Leading Indian higher education institutions and the Leiden 2014 and SIR 2013 rankings

The Centre for Science and Technology Studies (CWTS) Leiden 2014 rankings (http://www.leidenranking.com/) based on Thomson Reuters' *Web of Science* (*WoS*) data covering the period 2009–2012 and the SCImago Institutions Rankings (SIR) World Reports (http://www.scimagoir.com/) based on *SCOPUS* data covering 2007–2011 period are now available.

The CWTS Leiden University's ranking for 2014 now reports the scientific performance of 750 major universities worldwide instead of 500 earlier[1]. The equivalent of more than 1000 papers (articles and reviews) in international journals is required for a university to be considered. As a result, the number of higher education institutions (HEIs)

appearing from India has increased from 4 to 16. This will mean that 2.1% of the top HEIs in the world is based in India, and is roughly the same as the country's share of the nominal world GDP (http://www.tradingeconomics.com/india/gdp).

Over the years CWTS has found that the proportion of top 10% publications ($PP_{top\ 10\%}$) is arguably the most robust, size-independent proxy or indicator for quality of publications. This is the proportion of the publications of a university that, compared with other similar publications, belongs to the top 10% most frequently cited. Publications are considered similar if they have been published in the same field and the same publication year and if they have the same document type. It therefore has a

normalizing effect across fields, publication year and document type. The ratio $q = PP_{top\ 10\%}/10$, allows one to fractionalize this proxy, such that a value of 1.00 is the expected global norm. The Leiden rankings also give the option of bibliometric fractionalizing (i.e. publications co-authored by multiple institutions are fractionally attributed) and this allows us to see the difference that fractionalization makes.

The SIR World Reports quantify the research performance of leading research institutions in the world using citation and publication data from *SCOPUS* (www.scopus.com). The performance of leading Indian HEIs from the 2013 report (covering the period 2007–2011) is the nearest that can be directly compared

Table 1. Comparison of the performance of top Indian higher education institutions using fractionalized data from Leiden 2014 with those of SIR 2013 data

Higher educational institution	Leiden 2014: *WoS* 2009–2012				SCImago 2013: *SCOPUS* 2007–2011			
	P	q	q^2	X	P	q	q^2	X
Indian Institute of Science	3631	0.66	0.4356	1581.7	9111	1.23	1.5055	13716.9
Indian Institute of Technology, Kharagpur	2933	0.65	0.4225	1239.2	7665	1.18	1.3877	10636.6
Indian Institute of Technology, Delhi	1958	0.76	0.5776	1130.9	6629	1.25	1.5500	10275.1
Indian Institute of Technology, Bombay	1968	0.61	0.3721	732.3	5822	1.20	1.4376	8369.7
Indian Institute of Technology, Madras	2268	0.64	0.4096	929.0	6252	1.11	1.2410	7758.7
Indian Institute of Technology, Roorkee	1446	0.87	0.7569	1094.5	4277	1.30	1.6978	7261.5
Panjab University	1055	0.68	0.4624	487.8	2895	1.47	2.1492	6221.8
Indian Institute of Technology, Kanpur	1708	0.57	0.3249	554.9	5075	1.09	1.1816	5996.5
University of Delhi	1847	0.60	0.3600	664.9	6488	0.95	0.9044	5867.8
Tata Institute of Fundamental Research					3490	1.29	1.6564	5780.7
Banaras Hindu University	2259	0.68	0.4624	1044.6	5336	0.99	0.9801	5229.8
Jadavpur University	1473	0.59	0.3481	512.8	5201	1.00	0.9900	5149.1
Indian Institute of Technology, Guwahati	1173	0.74	0.5476	642.3	2626	1.17	1.3666	3588.6
Shivaji University					1121	1.66	2.7423	3074.2
Jawaharlal Nehru Centre for Advanced Scientific Research					1325	1.52	2.3043	3053.2
Aligarh Muslim University	1113	0.59	0.3481	387.4	3124	0.90	0.8100	2530.4
Annamalai University					3152	0.89	0.7885	2485.5
Anna University	1012	0.67	0.4489	454.3	4832	0.71	0.5084	2456.4
All India Institute of Medical Sciences	1956	0.35	0.1225	239.6	5992	0.60	0.3636	2178.7
University of Hyderabad					2223	0.91	0.8263	1836.8
National Institute of Pharmaceutical Education and Research					796	1.44	2.0678	1646.0
University of Calcutta					2869	0.75	0.5610	1609.5
University of Pune					1870	0.90	0.8082	1511.3
Jawaharlal Nehru University					1766	0.77	0.5898	1041.6
Postgraduate Institute of Medical Education and Research	1082	0.33	0.1089	117.8	3700	0.38	0.1421	525.9

P is the number of papers published during the periods shown; *q* is the quality proxy based on PP which is the proportion of the publications belonging to the top 10% most frequently cited according to the Leiden ranking, and ER which is the proportion of an institution's scientific output that is included into the set formed by 10% of the most cited papers in their respective scientific fields from the SCImago ranking; *X* is the second-order indicator of performance in each case.

