Scientific Productivity of Universities Accredited with Universities with Potential for Excellence (UPE) status in India

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Abstract

The present study examines the contribution of fifteen universities accredited with Universities with Potential for Excellence (UPE) status in India for the period 1999-2014. The data for the present study has been taken from the ISI web of science - Science Citation Index Expanded (SCIE). The results of the study show that i) Acta Crystallographica Section E-Structure Reports online (USA) received the highest number of publications ii) The Centre National de la Researche Scientifique ranked first among the top ten foreign organizations collaborating with Indian UPE status universities.

Keywords

Scientometrics, UPE, Scientific Productivity, Publication Productivity, SCI-E, International Collaboration.

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1. INTRODUCTION

The contribution of the UGC is enormous in the growth and development of Indian higher education system. It has designed various programmes and implemented various schemes through academic, administrative and financial support. To discharge its cardinal function of coordinating and maintaining standards of higher education, over the years, the UGC has evolved with wide variety of programmes for realization of the goals of higher education. One of the programmes is accreditation of University with Potential for Excellence status to the universities of India (UGC, 2012). The UGC assists selected Universities with a perception to accomplish excellence in teaching and research by granting on them the status of 'Universities with Potential for Excellence (UPE)'. Organizations with such status are eligible for enhanced funding to boost their academic and research infrastructure and also to advance innovative approaches towards the teaching-learning process. Universities which apply for the support of the UGC under the UPE Scheme may set higher achievement aims and endeavor for achieving them. In the process, the university has to analyze its progressions on the basis of some parameters and indicators - measurable as well as non-measurable and improve the processes so as to achieve better results. As a part of this effort, the UGC, during the IX and X Plan periods implemented a strategy to recognize few universities, which have the potential to achieve excellence in teaching and research activities (Shiv Mishra, 2012).

The UGC has, conferred the status of Universities with Potential for Excellence to 15 Universities (as on 30th April, 2015). During the IX Plan period, 5 universities were selected under the UPE Scheme, viz., Jawaharlal Nehru University, New Delhi; University of Hyderabad, Hyderabad, Telangana; Jadavpur University, Kolkata, West Bengal; Savitribai Phule Pune University, Pune, Maharashtra; and University of Madras, Chennai, Tamil Nadu. During the X Plan period, against the target of 5 universities, only 4 universities were selected viz., University of Mumbai, Mumbai, Maharashtra; North Eastern Hill University, Shillong, Meghalaya; Madurai Kamaraj University, Madurai, Tamil Nadu; and University of Calcutta, Kolkata, West Bengal. During the XI Plan Period, 6 more universities were selected viz., Banaras Hindu University, Varanasi, Uttar Pradesh; Guru Nanak Dev University, Amritsar, Punjab; Karnatak University, Dharwad,

Karnataka; University of Mysore, Mysore, Karnataka; Osmania University, Hyderabad, Telangana; and University of Rajasthan, Jaipur, Rajasthan. The present study is conducted to know how each university is performing in various fields of research.

Many extensive studies on the international academic rankings of universities have been carried out (Abolghassemi et al., 2011) and have appeared in the literature to focus on the performance of individual institutions or universities. Some of the International studies are (Johnes and Johnes, 1995 on Research funding and performance in U.K. University Departments of Economics: A frontier analysis: Berghe, et al., 1998 on Bibliometric indicators of university research performance in Flanders; Zhu, et al., 2004 on Highly Cited Research Papers and the Evaluation of a Research University: A case study: Peking University 1974-2003; Van Raan, 2007 on Bibliometric statistical properties of the 100 largest European Research Universities: Prevalent scaling rules in the science system; Aguillo et al., 2009 on Webometric Ranking of World Universities: Introduction, Methodology, and Future Developments; Van Raan, 2010 on The social sciences and the Ranking of Universities; Waast and Rossi, 2010 on Scientific production in Arab countries: A Bibliometric Perspective; Wang, et al., 2011 on Comparison of Universities Scientific Performance using Bibliometric Indicators; Zhen Fu and Shan Ho, 2013 on Comparison of Independent Research of China's top Universities using Bibliometric Indicators; Noruzi and Abdekhoda, 2014 on Scientometric analysis of Iraqi-Kurdistan universities' scientific productivity). Some of the studies emphasize on Indian universities viz. (Jeevan and Gupta, 2002 on A scientometric profile of research output from Indian Institute of Technology, Kharagpur; Kumbar et al., 2008 on Growth and Impact of research output of University of Mysore, 1996-2008; Sagar and Kademani, 2011 on Growth and Impact of S&T in Madhya Pradesh during 2000-2009; Kumbar and Gupta, 2013 on A Comparative study of Mysore University and Karnatak University in S&T: Research output, Citation impact and collaboration during 2002-11; Gupta, et al., 2013 on Contribution and Impact of Indian Agricultural Universities: A Performance: Analyzing using scientometric techniques, 2007-11; Hadagali, 2014 on Publication output of Universities of Karnataka state during 1999-2012; Sheeja and Susan, 2014 on Trends in Research Productivity: An Analysis of the Research Publications of Cochin University of Science and Technology; Sheeja, et al., 2015 on Research Productivity of Universities in Kerala: Growth and Trends). Such studies on universities or group of universities will help the policymakers and science administrators to have better insights in framing science policy and guiding the researchers (Kademani et al., 2013).

