An IISc–Tsinghua head-to-head evaluation of research using CWTS Leiden Ranking 2017 data

There are now 19 different organizations running global university rankings[1]. In almost every one of them, since they first appeared (ARWU, the Academic Ranking of World Universities, also known as the 'Shanghai Ranking'), the Indian Institute of Science (IISc) is ranked as the best from India and Tsinghua University (TU) is the best from China. This year[1], IISc has moved down 38 places in the latest Quacquarelli Symonds (QS) ranking[1] (from 152 in 2017 to 190 in 2018) and yielded the first two positions in India to IIT Delhi (moving up 13 places from 185 to 172) and IIT Bombay (moving up 40 places from 215 to 175). Tsinghua has actually dropped one place globally (from 24 to 25) but retains its premier position in China.

We have shown earlier that the research performance of the IITs in engineering has not kept pace with similar institutions from the more developed countries in the world[2,3]. Two premier Singapore institutions, namely the National University of Singapore (NUS) and the Nanyang Technological University (NTU) outperform all the seven premier IITs taken together. A cluster comprising IISc and the seven IITs was handsomely outperformed by Singapore represented by NUS and NTU.

The Centre for Science and Technology Studies (CWTS) Leiden 2017 rankings (http://www.leidenranking.com/) are based exclusively on bibliometric data from the Web of Science database of Clarivate Analytics, USA. Over 902 universities from 54 different countries worldwide with more than 1000 fractionally counted Web of Science indexed core publications in the period 2012–2015 are included in the ranking. CWTS has established 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. It therefore has a normalizing effect across fields, publication year and document type. The ratio $q = PP$ (top 10%)/10, allows one to normalize this proxy, such that a value of 1.00 is the expected global norm. If we consider q to be the quality indicator, and P to be the zeroth-order indicator of performance, then it is possible to plot this as a two-dimensional graph and tracking this longitudinally over time one can show the research performance trajectory that each institution

Table 1. The quantity–quality indicators of performance over seven consecutive years of assessment based on four-year sliding windows

Year of assessment	2011	2012	2013	2014	2015	2016	2017
Sliding window	2006–09	2007–10	2008–11	2009–12	2010–13	2011–14	2012–15
Field				P			
TU – All sciences	9254	9469	10,105	10,777	11,898	13,343	14,930
TU – Biomedical and health sciences	744	778	837	924	995	1098	1251
TU – Life and earth sciences	648	741	838	950	1038	1164	1356
TU – Mathematics and computer science	1869	1811	1945	2083	2359	2633	2960
TU – Physical sciences and engineering	5854	5956	6239	6527	7177	8077	8950
TU – Social sciences and humanities	140	183	246	293	330	370	413
IISc – All sciences	3339	3464	3587	3745	3897	4134	4359
IISc – Biomedical and health sciences	465	479	480	516	548	581	622
IISc – Life and earth sciences	292	312	315	322	356	354	385
IISc – Mathematics and computer science	384	382	403	418	446	493	521
IISc – Physical sciences and engineering	2175	2265	2360	2456	2512	2674	2795
IISc – Social sciences and humanities	23	25	29	33	35	32	35
Field				q			
TU – All sciences	0.92	1.00	1.03	1.05	1.10	1.14	1.18
TU – Biomedical and health sciences	0.52	0.63	0.65	0.80	0.88	0.90	0.95
TU – Life and earth sciences	0.77	1.01	1.20	1.15	1.15	1.24	1.37
TU – Mathematics and computer science	0.84	0.96	0.94	0.93	1.05	1.12	1.24
TU – Physical sciences and engineering	1.01	1.05	1.09	1.11	1.15	1.17	1.18
TU – Social sciences and humanities	0.86	1.21	0.95	0.91	0.88	0.95	1.04
IISc – All sciences	0.80	0.81	0.83	0.75	0.69	0.69	0.66
IISc – Biomedical and health sciences	0.45	0.35	0.28	0.29	0.30	0.30	0.28
IISc – Life and earth sciences	0.57	0.50	0.43	0.54	0.66	0.54	0.66
IISc – Mathematics and computer science	0.87	0.84	0.97	0.80	0.70	0.66	0.59
IISc – Physical sciences and engineering	0.89	0.95	0.98	0.87	0.78	0.81	0.76
IISc – Social sciences and humanities	0.43	0.03	0.11	0.21	0.22	0.25	0.38