Table 2. Comparison of the performance of top Indian higher education institutions using unfractionalized data from Leiden 2014 with those of SIR 2013 data

Higher educational institution	Leiden 2014: *WoS* 2009–2012				SCImago 2013: *SCOPUS* 2007–2011			
	P	q	q^2	X	P	q	q^2	X
Indian Institute of Science	5361	0.73	0.5329	2856.9	9111	1.23	1.5055	13716.9
Indian Institute of Technology, Kharagpur	4108	0.64	0.4096	1682.6	7665	1.18	1.3877	10636.6
Indian Institute of Technology, Delhi	2919	0.76	0.5776	1686.0	6629	1.25	1.5500	10275.1
Indian Institute of Technology, Bombay	2987	0.67	0.4489	1340.9	5822	1.20	1.4376	8369.7
Indian Institute of Technology, Madras	3163	0.66	0.4356	1377.8	6252	1.11	1.2410	7758.7
Indian Institute of Technology, Roorkee	2080	0.87	0.7569	1574.4	4277	1.30	1.6978	7261.5
Panjab University	2101	0.99	0.9801	2059.2	2895	1.47	2.1492	6221.8
Indian Institute of Technology, Kanpur	2390	0.63	0.3969	948.6	5075	1.09	1.1816	5996.5
University of Delhi	3333	0.75	0.5625	1874.8	6488	0.95	0.9044	5867.8
Tata Institute of Fundamental Research					3490	1.29	1.6564	5780.7
Banaras Hindu University	3121	0.74	0.5476	1709.1	5336	0.99	0.9801	5229.8
Jadavpur University	2437	0.58	0.3364	819.8	5201	1.00	0.9900	5149.1
Indian Institute of Technology, Guwahati	1599	0.74	0.5476	875.6	2626	1.17	1.3666	3588.6
Shivaji University					1121	1.66	2.7423	3074.2
Jawaharlal Nehru Centre for Advanced Scientific Research					1325	1.52	2.3043	3053.2
Aligarh Muslim University	1529	0.68	0.4624	707.0	3124	0.90	0.8100	2530.4
Annamalai University					3152	0.89	0.7885	2485.5
Anna University	1647	0.68	0.4624	761.6	4832	0.71	0.5084	2456.4
All India Institute of Medical Sciences	2742	0.57	0.3249	890.9	5992	0.60	0.3636	2178.7
University of Hyderabad					2223	0.91	0.8263	1836.8
National Institute of Pharmaceutical Education and Research					796	1.44	2.0678	1646.0
University of Calcutta					2869	0.75	0.5610	1609.5
University of Pune					1870	0.90	0.8082	1511.3
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P, q and X are same as in Table 1.

with the Leiden ranking. *SCOPUS* is a more comprehensive database than the *WoS* and contains more records. Although eight bibliometric indicators are available in the SIR datasets, we shall focus only on the quantity proxy, the O (or output) indicator which is a measure of the quantity or size of the publication output of an institution and one quality proxy, ER (or excellence rate), which indicates the percentage of an institution's scientific output that is included into the set formed by the 10% of the most cited papers in their respective scientific fields. Again, the ratio $q = \text{ER}/10$, allows one to fractionalize this proxy, such that a value of 1.00 is the expected global norm derived from the *SCOPUS* database.

In both the Leiden and SCImago rankings, if we consider q to be the quality indicator, and Q to be the zeroth-order indicator of performance, then it is possible to combine this to obtain a first-order indicator of performance qQ and a second order indicator[2] of performance $X = q^2Q$. In this manner, the quantity term (Q) and the quality term (q) in the

SIR and Leiden datasets can be integrated into a single composite term, that serves as the best size-dependent proxy for total performance in the research context.

We next examine the 16 Indian HEIs from the Leiden ranking and the 25 leading HEIs from India in the SIR 2013 list. Table 1 is a league table using the X indicator based on the quantity and quality proxies with fractionalized data from Leiden 2014 and unfractionalized data from SIR 2013 for these institutions. Table 2 is based on unfractionalized data from Leiden 2014 and this is again compared with the data from SIR 2013. In both cases the quality proxy has been normalized in the sense that it corrects for differences in citation practices between scientific fields.

We see from Table 2 that if we rely on unfractionalized data and the size-independent indicator q as the proxy for performance (recommended by CWTS Leiden), then Panjab University ranks first in India according to Leiden 2014. After fractionalization, it is IIT Roorkee that takes the top spot. If X is considered

to be the best size-dependent proxy for performance, the Indian Institute of Science, Bangalore occupies top spot in both Leiden and SIR lists.

We can also note from the values of q that the *WoS* bibliometric data show all leading HEIs in India performing research at lower than the global norm, whereas the *SCOPUS* bibliometric data are more generous with many of the HEIs in the SIR list showing above-average performance. It is also evident that the two leading medical research institutions in both lists perform far below expected global norms.

1. Prathap, G., *Curr. Sci.*, 2013, **104**, 407–408.
2. Prathap, G., *Curr. Sci.*, 2010, **98**, 995–996.

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