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Research Productivity of First Ten NIRF Ranking Academic Institutes in
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Abstract:

This scientometric study analyses the research productivity of the first ten NIRF ranking academic institutes in India using Web of Science (WoS) data. In particular, this study focused on research output in terms of the total number of publications as indexed in the Web of Science database, citations received, and research area. We examined 42300 publications downloaded from the Web of Science. The results show that the publications output of each institute is in increasing trend but yearly citations per publication are uniform. On the other hand, articles per journal statistics show that publications are scattered distributed in various journals, not centered on only a few preferred journals. For the classification of research publications by subject, we used a modified subject group, which is based on OECD and ESI of WoS. It has been seen that the productivity in chemical sciences is maximum which also supports the world report.

Keywords: Research performance; Academic institutions; Research productivity; Scholarly performance

Introduction:

Scientometrics became a branch of the discipline “science of science” and it is being used as a powerful tool for research (Ivancheva, 2013). Scientometrics analyses scientific performance on the basis of publications and citation data, using statistical methods. It has been universally accepted that the outcome of a judicious scientometric investigation possibly

the most important facet in evaluating scientific performance (Beck & Gáspár, 1991). In some earlier studies (Osareh & Zare 2010; Riahinia, Asemi & Zandian 2011; Sengar 2013; Noruzi & Abdekhoda 2014; Torrisi 2014; Uma and Rao 2014; Mukherjee 2017; Damar 2018; Dabas & Kumar 2018;) where publication output has been used to analyze the academic institutes' performance. However, the publications trend in academic institutes in India and their contributions in major subfields of their study always remains an important issue. The academic institutes have an important role to initiate innovative research and giving a proper direction for research and development. The present study is involved to explore research trends of the top ten NIRF ranking academic institute in India based on three facets, namely Scholarly Output which is measured by research productivity as indexed in Web of Science (WoS) database; Citations which is measured by citation count of each publication, and subject fields; during 2015 to 2019. We examined 42300 publications downloaded from the Web of Science.

Objectives of the study:

The primary objective of this research work is to study the publication output of the top ten NIRF ranking Indian universities in terms of quantity, source journals, citations received, and area of research.

Data and Methodology:

The present study was attempted to explore the publication trends of the top ten NIRF ranking universities in India (Table 1). The methodology of this study relies on scientometric techniques. The publications data has been derived from the Web of Science international database to conduct a comprehensive analysis of the research output. The search string was used for searching the database was University name as Organization-Enhanced field. We examined 42300 publications downloaded from the Web of Science for the time period from 2015 to 2019. The study was based on mainly three indicators- scholarly output, citations, and major subfields of study. Scholarly output is viewed by productivity as reflected in WoS international database in each academic institute. Citations which is measured by the citation count of each publication i.e. total citations(TC), yearly citations(YC), citations per publication(CPP), yearly citations per publication(YCPP), etc. We used citation data to measure the quality of publications of selected academic institutes. In addition, for classification of productivity by subject, we used SC field of Web of Science data to see the trend of research in different scientific subfields. Since WoS classifies papers under different combinations of subject categories, we got more than 1200 different subject heading. To

make a clear picture of the distribution of paper in the different subject category in the present context, we prepared a Modified Subject Group (MSG) after rigorous consultation of OECD (Organization for Economic Cooperation and Development) and ESI (Emerging Subject Fields) of Web of Science subject classification schema.

Table 1: First Ten NIRF Rankings (2020) University
(Source: <https://www.nirfindia.org/2020/UniversityRanking.html>)

Institute Name	State	Website Address	Year of Establishment	NIRF Rank
Indian Institute of Science(IISC)	Karnataka	https://www.iisc.ac.in/	1909	1
Jawaharlal Nehru University(JNU)	Delhi	https://www.jnu.ac.in/	1969	2
Banaras Hindu University(BHU)	Uttar Pradesh	http://www.bhu.ac.in/	1916	3
Amrita VishwaVidyapeetham(AVV)	Tamil Nadu	https://www.amrita.edu/	1994	4
Jadavpur University(JU)	West Bengal	http://www.jaduniv.edu.in/	1955	5
University of Hyderabad(HU)	Telangana	https://www.uohyd.ac.in/	1974	6
Calcutta University(CU)	West Bengal	https://www.caluniv.ac.in/	1857	7
Manipal Academy of Higher Education(MAHE)	Karnataka	https://manipal.edu/mu.html	1953	8
SavitribaiPhule Pune University(PU)	Maharashtra	http://www.unipune.ac.in/	1948	9
Jamia Millia Islamia(JMI)	Delhi	https://www.jmi.ac.in/	1920	10

Results:

The present analysis contains data on the scientific output of the top ten NIRF ranking academic institutes in India. We examined 42300 publications data downloaded from Web of Science (WoS) for the time period from 2015 to 2019. The year-wise and institution-wise summary of publications is shown in Table 2. It has been seen that 50% of the total publications are from IISC, BHU, and JU; however, the publications output of each institute is in increasing trend. On the other hand, articles per journal statistics (Table 3) show that publications are scattered distributed in various journals, not centered on only a few preferred journals. We also noticed that the number of journals used for publishing is proportionally increased with the number of articles published from 2015 to 2019.