2. OBJECTIVES OF THE STUDY

The main objective of the present study is to determine the research productivity of the academic and research community working in Universities with UPE status in India. The specific objectives of the study are to:

- study the year wise distribution of research publications
- study the Subjects covered in the publications
- study the Highly productive authors
- determine the preference of research communication channel among the research Community;
- growth pattern of universities by calculating Relative Growth Rate and Doubling Time for publications

3. METHODOLOGY

The data for this study were collected by searching the Science Citation Index- Expanded (SCI-E) of Web of Science Database which is a very comprehensive and exhaustive database enveloping almost all subjects of Science and Technology, via the address of concerned UPE status accredited universities for the period from 1999-2014. In the present study, the authors have referred UGC official e-portals to identify Universities accredited with UPE status in India. The distribution of publications with respect to journals, the type of co-authorships and the scientific fields are identified. Additional characteristics are also investigated, such as highly cited papers, prolific authors, distribution of papers by discipline, research communication channels, and international collaborators. The Web of Science Affiliation search was used to gather the raw data required to study the scientific productivity of each university (for example, OG=Banaras Hindu Univ and CU=India). Here, OG (Organization Enhanced) search aid is used to retrieve the most comprehensive and accurate results.

4. SCIENTOMETRIC INDICATORS

Some of the Indices used for the study to analyze the collected data, based on SCIE are as follows:

Participative Index (PaI)

Garcia- Garcia et al. (2005) proposed Participative Index to evaluate the performance level of research of an institution; an index called 'Participative Index' (PaI) has been calculated. PaI is the ratio of the number of papers generated in a country or institution and the total number of documents collected in this repertoire. This can be expressed as:

$$PaI = \frac{\text{No. of papers generated in an institution}}{\text{Total number of documents collected in this repertoire}} X100$$

Relative Growth Rate (RGR) and Doubling Time (Dt)

The Relative Growth Rate (RGR) is the increase in number of articles per unit of time. This definition is derived from the definition of relative growth rates in the study of growth analysis of individual plants and effectively applied in the field of Botany (Hunt (1978 and 1982); Poorter and Garnier, 1996; Hoffmann and Poorter, 2002). There exists a direct equivalence between Relative Growth Rate and Doubling Time (Bradford, 1934). If the number of articles of a subject get doubled during a given period then the difference between the logarithms of numbers at the beginning and end of the period must be logarithms of number 2. If natural logarithm is used this difference has a value of 0.693. The mean RGR of articles over the specific period of interval is represented as

$$R_t(P) = \frac{1}{t}[log_e p(t) - log_e p(0)]$$

R_t= Relative Growth Rate of the Articles Over the specific period of Time

$log_e p(t)$=Logarithm of initial number of Articles

$log_e p(0)$=Logarithm of Final number of Articles

Doubling Time (DT) = 0.693/R

5. RESULTS AND DISCUSSIONS

Evaluation in any sphere of activity is always for the betterment by comparing the latest trends with the existing ones. Evaluation of research activity in the university system is not an exception (Kademani and Sagar, 2013).

