

Rationalization of the S. S. Bhatnagar Prizes scheme using CWTS Leiden 2019 data

The Shanti Swarup Bhatnagar (SSB) Prize for Science and Technology, arguably the most coveted award in science and technology in India, is given annually for outstanding research, in seven broad areas: biology, chemistry, environmental science, engineering, mathematics, medicine and physics. Up to two awards can be made in each area. This means, that mathematics and chemistry share the same number of awards, although there is enough evidence that there is far greater activity in the latter than the former. This was quantitatively established using data from Essential Science Indicators based on aggregated data on research output and impact in specific fields of research¹ – chemistry's share of output was 21.5%, and that of engineering was nearly 20%, and including the share of computer science and space science, this rose to 22.5%. The share of mathematics was a meagre 1.73%. Based on such aggregated output data, it was proposed that two

prizes be continued every year in chemistry, physics and engineering, and only one awarded every year in medicine, biology and materials science respectively¹. The prize in geoscience and environmental science needs to be awarded only once every two years, and the mathematics prize needs to be given only once in five years.

The input side, namely the number of scientists and their activity as accounted for by authorship was not considered earlier¹. The CWTS Leiden Ranking 2019 enriches and curates bibliographic data from the Web of Science (WoS) database of Clarivate Analytics². The latest ranking includes 963 universities from 56 different countries of which 25 are from India². Each university has at least 1000 WoS indexed publications during the period 2014–2017, and only research and review articles published in international scientific journals have been counted. Publication and citation data are made available for each university in the public

domain for five main fields of science: biomedical and health sciences (BMH), life and earth sciences (LES), mathematics and computer science (MCS), physical sciences and engineering (PSE), and social sciences and humanities (SSH). Here we shall restrict attention to the first four fields in which SSB Prizes are awarded and also consider only the 2014–2017 time window.

An interesting innovation in the Leiden Ranking is the indicator providing the total number of authorships (A) of a university. Thus if a publication has five authors, of which three report university X as their affiliation and two report university Y as their affiliation, this yields three authorships for university X and two for university Y . Correspondingly, the paper is counted fractionally, assigning $3/5$ to the first university and $2/5$ to the second. The count of authorships is therefore an indication of the activity in each broad area in the university. Tables

Table 1. Fractional count of authorships during the 2014–2017 window in each of four broad areas for the leading 25 universities and a simple heuristic sharing of 10 awards based on the share of authorships

University	All	BMH	LES	MCS	PSE
Aligarh Muslim University	6,412	1,827	935	383	3,268
All India Institute of Medical Sciences	13,073	12,415	490	19	150
Anna University	7,554	842	1,050	1,313	4,349
Annamalai University	3,857	922	648	96	2,192
Banaras Hindu University	12,758	3,099	2,445	601	6,613
Indian Institute of Science	16,046	2,657	1,722	1,443	10,225
Indian Institute of Technology (Indian School of Mines)	4,628	101	707	868	2,952
Indian Institute of Technology Bombay	13,131	1,044	1,307	1,358	9,421
Indian Institute of Technology Delhi	10,809	963	1,140	1,738	6,969
Indian Institute of Technology Guwahati	7,288	785	876	703	4,924
Indian Institute of Technology Kanpur	8,901	579	589	1,173	6,560
Indian Institute of Technology Kharagpur	14,082	1,470	2,080	1,823	8,708
Indian Institute of Technology Madras	11,135	998	770	1,147	8,221
Indian Institute of Technology Roorkee	8,828	601	1,595	1,234	5,397
Institute of Chemical Technology	3,695	495	469	5	2,728
Jadavpur University	8,795	1,084	875	1,068	5,768
Manipal Academy of Higher Education	5,267	3,495	486	101	1,184
National Institute of Technology Rourkela	4,538	601	461	808	2,668
Panjab University	11,499	1,846	823	312	8,518
Postgraduate Institute of Medical Education and Research	5,961	5,518	386	15	43
Thapar Institute of Engineering and Technology	3,369	204	258	821	2,086
University of Calcutta	6,659	1,643	1,347	334	3,336
University of Delhi	14,653	3,089	1,909	553	9,103
University of Hyderabad	4,977	1,199	711	146	2,922
Vellore Institute of Technology	7,084	1,598	814	679	3,993
India authorship	214,997	49,073	24,891	18,738	122,296
SSB prize proposal (authorship-based)	10	2	1	1	6

Table 2. Fractional count of publications during the 2014–2017 window in each of four broad areas for the leading 25 universities and a simple heuristic sharing of 10 awards based on the share of publications

University	All	BMH	LES	MCS	PSE
Aligarh Muslim University	1,427	387	247	131	662
All India Institute of Medical Sciences	2,142	2,023	86	3	28
Anna University	2,238	216	284	486	1,252
Annamalai University	1,039	242	157	37	602
Banaras Hindu University	3,097	740	602	206	1,549
Indian Institute of Science	4,548	602	463	562	2,921
Indian Institute of Technology (Indian School of Mines)	1,451	33	212	338	868
Indian Institute of Technology Bombay	3,290	236	369	481	2,203
Indian Institute of Technology Delhi	3,228	233	326	627	2,042
Indian Institute of Technology Guwahati	2,245	198	274	272	1,501
Indian Institute of Technology Kanpur	2,747	149	163	435	2,000
Indian Institute of Technology Kharagpur	4,081	319	618	652	2,492
Indian Institute of Technology Madras	3,358	258	249	433	2,417
Indian Institute of Technology Roorkee	2,737	160	438	461	1,678
Institute of Chemical Technology	1,192	138	159	1	894
Jadavpur University	2,190	228	207	349	1,406
Manipal Academy of Higher Education	1,002	631	81	29	261
National Institute of Technology Rourkela	1,407	130	128	320	829
Panjab University	1,474	460	212	115	686
Postgraduate Institute of Medical Education and Research	1,082	1,000	71	4	7
Thapar Institute of Engineering and Technology	1,172	67	86	335	683
University of Calcutta	1,696	366	322	123	885
University of Delhi	2,571	641	435	194	1,301
University of Hyderabad	1,315	253	164	55	842
Vellore Institute of Technology	2,011	432	223	251	1,105
India papers	54,739	10,144	6,578	6,902	31,115
SSB prize proposal (publication-based)	10	2	1	1	6

1 and 2 show the count of authorships and the count of publications for the leading 25 universities from India for the period 2014–2017 respectively, in each of four broad areas. In each case, we can devise a simple heuristic sharing of 10 awards based on the share of authorships (input side) or publications (output side). There is a remarkable linearity between input and output, which will be the subject of another study, and because of this, the share of awards using either consideration is identical after rounding-off.

Based on this we can propose the following: two prizes be continued every year in chemistry and engineering, and one each in physics and materials science (making a total of six each year for the BMH category); and only one prize be awarded every year in medicine and biology. The prizes in geoscience and life science and environmental science can be alternated once in every two years. Similarly, the mathematics and computer science prizes can be alternated once every two years.

1. Prathap, G., *Curr. Sci.*, 2014, **106**, 790–792.
2. <https://www.leidenranking.com/> (accessed between 1 and 7 August 2019).

GANGAN PRATHAP

*APJ Abdul Kalam Technological
University,
Thiruvananthapuram 695 016, India
e-mail: gp@ktu.edu.in*