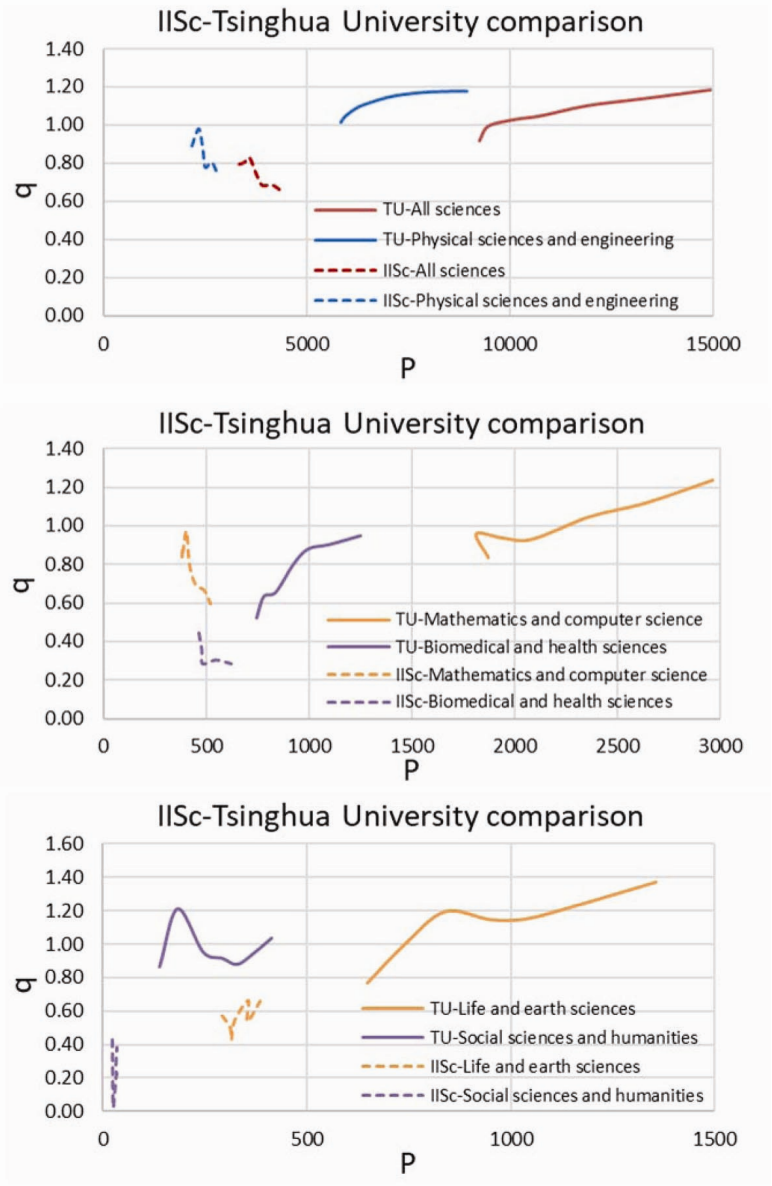

Figure 1. The quantity–quality indicators of performance over seven consecutive years of assessment based on four-year sliding windows.

takes. CWTS Leiden 2017 now has bibliometric data over seven sliding windows from 2006–09 to 2012–15. We can easily compute the performance trajectories to see how IISc and Tsinghua have been performing over this period.

We follow the same methodology that was reported earlier[4]. For each assessment window (say, 2012–15 for the assessment year 2017), the total number of papers or articles counted fractionally, P gives a zeroth-order measure of performance[5]. P can be taken as the indicator or proxy measure for the output size of the unit. The proportion of top 10% publications, PP (top 10%) is taken as a 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. The ratio $q = PP$ (top 10%)/10, is a normalized quality proxy, such that a value of 1.00 is the expected global norm.

Leiden data is available in an aggregated form for all sciences, and separately field-wise in five major categories: Biomedical and health sciences, Life and earth sciences, Mathematics and computer science, Physical sciences and engineering, and Social sciences and humanities. We can now plot q and P in a two-dimensional quality–quantity graph to show the research performance trajectory field-wise that each institution takes over seven sliding windows from 2006–09 to 2012–15 (corresponding to assessment years 2011 to 2017). The performance trajectories show head-to-head how IISc and Tsinghua have been performing over this period for all fields taken together and also by major field aggregations.

Table 1 lists the values of P and q as respective quantity and quality indicators of performance over seven consecutive years of assessment based on four-year sliding windows. In all areas, both institutions show a steady growth in the quantity of output, with Tsinghua growing faster from a much higher base. However the story is different when it comes to the quality attribute: here Tsinghua has been improving steadily while IISc has shown a gradual decline in all areas except Life and earth sciences. Figure 1 captures these trends graphically as we move from the 2006–09 window to the 2012–15 window. It is clear that Tsinghua is not only much bigger than its Indian counterpart, it is also performing at much higher levels of quality and is growing at a much healthier rate.

The Leiden 2017 data have been used to decompose the research performance of the IISc and Tsinghua University into two components – size and quality. Not only does Tsinghua outperform IISc, it is also rising respectably in terms of quality of research while the Indian counterpart is showing a gradual decline.

1. QS World University Rankings, 2018; https://www.topuniversities.com/ (accessed on 9 June 2017).
2. Prathap, G., *Curr. Sci.*, 2013, **105**, 1134–1138.
3. Prathap, G., *Curr. Sci.*, 2017, **112**, 1012–1015.
4. Prathap, G., *Curr. Sci.*, 2014, **106**, 1467–1468.
5. Prathap, G., *Scientometrics*, 2011, **87**(3), 515–524.

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