5.1. Research output of Universities with UPE Status in India

Table 1 shows the number of publications and citations received for UPE status accredited universities in India. A total of 56,178 papers were published by these universities considered for the study (1999 to 2014). The average output of 15 Universities for the study period is 3745 papers. These 15 Universities have received an average of 9.38 citations per paper for a total of 5,27,219 citations. Only five universities, namely Banaras Hindu University, Varanasi, Uttar Pradesh (10,583), Jadavpur University, Kolkata, West Bengal (8,150), University of Calcutta, Kolkata, West Bengal (5,674), University of Madras, Chennai, Tamil Nadu (4,732) and University of Hyderabad, Telangana, Andhra Pradesh (4,674) have higher research output than the average output (3745) of the 15 universities. Similarly, 8 Universities, namely Banaras Hindu University, Varanasi, Uttar Pradesh (9.52), University of Madras, Chennai, Tamil Nadu (9.42), University of Hyderabad, Telangana, Andhra Pradesh (13.38), Jawaharlal Nehru University, New Delhi (10.40), University of Rajasthan, Rajasthan (10.72), Guru Nanak Dev University, Amritsar Punjab (10.45), Karnatak University, Dharwad, Karnataka (11.32) and University of Mumbai, Mumbai, Maharashtra (11.61) have higher average citations per paper than the average impact (9.38) of all the 15 Universities. The average H-index of these 15 Universities is 58. Eight Universities, namely Banaras Hindu University, Uttar Pradesh (H-index, 96), Jadavpur University, Kolkata, West Bengal (H-index, 80), University of Calcutta, Kolkata, West Bengal (H-index, 60), University of Madras, Chennai, Tamil Nadu (H-index, 64), University of Hyderabad, Telangana, Andhra Pradesh (H-index, 86), Jawaharlal Nehru University, New Delhi (H-index, 59), University of Rajasthan, Rajasthan (H-index, 68) and Guru Nanak Dev University, Amritsar, Punjab (H-index, 60) have higher h-index than the average h-index of the 15 Universities. The scientific research productivity of North Eastern Hill University, Meghalaya is below the average in all the aspects.

5.2. Year wise distribution of Publications

The Table 2 highlights the year wise distribution of publications of the Universities accredited with UPE status. It is found that the most productive year in terms of publication count is 2014 with 5686 publications, which is 10.12% of the total publication followed by 5277 publications (that is 9.4 %) published during 2013. About 5031 (8.95%) papers were published in the year 2011, followed by 4879 (8.68%), which were published during 2012. Lowest number of articles, i.e. 1941 (3.45%) were published in the year 2000. Banaras Hindu University (BHU) has contributed 18.84% of PaI and placed first, followed by, Jadavpur University (JU) with 14.51 % of PaI ranked second and PaI of University of

Calcutta (UC) is 10.10%, Participative Index (PaI) shows the performance level of an institution in research. The PaI of North Eastern Hill University (NEHU) is 0.25%, which is lowest among 15 Universities. This may be due to zero or less publications from 1999 to 2010 and less output from 2012 to 2014.

The level of co-efficient of variation in research output is lowest in University of Madras, Tamil Nadu (UMT) i.e. 23.67%. The lowest co-efficient of variation, in case of, University of Madras, Tamil Nadu has shown consistent performance of its faculties throughout the study. The year wise variation of North Eastern Hill University, Shillong, Meghalaya is 156.99%, which is highest in the study period.

Table 1: University with their Publications

Sl. No.	Name of the University	TP	TC	ACPP	h-index
1	Banaras Hindu University, Varanasi, Uttar Pradesh (BHU)	10,583	1,00278	9.52	96
2	Jadavpur University, Kolkata, West Bengal (JU)	8,150	76,037	9.33	80
3	University of Calcutta, Kolkata, West Bengal (UC)	5,674	41,739	7.36	60
4	University of Madras, Chennai, Tamil Nadu (UMT)	4,732	44,587	9.42	64
5	University of Hyderabad, Telangana (UH)	4,674	62,541	13.38	86
6	Jawaharlal Nehru University, New Delhi (JNU)	3,291	34,241	10.40	59
7	University of Mysore, Mysore, Karnataka (UMK)	3,127	17,632	5.62	45
8	University of Rajasthan, Rajasthan (UR)	3,048	32,669	10.72	68
9	Guru Nanak Dev University, Amritsar, Punjab (GNDU)	2,882	30,107	10.45	60
10	Osmania University, Hyderabad, Telangana (OU)	2,672	18,182	6.80	49
11	Madurai Kamaraj University, Tamil Nadu (MKU)	2,281	19,362	8.49	48
12	Savitribai Phule Pune University, Pune, Maharashtra (UP)	2,120	17,673	8.34	50
13	Karnatak University, Dharwad, Karnataka (KU)	1,842	20,844	11.32	54
14	University of Mumbai, Mumbai, Maharashtra (UMM)	964	11,191	11.61	47
15	North Eastern Hill University, Shillong, Meghalaya (NEHU)	138	199	1.44	6
		56,178	5,27,219	9.38	

*TP=Total Publications *TC=Total Citations *ACP= Average Citations Per publication*

