The ecology of young talent in science in India

Recently, the Elsevier–Stanford List was used to delineate the research skyscape over Indian Institute of Science and the various Indian Institute of Technologies[1]. This was based on the latest Elsevier BV data update (Version 3, August 2021) for 'Updated science-wide author databases of standardized citation indicators', which was published on 19 October 2021 (DOI: 10.17632/btchxktzyw.3, Contributors: Jeroen Baas, Kevin Boyack, and John P.A. Ioannidis). Originally it was available as a database of over 100,000 top scientists using citation metrics from Scopus, with separate datasets for career-long (updated to end of 2020) and single-year impact (only for 2020). Scientists are classified into 22 scientific fields and 176 sub-fields. Field- and subfield-specific percentiles are also provided for all scientists who have published at least five papers. The selection is based on the top 100,000 by a composite c-score (with and without self-citations), or a percentile rank of 2% or above in the sub-fields (hence top 2% scientists). This serves as an excellent resource to identify the top achievers in these areas of science and technology[2].

The latest dataset and code are based on 1 August 2021 snapshot from Scopus and updated to citation year 2020 (https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3 gives complete details).

Recently, Bornmann and Haunschild[3] have proposed a method based on bibliometric data for the identification of young, talented individuals in science. They produced a set of 46,200 potential talented individuals in the top 1% cohort of scientists who published their first paper within the five-year time period 2007–11. The Elsevier–Stanford list offers a database from which using simple Excel commands, the same exercise can be replicated to identify the most promising scientific talent from the cohort of scientists from India who have published their first paper during 2007–11. Note that this will now (i.e. in 2022) cover young scientists roughly in the age group 35–45 years, the prime hunting grounds for election to the academies of science and for the award of the Shanti Swarup Shanti Bhatnagar (SSB) Prizes in India. The SSB Prize for Science and Technology, and election to the various learned societies or academies of science are among the highest academic recognitions accorded to a scholar in the country.

The single year list in the Elsevier–Stanford database gives the citation impact during the single calendar year 2020, while the career list assesses scientists for career-long citation impact, from 1996 until the end of 2020. Taken together, the single year and career lists allow us to separate the young talent into two groups, with the latter excelling enough to compete with older cohorts. Table 1 shows the number of top 2% young scientists who have published their first paper in 2007–11 from India, according to the career and single year lists for the 22 main fields covered in the Scopus classifcation. It can be noticed that about one-sixth of the single year candidates (596 out of a global total of 18,174 for 3.3% global share) have built up portfolios of highly cited work that take them into the career list (103 out of a global total of 2955 for 3.5% global share). This is to be expected as India has an approximate global share of about 3.5% of world GDP. Also, in many fields, India has drawn a blank. Research excellence is highly skewed, and physical science and engineering (chemistry, enabling and strategic technologies, engineering, information and communication technologies, physics and astronomy) account for 71% of the single year list and 86% of the career list respectively. An exercise to map these numbers to an even broader classification can de done, as is common for the election to the academies and for the SSB Prizes (Table 2). Engineering and technology, and the information and communication technologies account for about half of the current top-end scientific activity in the country, just as the earlier studies have shown[4–8]. In biological sciences, and earth and environmental sciences, only a token presence is felt. However, the election and selection practices for academic recognition of the highest order continue with expectations that are now clearly outdated.

From Tables 2 and 3 we also see the emergence of a new, broad classification called enabling and strategic technologies, where activities like nanoscience and nanotechnology, biotechnology, optoelectronics and photonics, geomatics engineering, energy, materials, etc. find a place, and where chemistry, physics and engineering cannot do justice to the multidisciplinary and transdisciplinary nature of these subfields. Typically, they promise discoveries and innovations that have implications

Table 1. The number of top 2% young scientists who have published their first paper during 2007–11 from India, according to the career and single year lists

Field	Career	Single year
Agriculture, fisheries and forestry	0	10
Biology	2	21
Biomedical research	0	14
Built environment and design	0	1
Chemistry	17	97
Clinical medicine	7	93
Communication and textual studies	0	0
Earth and environmental sciences	2	10
Economics and business	1	7
Enabling and strategic technologies	23	110
Engineering	20	81
General arts, humanities and social sciences	0	0
General science and technology	0	0
Historical studies	0	0
Information and communication technologies	23	92
Mathematics and statistics	1	11
Philosophy and theology	0	0
Physics and astronomy	6	47
Psychology and cognitive sciences	0	0
Public health and health services	1	2
Social sciences	0	0
Visual and performing arts	0	0
Total	103	596

Table 2. The number of top 2% young scientists who have published their first paper during 2007–11 from India, according to the career and single year lists using a broader classification

Broad field	Career	Single year	Career share	Single year share
Agriculture and biological sciences	2	31	0.02	0.05
Chemistry	17	97	0.17	0.16
Medical sciences	8	109	0.08	0.18
Engineering and technology	43	192	0.42	0.32
Information and communication technologies	23	92	0.22	0.15
Mathematics and statistics	1	11	0.01	0.02
Social sciences, arts and humanities	1	7	0.01	0.01
Earth and environmental sciences	2	10	0.02	0.02
Physics and astronomy	6	47	0.06	0.08
Total	103	596	1	1

Table 3. The year-wise count of top 2% young scientists who have published their first paper during 2007–11 from India, according to the career and single year lists

Year	Career	Single year	Career share	Single year share
2007	24	110	0.23	0.18
2008	31	136	0.30	0.23
2009	16	112	0.16	0.19
2010	15	123	0.15	0.21
2011	17	115	0.17	0.19
Total	103	596	1	1

across a wide range of product categories, or have significant strategic value.

We conclude with a longitudinal representation in Table 3 of how the top 2% young scientists who have published their first paper during 2007–11 from India have fared according to the career and single year lists. The advantage that earlier cohorts have in getting into the career lists is evident.

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