Table 2: Summary of Publications (2015-2019) of Top Ten NIRF Ranking University.
(Data sourced from Web of Science Core Collection)

Year	IISC	JNU	BHU	AVV	JU	HU	CU	MAHE	PU	JMI	Total
2015	1853	461	1218	245	954	579	762	610	409	330	7421
2016	1871	503	1194	280	979	589	749	785	593	366	7909
2017	2020	531	1227	329	982	584	794	834	575	439	8315

2018	2202	649	1321	471	1084	551	762	992	561	558	9151
2019	2231	687	1484	563	1109	647	800	1278	654	656	10109
Total	10177	2831	6444	1888	5108	2950	3867	4499	2792	2349	42905
Percentage	23.72	6.60	15.02	4.40	11.91	6.88	9.01	10.49	6.51	5.47	100

Table 3: Yearly Distribution of Articles with number of Journals Used for Publishing

Year	Articles Published	No of Journals Publishing Articles	Articles per Journal
2015	7421	2194	3.38
2016	7909	2303	3.43
2017	8315	2335	3.56
2018	9151	2550	3.59
2019	10109	2866	3.53

The total number of publications and their citations by other researchers can be used as an indicator to determine the quality of academic researchers and the level of academic impact. Figure 1 derived from Table 4, which shows year-wise total publication (TP) and their citations per publication. It has been clearly indicating that the trend of publication is increasing in terms of the total number of publications in each year but yearly citations per publication are uniform. So we can say that universities are maintaining their quality of publications.

Table 4: Citations Count of the Published Paper

Year	TP	TC	YC	CPP	YCPP
2015	7421	115666	23133	15.59	3.12
2016	7909	134321	33580	16.98	4.25
2017	8315	94860	31620	11.41	3.80
2018	9151	97910	48955	10.70	5.35
2019	10109	48421	48421	4.79	4.79
Total	42905	491178	185709	11.45	4.33

TP: Total Publications; TC: Total Citations; YC: Yearly Citations; CPP: Citations Per Publication; YCPP: Yearly Citations Per Publication

Fig.1 Graph of Citation Count.

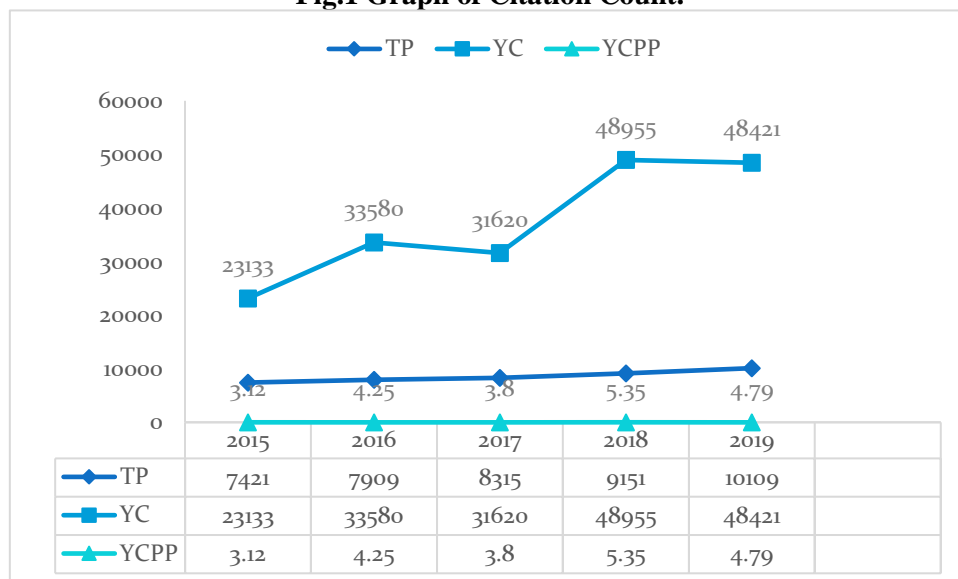


Table 5 presents the university-wise distribution of citations count. From the tabular data, the inference can be drawn that Pune University's publications got the highest number of citations in terms of citations per publication (CPP).

Table 5: University wise distribution of citations count.

University	TP	TC	CPP
SavitribaiPhule Pune University(PU)	2792	42048	15.06
Banaras Hindu University(BHU)	6444	86199	13.38
Jamia Millia Islamia(JMI)	2349	31208	13.29
Amrita VishwaVidyapeetham(AVV)	1888	22912	12.14
Indian Institute of Science(IISC)	10177	113967	11.2
Jadavpur University(JU)	5108	53484	10.47
University of Hyderabad(HU)	2950	29607	10.04
Calcutta University(CU)	3867	35522	9.19
Jawaharlal Nehru University(JNU)	2831	10138	3.58
Manipal Academy of Higher Education(MAHE)	4499	468	0.1

To evaluate faculty research performance, still many academic institutes in the world use Journal Citation Report for journal ranking and also encourage their faculty members to publish in indexed journals (Zhao, Pan & Hua 2021). University Grants Commission (UGC) also created a list of journals as UGC-CARE list to encourage university faculty members to publish their articles in the specified list, and it is also used as a standard for recruitment and promotion in India. From Table 6, it is revealed that the top ten journals that were used to publish articles mostly belong to chemistry and allied sciences. The top three journals that were used to publish are RSC Advances, Scientific Reports, and Current Science. We mentioned here journals' impact factor with their JCR (Journal Citation Report) rank.