Table 2: Publication Portraits along with the Years

Sl. No	Name of University	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total	PaI %	SD	Mean	CV
1	BHU	406	388	358	322	364	363	389	480	638	784	869	921	1,069	1,004	1,105	1,123	10583	18.84	311.05	661.44	47.03
2	JU	229	243	273	253	336	375	406	453	500	600	697	657	720	745	798	865	8150	14.51	217.27	509.38	42.65
3	UC	176	169	168	197	204	232	229	266	320	338	433	433	547	572	661	729	5674	10.10	186.09	354.63	52.48
4	UMT	245	179	199	203	271	247	330	416	369	349	385	289	350	276	294	330	4732	8.42	70.01	295.75	23.67
5	UH	157	179	171	184	179	200	250	274	284	265	285	376	409	471	484	506	4674	8.32	120.25	292.13	41.16
6	JNU	119	124	152	140	147	160	191	161	175	224	224	218	264	317	300	375	3291	5.86	74.94	205.69	36.44
7	UMK	107	76	111	149	109	154	198	260	303	192	259	280	298	194	211	226	3127	5.57	72.67	195.44	37.18
8	UR	102	106	122	152	219	179	159	224	254	225	227	271	252	202	200	154	3048	5.43	53.28	190.50	27.97
9	GNDU	63	100	93	127	116	137	148	178	179	211	234	229	224	232	296	315	2882	5.13	73.05	180.13	40.55
10	OS	129	140	106	116	135	113	138	153	126	157	220	195	221	226	219	278	2672	4.76	51.81	167.00	31.03
11	MKU	113	72	107	117	126	114	121	121	145	145	130	126	205	197	202	240	2281	4.06	44.81	142.56	31.43
12	UP	41	32	36	40	37	48	56	92	97	128	130	229	281	283	289	301	2120	3.77	105.92	132.50	79.94
13	KU	68	66	68	93	98	110	109	171	152	131	149	151	142	112	105	117	1842	3.28	32.36	115.13	28.11
14	UMM	85	67	68	76	32	48	48	63	58	82	78	57	47	45	49	61	964	1.72	15.08	60.25	25.03
15	NEHU				01		01			01				02	03	64	66	138	0.25	30.95	19.71	156.99
	Total	2040	1941	2032	2170	2373	2481	2772	3312	3601	3831	4320	4432	5031	4879	5277	5686	56178	100	1296.2	3511.1	36.92

Research publications published in various subject fields have been reported in Figure 1, which shows the subject wise dispersion of published papers in Universities with UPE status in India. The figure 1 indicates that Chemistry, Physics, Material Science, Engineering, Biochemistry, Molecular Biology and Pharmacology Pharmacy dominated the areas of research contributions by the academicians of the universities. It indicates that research output in Indian UPE status accredited Universities is oriented towards Physical sciences compared to Life sciences and Formal sciences.

5.3. Relative Growth Rate and Doubling Time of Publications

Table 3: Relative Growth Rate (RGR) and Doubling Time (Dt) of articles

Year	No. of articles	Cumulative no. of articles	Loge 1p	Loge 2p	R (P)	Mean R (P)	Dt.	Mean Dt.
1999	2040	2040		7.62				
2000	1941	3981	7.62	8.29	0.67		1.03	
2001	2032	6013	8.29	8.70	0.41		1.69	
2002	2170	8183	8.70	9.01	0.31		2.24	
2003	2373	10556	9.01	9.27	0.26		2.67	
2004	2481	13037	9.27	9.48	0.21		3.30	
2005	2772	15809	9.48	9.67	0.19		3.65	
2006	3312	19121	9.67	9.86	0.19	0.22	3.65	4.07
2007	3601	22722	9.86	10.03	0.17		4.08	
2008	3831	26553	10.03	10.19	0.16		4.33	
2009	4320	30873	10.19	10.34	0.15		4.62	
2010	4432	35305	10.34	10.47	0.13		5.33	
2011	5031	40336	10.47	10.61	0.14		4.95	
2012	4879	45215	10.61	10.72	0.11		6.30	
2013	5277	50492	10.72	10.83	0.11		6.30	
2014	5686	56178	10.83	10.93	0.1		6.93	

It is observed from Table 3 that RGR has been decreasing from 0.67 (1999) to 0.1 (2014). On the other hand, the doubling time (Dt.) has shown an increasing trend. The data reveals that Doubling time has increased from 1.03 (1999) to 6.93 (2014).

