. In the section that follows we discuss and analyze the publication trend of the leading countries in these four journals. Figure 1 represents the publication trend in the leading five journal in the last twelve years.

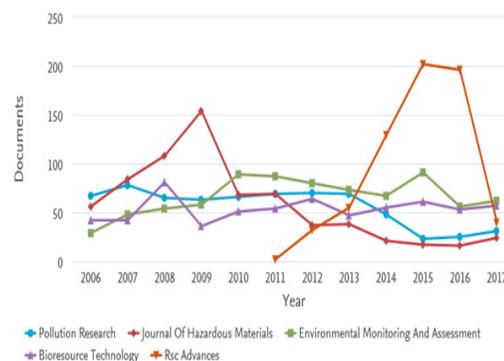
Environmental Monitoring and Assessment

Environmental Monitoring and Assessment is leading International Journal, based in the Netherlands, dedicated for advancements in knowledge of Environmental Science. The subject area covered by this journal are Ecology, Environmental Chemistry, Environmental Management, Monitoring

Table 6: The Leading Research Institutions and Their Publication Trend (Scopus).

Ranks	Name of Institute	Number of publications	Environmental Monitoring and Assessment	Total citation	Journal of Hazardous Materials	Total citation	Pollution Research	Total citation	RSC Advances	Total citation
1	Bhabha Atomic Research Centre	1821	6	90	36	1709	0	0	34	352
2	Indian Institute of Technology, Kharagpur	1788	5	94	29	1743	1	5	20	298
3	Indian Institute of Technology Roorkee	1464	15	211	42	4807	0	0	15	1116
4	Anna University	1428	24	584	30	2649	16	15	8	106
5	Indian Institute of Technology, Madras	1362	4	16	18	1104	1	0	11	77
6	Indian Institute of Technology Delhi	1319	11	411	15	1283	2	3	3	128
7	Indian Institute of Technology, Bombay	1317	7	38	13	652	0	0	8	82
8	Indian Institute of Science, Bangalore	1307	5	62	4	215	3	2	17	522
9	Council of Scientific and Industrial Research India	1299	42	723	23	1187	1	0	25	325
10	Jadavpur University	1060	4	47	8	288	1	1	18	98
11	Indian Institute of Technology, Guwahati	940	4	48	16	1244	0	0	24	313
12	Indian Institute of Technology, Kanpur	912	4	64	12	534	0	0	25	362
13	National Institute of Oceanography India	881	66	726	0	0	2	1	0	0
14	Annamalai University	877	19	342	10	625	13	2	0	0
15	Banaras Hindu University	870	15	439	9	859	5	1	14	197
16	University of Calcutta	850	25	393	5	362	4	4	15	133
17	Vellore Institute of Technology	752	2	12	7	378	3	0	9	109
18	Indian Agricultural Research Institute	718	29	361	2	61	0	0	0	0
19	Indian Institute of Chemical Technology	701	3	58	3	58	0	0	18	255
20	Indian Council of Agricultural Research	674	12	220	3	344	4	3	0	0

and Environmental Analysis, Pollution and Remediation. The Journal has an Impact factor of 1.804 and an H-index of 84. When we compare the publication trend by leading countries in this journal from Table 5a, we observe that India has the highest number of publications in this Journal followed by the United States and China. Within the period of 2006-2017, the most cited paper in this journal is titled “Leachate characterization and assessment of groundwater pollution near municipal solid waste landfill site” (2006) by Suman Mor., K. Ravindra, R.P. Dahiya and A. Chandra, is the most cited paper with 248 citations. During this period the institutions most actively engaged in water-related research are National Institute of Oceanography India with total 66 publications which

**Figure 1:** Publication Trend in the Major Water Related Journals (Source: Scopus).

have received total 735 citations, National Environmental Engineering Research Institute India with total 47 publications and 464 citations and Council of Scientific and Industrial Research India with total 42 publications with total 733 citations (CSIR).

