The research performance of top Indian and Chinese higher education institutions compared

The latest release of the SCImago Institutions Rankings (SIR) World Reports (http://www.scimagolab.com/, http://www.scimagoir.com/) quantifies the research performance of 3042 leading research institutions in the world. Citation and publication data from *Scopus* (www.scopus.com), an Elsevier product, is used. The bibliometric data is presented in the form of six indicators representing categories like scientific impact, thematic specialization, output size and international collaboration networks of the institutions. It covers the period 2005–09 and accounts for nearly 80% of all research (according to the SCOPUS database). The institutions have been chosen on the basis of having published at least 100 scientific documents of any type, that is, articles, reviews, short reviews, letters, conference papers, etc. during 2009 as collected by *Scopus*. Altogether, 111 institutions from India appear in this list, of which 85 belong to the higher education (HE) sector (nearly 77%). For China, 285 institutions are represented, of which 239 are from the HE sector (nearly 84%). These statistics also suggest that the Chinese HE system is nearly three times bigger than the corresponding Indian system.

The SIR approach allows the bibliometric data to be separated into a quantity proxy and various quality proxies. The *O* (or output) indicator is a measure of the quantity or size of the publication output of an institution. Three of the other five indicators used in SIR 2001 are proxies, in various ways, of the quality of output. The NI (or normalized impact) compares the average scientific impact of the institution with the world average (taken as 1). Thus a score of 0.8 implies a 20% below average performance, whereas a score of 1.3 means the institution is cited 30% above average. *Q*1 (or high quality publications) is the ratio of publications that the institution publishes in what the SCImago team takes as the most influential scholarly journals of the world; those ranked in the first quartile (25%) in their categories as ordered by SCImago Journal Rank. Since this is reported as a percentage, the ratio (*Q*1/25) is a crude normalized proxy for quality of publication, with a value of 1 taken as the world average. The third, and probably the best of the three quality proxies, is ER (or excellence rate). This indicates the percentage 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, and serves as a measure of the high-quality output of research institutions. Again, the ratio ER/10 allows one to normalize this proxy so that the world average becomes 1. These three quality proxies can be combined into a single composite one, the *q* proxy, where q^2 is defined as $((NI)^2 + (Q1/25)^2 + (ER/10)^2)/3$. A value of 1 describes the world norm. Thus in this analysis we have simplified the SIR 2011 data to a quantity term (Q = O) and quality term (q). From this, we define that a single composite term, $X = q^2Q$, is one that serves as the best proxy for total performance in the research context. X is a scalar term, which allows it to be added. The 239 Chinese HE institutions have a exergy total of 560,500, for an average X/institution that is 2345.2. Correspondingly, the 85 Indian HE institutions have 184,709 and 2173 respectively. This implies that at this level, the ratio of exergies is 3.03, giving a rough estimate for the ratio of research done by the HE sectors of the two systems. In policy terms, this can be interpreted to mean that to match the Chinese effort in research contributions of the HE sector, India needs to scale up its own HE system by a factor of 3.

Table 1 is a league table using the X indicator based on the quantity and quality proxies used by SCImago. There are no surprises, except that Peking now ranks ahead of Tsinghua when the quality aspect is factored in. Most league tables like ARWU of Shanghai Jiao Tong, etc. tend to rank Tsinghua ahead of Peking as the quantity proxy assumes prominence.

Table 1. League tables of top 20 Chinese and Indian higher education institutions appearing in SIR 2011 according to the exergy indicator

	Chinese HE institution		Indian HE institution	
Rank	Name	*X*	Name	*X*
1	Peking Univ	50,473	IISc	20,683
2	Zhejiang Univ	31,394	IITKgp	11,970
3	Fudan Univ	30,566	IITKnp	9,531
4	Tsinghua Univ	30,551	TIFR	9,292
5	Nanjing Univ	25,572	IITD	8,956
6	Shanghai Jiao Tong Univ	25,115	IITM	8,503
7	Sun Yat-Sen Univ	17,705	IITB	8,447
8	Nankai Univ	12,875	Univ Delhi	6,611
9	Shangdon Univ	12,506	JNCASR	6,354
10	Jilin Univ	12,217	AIIMS	6,348
11	Lanzhou Univ	10,733	IITRoorkee	5,332
12	Sichuan Univ	10,428	BHU	4,915
13	Wuhan Univ	9,562	Panjab Univ	4,607
14	Huazhong UST	9,023	Univ Hyderabad	4,448
15	Harbin Inst Tech	8,883	Jadavpur Univ	4,326
16	Dalian Inst Tech	8,405	PGIMER	3,101
17	Xi'an Jiao Tong Univ	7,573	Univ Madras	2,903
18	Beijing Normal Univ	7,173	Univ Pune	2,835
19	Tongi Univ	6,663	IITGuwahati	2,764
20	China Agri Univ	6,480	JNU	2,724

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