5.4. Top Twenty Journals Preferred

Table 4 presents a list of journals used by the faculty members of the Universities with UPE status in India. Among the various scientific communication journals, the top 20 journals in which 16 percent of the papers have been appeared are shown in Table 4. It is found that the *Acta Crystallographica Section E-structure Reports Online* received (USA) the highest number of publications i.e. 1,353 and 2,815 citations, followed by *Current Science* (India) with 930 publications and 5,122 citations, *Tetrahedron Letters* (England) with 614 publications and 8,696 citations, *Journal of the Indian Chemical Society* (India) with 538 publications and 1,089 citations, *Polyhedron* (England) with 497 publications and 6,610 citations ranked third to fifth respectively. Of the total 56,178 papers, 8,835 (16%) publications appeared in top 20 journals. It is noticed from the table 4 that *Tetrahedron Letters* (England) has received highest number of citations 8,696 among the list; this retrieves the quality of the journal. Out of the top 20 journals, seven journals are from India, six journals are from USA, and five journals are from England and two are from Switzerland

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Table 4: Preferred Journals for Publication

Name of the Journal	Country	TP	(%)	TC	Impact Factor
Acta Crystallographica E-structure Reports Online	USA	1,353	2.41	2,815	0.347

Current Science	India	930	1.66	5,122	0.833
Tetrahedron Letters	England	614	1.09	8,696	2.391
Journal of the Indian Chemical Society	India	538	0.96	1,089	0.251
Polyhedron	England	497	0.88	6,610	2.047
Indian journal of Chemistry Section B Organic Chemistry Including Medicinal Chemistry	India	423	0.75	1,671	0.489
Journal of Applied Polymer Science	USA	396	0.70	4,111	1.64
Indian Journal of Chemistry Section A Organic Bio-inorganic Physical Theoretical Analytical Chemistry	India	375	0.67	1,693	0.628
Spectro chemical Acta part- A Molecular and Bio-molecular Spectroscopy	England	367	0.65	3,011	2.129
Journal of the Geological Society of India	India	343	0.61	854	0.513
Plos One	USA	341	0.61	1,679	3.534
Synthetic communications	USA	332	0.59	2,050	0.984
RSC Advances	England	331	0.59	977	3.708
Asian Journal of Chemistry	India	323	0.57	428	0.355
Pramana Journal of Physics	India	306	0.54	1,003	0.72
Journal of Applied Physics	USA	293	0.52	3,587	2.185
Tetrahedron	England	289	0.51	5,184	2.817
Physical Review E	USA	271	0.48	2,848	2.326
Inorganica Chemica Acta	Switzerland	263	0.47	2,822	2.041
Journal of Alloys and compounds	Switzerland	250	0.45	2,270	2.73
Total		8,835	16		

5.5. International Collaboration

Research collaboration and co-authorship is an increasing phenomenon in research and development (R&D) (Noruzi and Abdekhoda, 2013). The Table 5 presents the distribution of international collaboration; the 15 universities together have published 22,998 international collaborative papers, constituting 40.93% of share out of the total output of these universities. The 15 universities with UPE status in India together have collaborated with 139 countries of the world during 1999-2014. Among these collaborative countries, 42 countries have published more than 100 collaborative papers. The top five countries with which largest number and share of papers were published are United States (3639), followed by Germany (1956), Japan (1240), England (1229) and France (1083). Among the most productive top 10 foreign organizations collaborating with Indian UPE status universities during 1999-2014 is from, The Centre National de la Recherche Scientifique (National Center for Scientific Research), France (717), followed by University of California, USA (553), United States Department of Energy (DOE), USA (507), Joint Institute for Nuclear Research, Russia (415) and (412) by Universidade de Sao Paulo, Brazil and so on (Table 6) ranked first to fifth respectively

.

Table 5: Collaboration with other Countries

Country	**TP**	**%**	**Country**	**TP**	**%**	**Country**	**TP**	**%**
USA	3639	6.07%	Poland	469	0.78%	Denmark	202	0.34%
Germany	1956	3.26%	Czech Republic	433	0.72%	Turkey	192	0.32%
Japan	1240	2.07%	Netherlands	426	0.71%	Norway	183	0.31%
England	1229	2.05%	Malaysia	401	0.67%	Greece	172	0.29%
France	1083	1.81%	Switzerland	389	0.65%	Singapore	171	0.29%
South Korea	1020	1.70%	South Africa	335	0.56%	Romania	162	0.27%
Peoples R China	773	1.29%	Australia	324	0.54%	Iran	161	0.27%
Italy	641	1.07%	Hungary	313	0.52%	Nepal	150	0.25%
Spain	619	1.03%	Croatia	268	0.45%	Portugal	145	0.24%