Journal of Hazardous Materials

Journal of Hazardous Materials is another leading international journal in the area of Environmental Sciences based in Netherland. The subjects covered in this journal are hazards and risks of certain materials on public health and the environment, controlling and mitigating risks of hazardous materials. The Journal has an impact factor of 6.434 and H-Index 217. We can observe from Table 5a, that India has the third highest contribution in this Journal after the United States and China. The Indian Institutions publishing actively in this journal are Indian Institute of Roorkee with 42 publications, which have received total 4871 citations, Bhabha Atomic Research Centre with 36 publications, which have received total 1741 citations and Anna University with 30 publications, which have received total 2695 citations. The most cited paper in this journal, with 1927 citations is titled "Arsenic removal from water/wastewater using adsorbents- A critical review (2007) by Dinesh Mohan", CU Pittman Jr.

Pollution Research

Pollution Research is an India based International Journal dedicated to the advancement of knowledge in the area of Environmental Science, Pollution and Water Science and Technology. The Journal has an impact factor of 0.21 and *h* index 21. Even when this journal has been publishing since 1997, United States had only one publication in this journal in the period 2006–2011 which has received only two citations, whereas India has received 436 citations for the 408 publications during this period. We can clearly observe from Table 5b that no other country has published in this journal during this period had any publications Hence we can argue that this journal is sought more by Indian as compared to other nationalities for publication. During the period 2012–2018 also, we observe the journal published papers from US, India and Japan. The paper titled "Bioaccumulation study by Lemna Gibba Lin by D Sivakumar, D. Shankar, P. Dhivya and K Balasubramanian is the most cited paper and has received 19 citations. The most actively engaged institute are Gauhati University with 29 publications which have received total 19 citations, Cotton University has 17 publications, which have received total eight citations and Anna University with 16 publications which have received total 15 citations.

RSC Advances

RSC Advances is an international journal based in the United Kingdom, dedicated to knowledge advancement of knowl-

edge in the area of Chemical Engineering and Chemistry. The journal has an H-Index of 96 and citation of 2.936. Bhabha Atomic Research Centre with total 34 publications which have received total 356 citations, has the highest number of publications in this journal followed by CSIR India with 25 publication which have received 329 citations and Indian Institute of Technology (IIT), Kanpur with 25 publication which has received total 366 citations. Since the journal was founded in the year 2011, we could only 2 Indian papers in the issue of 2011. The most cited paper with 747 citations in this journal is "Chemical treatment technologies for wastewater recycling - An overview" by Gupta et al. However, the highest number of papers in this journal comes from Ministry of Education China with 408 publications, Chinese Academy of Science with 360 publications and University of Chinese Academy of Science with 93 publications.

Table 6 captures the publication trends of the leading research institutions in India in the area of water technology. We can observe that Bhabha Atomic Research Centre has the highest number of publications in the field of water technology, followed by the Indian Institute of Technology Kharagpur and Indian Institute of Technology Roorkee. In this Table, we also present the publication trend of these leading institutions in the four core journals in the area of water. We observe that in the case of the journal Environmental Monitoring and Assessment citation per document is highest for Indian Institute of Technology Delhi (37.36), followed by Banaras Hindu University (29.26) and Anna University (24). However, citations per documents remain lowest for Indian Institute of Technology Madras (4), Indian Institute of Technology Bombay (5.42) and Vellore Institute of Technology (6). Even though the National Institute of Oceanography India has the highest number of publications in this journal, the citations received per document remain low (11).

In the case of Journal of Hazardous Materials, we can clearly observe that the research publications have received relatively more citations as compared to other three journals. Indian Institute of Technology Roorkee has the highest number of publications in this journal and also has received the highest number of citations per paper of 114.45. However, it is interesting to note that the Indian Council of Agricultural Research which has only three publications in this journal have also had also received 114.66 citations per document. Nevertheless, other institutions with high citations per paper include Banaras Hindu University (95.44), Anna University (88.3) and Indian Institute of Delhi (85.53). The institution receiving lowest citation per document are Indian Institute of Chemical Technology (19.33). It is interesting to note that the National Institute of Oceanography (India) has no publication in this journal in the given duration.