Table 6: Top ten journals publishing most publications of the top ten NIRF ranking University during 2015-2019

Rank	Journal Title	Articles	Ratio (%)	Impact Factor (2019)	JCR Rank (2020)	Subject Coverage
1	RSC Advances	856	1.99	3.119	4415	Chemistry, Multidisciplinary
2	Scientific Reports	639	1.49	3.998	1776	Multidisciplinary Sciences
3	Current Science	397	0.93	0.725	13528	Multidisciplinary Sciences
4	Materials Research Express	352	0.82	1.929	8629	Materials Science, Multidisciplinary
5	International Journal of Biological Macromolecules	341	0.79	5.162	1081	Biochemistry & Molecular Biology
6	Plos One	338	0.79	2.74	4935	Multidisciplinary Sciences
7	Chemistryselect	337	0.79	1.811	8893	Chemistry, Multidisciplinary
8	New Journal of Chemistry	324	0.76	3.288	4263	Chemistry, Multidisciplinary
9	Journal of Alloys and Compounds	248	0.58	4.65	3552	Chemistry, Physical
10	Physical Review D	245	0.57	4.833	1241	Astronomy & Astrophysics

Total Number of Journal JCR Report 2020: 15212

For the classification of research publications by subject, we used a modified subject group, which is based on OECD and ESI of WoS. Table 7 presents university-wise paper counts under each subject group. We assigned 42300 papers in 21 subject categories using the excel formula. From the tabular data, it has been seen that the productivity in chemical sciences is maximum which also supports the world report.

Table 7: Subject wise Division of Research publications in Different Institute during 2015-2019

Subject fields	IISC	JNU	BHU	AVV	JU	HU	CU	MAHE	PU	JMI	Total
Chemical Sciences	1362	286	819	112	877	566	659	150	399	309	5539
Engineering	1515	350	614	247	958	241	411	455	264	325	5480
Medical & Health Sciences	450	379	960	640	98	255	275	1787	209	217	5270
Physical Sciences	1332	166	573	81	679	316	535	239	196	231	4348
Materials Science	1472	145	576	202	506	362	251	226	320	265	4325
Multidisciplinary	1295	155	490	125	571	318	334	262	283	165	3998
Biochemistry & Molecular Biology	651	420	350	125	192	252	305	358	180	296	3129
Earth & Related Sciences	408	139	311	12	179	69	172	29	149	37	1505
Computer Science	352	142	109	107	334	76	100	100	40	60	1420
Pharmacology & Pharmacy	110	98	257	38	166	100	107	309	106	126	1417
Environmental Sciences	182	178	286	53	158	45	158	61	39	4	1128
Astronomy, Astrophysics, Space Science	328	10	110	20	119	52	82	17	193	84	1015
Mathematics	309	22	107	23	119	48	118	17	82	55	900
Biological Sciences	93	47	122	18	30	6	46	80	32	65	838
Biotechnology	48	100	160	45	61	45	73	106	112	49	799
Plant Sciences	40	104	250	7	24	89	143	28	63	25	773
Agricultural Sciences	93	29	190	7	19	10	66	27	71	11	535
Microbiology & Virology	93	55	93	16	8	94	24	46	46	21	496
Psychiatry	13	2	66	8	1	2	6	97	2	4	201
Economics & Business	15	1	0	3	8	0	2	96	0	0	125
Social Science	1	1	1	2	0	4	0	8	4	0	21
Total	10172	2829	6444	1891	5107	2950	3887	4496	2792	2349	42917

Conclusion:

To give an overview of research productivity of the top ten NIRF ranking Indian universities during 2015 to 2019, the present study applied three facets i.e. scholarly output, citations received and area of research. We examined 42300 publications downloaded from the Web of

Science. The outcome of the study presented in terms of the total number of research articles published during the period, participation of different academic institutes in publishing, yearly citation received per publication, and the trend of research in different scientific fields. The analysis result shows that 50% of the total publications are from IISC, BHU, and JU; however, the publications output of each institute is in increasing trend. On the other hand, articles per journal statistics show that publications are scattered distributed in various journals, not centered on only a few preferred journals. We also noticed that the number of journals used for publishing is proportionally increased with the number of articles published during 2015 to 2019. It has also been clearly indicating that the trend of publication is increasing in terms of the total number of publications in each year but yearly citations per publication are uniform. So we can say that universities are maintaining their quality of publications. It is revealed that the top ten journals that were used to publish articles mostly belong to chemistry and allied sciences.

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