Russia	560	0.93%	Israel	268	0.45%	Saudi Arabia	144	0.24%
Brazil	557	0.93%	Belgium	260	0.43%	Australia	127	0.21%
Canada	519	0.87%	Mexico	243	0.41%	Slovakia	116	0.19%
Taiwan	512	0.85%	Finland	223	0.37%	Ukraine	115	0.19%
Sweden	504	0.84%	Scotland	219	0.37%	Pakistan	112	0.19%

Table 6: Most productive Foreign Organizations Collaborating with Indian UPE status Universities

Sl. No	Name of the Foreign Organization	Country	No. of papers
1	The Centre National de la Recherche Scientifique (National Center for Scientific Research)	France	717
2	University of California	USA	553
3	United States Department of Energy (DOE)	USA	507
4	Joint Institute for Nuclear Research	Russia	415
5	Universidade de Sao Paulo	Brazil	412
6	Institute of High Energy Physics – IHEP	Russia	374
7	Czech Academy of Sciences	Prague	351
8	Goethe University Frankfurt	Germany	331
9	Max Planck Institute of Physics & Astrophysics	Germany	322
10	Howard University	USA	318

5.6. Prolific Authors (Top 20)

The most productive authors of Universities with UPE status in India are listed in Table 7. It is worth to note that the first 3 authors are affiliated to Banaras Hindu University, Varanasi. Kumar, Ashok top the list by contributing 835 papers, followed by Kumar, Sanjay and Singh, Sanjay contributing 810 papers and 794 papers respectively. Chattopadhyay, S from University of Rajasthan, Rajasthan stand first in terms of h-index 61, followed by Gupta, Abhishek from Banaras Hindu University, Varanasi, Uttar Pradesh with h-index 58 and Singh, Vivek from Banaras Hindu University, Varanasi with h-index 56 ranked second and third respectively. It is observed from the table 7 that authors of Banaras Hindu University are more prolific in research activity, occupying almost 45% of the total contribution. The cumulative research output of these most productive authors during 1999-2014 varies from 376 to 835 papers, with an average of 523 papers per author. Similarly, the average citation per paper scored by these most productive top 20 authors vary from 2.92 to 35.34, with an average impact of 13.75 per author. A list of top 20 productive authors along with their contributions and citations received is presented in table 7.

Table 7: List of Prolific Authors

Sl. No.	Author	Institution	State	TP	TC	ACPP	h-index
1	Kumar, Ashok	Banaras Hindu University, Institute of Medical Sciences, Dept. of Pediatrics, Varanasi, Uttar Pradesh.	Uttar Pradesh	835	14,113	16.90	52
2	Kumar, Sanjay	Banaras Hindu University, Dept. of Physics, Varanasi, Uttar Pradesh.	Uttar Pradesh	810	6,979	8.62	33
3	Singh, Sanjay	Banaras Hindu University, Institute of Technology, Dept. of Pharmaceutical Chemistry, Varanasi, Uttar Pradesh.	Uttar Pradesh	794	6,276	7.90	34
4	Ghosh, Somnath	Jadavpur University, Dept. of Chemistry, Kolkata, West Bengal.	West Bengal	698	6,220	8.91	34
5	Das, Swagatam	Jadavpur University, Dept. of Electronic & Telecommunication, Kolkata, West Bengal.	West Bengal	670	13,105	19.56	50