When we analyse the publication trend in the Journal Pollution Research, we observe that seven institutions out of the twenty leading research institutions have not published any paper in this journal. We can observe that Bhabha Atomic Research Centre and Indian Institute of Technology which are leading research Institutes in the area of water have not published any paper in this journal. Another important observation that can be made from the Table the publications in this journal have received very low citations. Anna University has the highest number of publications in this journal, followed by Annamalai University and Banaras Hindu University. It is only in the case of IIT Kharagpur; a single publication has received five citations. IIT Delhi has two publications in this journal and they have received only three citations.

In the case of the journal RSC Advances, we observe that Bhabha Atomic Research Centre has the highest number of publications in this journal. Publications from IIT Roorkee, IIT Delhi and IISc Indian Institute of Science Bangalore have received the highest number of citations per document of 74.4, 42.66 and 30.70 respectively in this journal. It is also interesting to note that four out of these twenty research institutions have no publications in this journal. These four research institutions are National Institute of Oceanography India, Annamalai University, Indian Agricultural Research Institute and Indian Council of Agricultural Research. Overall from the Table, we can observe that the leading research institutions are publishing relatively more in the Journal of Hazardous Materials as compared to the other three journals. If we compare Table 5b with Table 6, we can observe that even though Pollution Research is a leading Indian Journal in the area of water, the leading research institutions do not opt to publish their research in this journal. A similar trend is observed in the case of RSC Advances, where some of the leading research institutions do not choose to publish. The leading two journals Environmental Monitoring and Assessment and the Journal of Hazardous Materials, however, comparatively more sought journal for the water scholarship in India.

DISCUSSION

The objective of this paper was to analyze the Indian scholarship in the area of water technology with special focus on the leading journal. Two Indian Journals (Pollution Research and Indian Journal of Environmental Protection) appear in the list of leading ten journals most sought for publications by Indian Scholarship. According to Scimago data, India's research performance has increased in 2012-2017 as compared to 2006-2011 as India has climbed to 5th rank from the 7th rank in the list. However, according to Scopus data, India ranks 3rd in the area of water technology research. We identified four leading Journals most opted by Indian authors for publishing their work. Here we identified that China supersedes India in

terms of a number of publications in the Journal of Hazardous Materials and RSC Advances. Even though the journal of Pollution Research appears to be opted by Indian Authors, we observed that the leading research institutions, engaged in research related to water technology, have few papers in this journal. Based on our findings, we can summarize that the journal has failed to attract visibility from scholarship abroad. Whereas in the case of the other three journals have received relatively more papers and citations.

CONCLUSION

Based on the analysis of data collected from Scopus, we can draw the following two conclusions. Firstly, the research performance of India in the area of water has accentuated over the last five years. One can argue that probably the National Water Policy 2012, which provides a substructure for adaptation to climate change strategies around water. It has opened a new horizon for innovation in water storage technologies and incentivized traditional water harvesting methods. Also, support from the Movement of 'Swachh Bharat Mission' - the Clean India Mission and espouse the water and sanitation technology research could have attributed to the rise in the research performance. The second, we can distinguish the performance of the leading research institutions in the core water journals. The study highlights that it is not necessary that the leading institution will publish in the most sought journals by Indian authors. The two possible explanation for such a phenomenon is that probably institutions other than these leading institutions chose these journals or the research on water-related technologies carried out in these research institutions are beyond the scope of these journals. Thereby, further research is required to explore the aspect of publication trend among leading research institutions in India in the area of water-related technology.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

UN-SDGs: United Nations' Sustainable Development Goals; **RSC Advances:** The Royal Society of Chemistry; **SJR:** Scimago Journal Ranking; **CSIR:** Council of Scientific and Industrial Research; **IIT:** Indian Institute of Technology.

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