6	Singh, Ashish. Kumar	Banaras Hindu University, Institute of Technology, Dept. of Applied Chemistry, Varanasi, Uttar Pradesh.	Uttar Pradesh	571	5,024	8.80	34
7	Singh, Adhar	Banaras Hindu University, Dept. of Chemistry, Varanasi, Uttar Pradesh.	Uttar Pradesh	521	3,926	7.54	28
8	Yathirajan, HS	University of Mysore, Dept. of Studies Chemistry, Mysore, Karnataka.	Karnataka	505	1,477	2.92	14
9	Chattopadhyay, S	University of Rajasthan, Rajasthan.	Rajasthan	489	15954	32.63	61
10	Singh, Ravichand	Guru Nanak Dev University, Dept.of Physics, Amritsar, Punjab.	Uttar Pradesh	478	6869	14.37	38
11	Kumar, Rajesh	Banaras Hindu University, Dept. of Chemistry, Varanasi, Uttar Pradesh.	Uttar Pradesh	477	4413	9.25	28
12	Singh, Prabhpreet	Guru Nanak Dev University, Dept. of Chemistry, Amritsar, Punjab.	Punjab	442	3598	8.14	26
13	Bhattacharya, S	Jadavpur University, Department of Chemistry, Inorganic Chemistry Sect, Kolkata, West Bengal.	West Bengal	422	4399	10.42	29
14	Chakraborty, Subenoy	Jadavpur University, Department of Mathematics, Inorganic Chemistry Sect, Kolkata, West Bengal.	West Bengal	410	3044	7.42	26
15	Kumar, Manoj	Guru Nanak Dev University, Dept. of Chemistry, Amritsar, Punjab.	Punjab	407	4647	11.42	35
16	Singh, Vivek	Banaras Hindu University, Dept. of Physics, Varanasi, Uttar Pradesh.	Uttar Pradesh	398	13140	33.02	56
17	Gupta, Abhishek	Banaras Hindu University, Dept. of Physics, Varanasi, Uttar Pradesh.	Rajasthan	393	13888	35.34	58
18	Ghosh, Ashutosh	University of Calcutta, Dept. of Chemistry, Kolkata, West Bengal.	West Bengal	388	4135	10.66	34
19	Singh, Narpinder	Guru Nanak Dev University, Dept. of Food Science and Technology, Amritsar, Punjab.	Punjab	377	4802	12.74	36
20	Singh, Kanwarjit	Guru Nanak Dev University, Dept. of Physics, Amritsar, Punjab.	Punjab	376	3243	8.63	26

5.7. Highly cited papers

The highly cited papers are important to the reputation of a university (Zhu et al., 2004). Table 8 depicts highly cited papers contributed by Universities with UPE Status in India. The table 8 shows that the majority of highly cited papers contributed by authors were in the field of chemistry. It is interesting that all the highly cited papers were published in the journals. The table 8 presents the papers that received 500 or more citations. The single authored paper *Cosmological constant - the weight of the vacuum* received highest citations, i.e. 1540. Six papers were cited 8,347 times, representing 57 per cent of all the citations (8,347of 14,592), with an average of 973 citations per paper. This indicates a concentration effect, whereby a relatively small number of papers earn most of the citations and research impact generated by the academicians of the universities with UPE status in India. Numerous studies found that highly cited papers have a major impact on research performance (e.g. Garfield, 1998; Kim and Kim, 2000; Martin et al., 1987; Nederhof and Noyons, 1999).

Table. 8 Highly cited papers

Title	**Authors**	**Year**	**Source**	**No. of citations**
Cosmological constant - the weight of the vacuum	Padmanabhan, T	2003	*Physics Reports-Review Section Of Physics Letters* Vol: 380 No: 5-6	1540

			Pp: 235-320	
Experimental and theoretical challenges in the search for the quark-gluon plasma: The STAR Collaboration's critical assessment of the evidence from RHIC collisions	Adams, J., Aggarwal, MM., Ahammed, Z ., Amonett, J., Anderson, BD., Arkhipkin, D ., Averichev, GS., Badyal, SK ., Bai, Y. and Balewski,	2005	*Nuclear Physics A* Vol: 757 No: 1-2 Pp: 102-183	1526
Formation of dense partonic matter in relativistic nucleus-nucleus collisions at RHIC: Experimental evaluation by the PHENIX Collaboration	Adcox, K.,Adler, SS., Afanasiev, S., Aidala, C., Ajitanand, NN., Akiba, Y ., Al-Jamel, A., Alexander, J., Amirikas, R. andAoki,	2005	*Nuclear Physics A* Vol: 757 No: 1-2 Vol: 757 No: 1-2 Pp: 184-283	1441
Recent advances in the Baylis-Hillman reaction and applications	Basavaiah, D., Rao, AJ. andSatyanarayana, T.	2003	*Chemical Reviews* Vol: 103 No: 3 Pp: 811-89	1304
Hydrogen bridges in crystal engineering: Interactions without borders	Desiraju, GR.	2002	*Accounts Of Chemical Research* Vol: 35 No: 7 Pp: 565-573	1284
Biodegradable polymeric nanoparticles as drug delivery devices	Soppimath, KS., Aminabhavi, TM., Kulkarni, AR. and Rudzinski, WE.	2001	*Journal Of Controlled Release* Vol: 70 No: 1-2 Pp: 1-20	1252
Guidelines for the use and interpretation of assays for monitoring autophagy	Klionsky, DJ., Abdalla, FC., Abeliovich, H., Abraham, RT., Acevedo-Arozena, A., Adeli, K., Agholme, L., Agnello, M., Agostinis, P. and Aguirre-Ghiso, JA.	2012	*Autophagy* Vol: 8 No: 4 Pp: 445-544	825
Emergence of a new antibiotic resistance mechanism in India, Pakistan, and the UK: a molecular, biological, and epidemiological study	Kumarasamy, KK.,Toleman, MA., Walsh, TR., Bagaria, J., Butt, F., Balakrishnan, R ., Chaudhary, U., Doumith, M., Giske, CG. andIrfan, S.	2010	*Lancet Infectious Diseases* Vol: 10 No: 9 Pp: 597-602	803
Recent advances on chitosan-based micro- and nanoparticles in drug delivery	Agnihotri, SA.,Mallikarjuna, NN. andAminabhavi, TM.	2004	*Journal Of Controlled Release* Vol: 100 No: 1 Pp: 5-28	796
The causes of land-use and land-cover change: moving beyond the myths	Lambin, EF., Turner, BL., Geist, HJ., Agbola, SB., Angelsen, A., Bruce, JW., Coomes, OT., Dirzo, R., Fischer, G. and Folke, C.	2001	*Global Environmental Change-Human and Policy Dimensions* Vol: 11 No: 4 Pp: 261-269	750
Elliptic flow of identified hadrons in Au+Au collisions at roots(NN)=200 GeV	Adler, SS., Afanasiev, S., Aidala, C., Ajitanand, NN., Akiba, Y., Alexander, J., Amirikas, R., Aphecetche, L., Aronson, SH. andAverbeck, R.	2003	*Physical Review Letters* Vol: 91 No: 18	725

Suppression of hadrons with large transverse momentum in central Au+Au collisions at root s(NN)=130 GeV	Adcox, K., Adler, SS., Ajitanand, NN., Akiba, Y ., Alexander, J ., Aphecetche, L ., Arai, Y ., Aronson, SH., Averbeck, R . andAwes, TC.	2002	*Physical Review Letters* Vol: 88 No: 2	648
Crystal engineering: A holistic view	Desiraju, GR.	2007	*AngewandteChemie-International Edition* Vol: 46 No: 44 Pp: 8342-8356	616
Drug resistance in leishmaniasis	Croft, SL ., Sundar, S . andFairlamb, AH.	2006	*Clinical Microbiology Reviews* Vol: 19 No: 1 Pp: 111-+	551
Identified charged particle spectra and yields in Au plus Au collisions at root (SNN)=200 Ge V	Adler, SS.,Afanasiev, S., Aidala, C., Ajitanand, NN., Akiba, Y., Alexander, J., Amirikas, R., Aphecetche, L., Aronson, SH. and Averbeck, R.	2004	*Physical Review* C Vol: 69 No: 3	531

CONCLUSION

The present study gives a scientometric description of the research performance of universities with UPE (Universities with Potential for Excellence) status in India. The Scientific productivity of universities can be measured by the counting of research publications in the journals and proceedings, and the number of citations received in those publications. Although the leading faculty members of universities contribute much of their work in international journals covered by Web of science, a significant number of publications of universities appear in national and other international journals, which are not covered by the Web of science. Pursuing international perception and visibility, the faculty members of the universities with UPE status publish many of their papers in international journals, including *Acta Crystallographica E-structure Reports Online, Current Science, Tetrahedron Letters, Journal of the Indian Chemical Society* and *Polyhedron.* It is evident from the study that international research collaboration generally leads to publication in conventional journals rather than in national journals. This study reveals that 22,998 of 56,178 (40.93 per cent) publications have international collaborations. It is interesting that all the highly cited papers were published in journals. In other words, this study has found that the papers published in conference proceedings are not highly cited. This study also discovered that the Six papers were cited 8,347 times, representing 57 per cent of all the citations (8,347 of 14,592), with an average of 973 citations per paper. This indicates concentration effect, whereby a relatively small number of papers earn most of the citations and research impact generated by the academicians of the universities with UPE status in India.

The authors opine that the universities with UPE status in India should pay special attention to develop a suitable research policy. As the UPE status accredited universities in India receive funds from UGC (University Grants Commission), universities should utilize funds for improving research facilities and availing equipment's for scientific productivity. To increase citations and visibility of publications from universities and to improve their research impact, universities should establish repositories at the regional or institutional level. The main purpose of digital repositories is to increase the availability, accessibility and visibility of knowledge that has been produced by academic staff in the host university (Noruzi and Abdekhoda, 2013). Open access repositories can significantly increase research and citation impact of publications contributed by the faculty members of the universities.

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