Excellence mapping of successful universities and research-focused institutions in India

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We use web applications that are now available to visualize scientific excellence worldwide in several subject areas, to see how Indian universities and research-focused institutions fare in the world of high-end research. Only in five out of twenty-two subject areas, does India have a presence among global institutions that is larger than its share of nominal GDP. In many areas, it has no presence or very meagre participation.

Keywords: Bibliometrics, scientific excellence, indicators.

WEB applications[1,2] are now available which visualize scientific excellence worldwide in several subject areas. For a very large number of top institutions (university or research focused institution), these applications identify those that publish highly cited papers or those which publish in the most influential journals. The evaluation is based on papers (articles, reviews and conference papers) published between 2008 and 2012 in 22 subject areas. For each subject area, universities and research-focused institutions worldwide, were selected in the *SCImago* Institutions Ranking, with at least 500 papers in the publication period (i.e. an average of 100 papers for each year in the period covered). In this paper, we look closely at Indian institutions which appear on the list. It gives an overall picture of how we fare in the world of high-end research.

We use both applications[1,2] and undertake painstaking queries to build-up India-specific indicators. A total of 70 unique organizations are considered in the subject-wise list of Indian universities and research-focused institutions which have published more than 500 papers in the respective areas during 2008 to 2012. They account for a total of 213 units of assessment where an institution publishing more than 500 papers during the five year window in a single subject area is counted as a unit of assessment. This list is available with the author. CSIR, ISRO, DRDO, ICMR etc. are counted as single entities. CSIR has the largest number of units of assessment; it has made the cut in fourteen of the fifteen areas in which India is active, with mathematics as the missing area. There are seven areas in which India does not have a single institution that published more than 500 papers in the five-year period 2008 to 2012. These are arts and humanities, business, management and accounting, health professions, neuroscience, nursing, psychology and social science.

Table 1 shows the subject-wise presence of Indian and Chinese universities and research-focused institutions, which have published more than 500 papers in the respective areas during 2008 to 2012. It is reasonable to expect that the presence of institutions should be related to the share of nominal GDP[3]. Only in five areas does India have a share of top institutions out of the world total that exceed their GDP share (2.65%): chemistry (3.34%), chemical engineering (3.32%), physics and astronomy (3.13%),

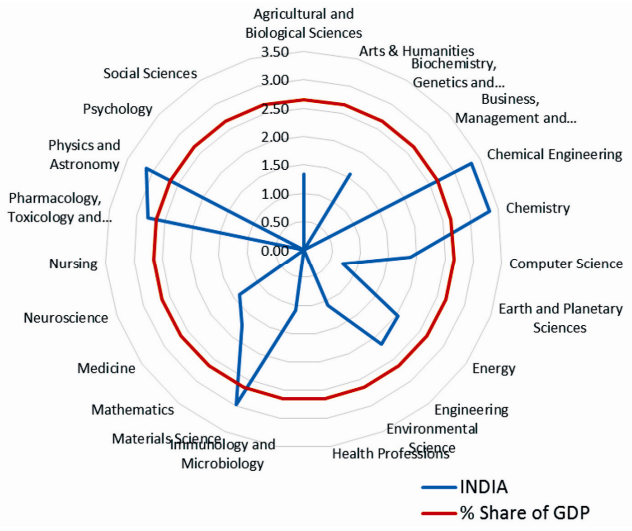

Figure 1. Radar diagram showing the subject-wise presence of Indian universities and research-focused institutions which have published more than 500 papers in the respective areas during 2008 to 2012 as compared to its share of world nominal GDP (ref. 3).

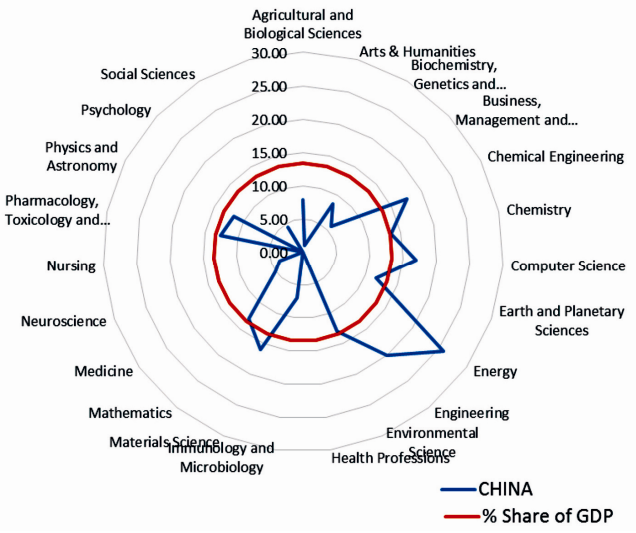

Figure 2. Radar diagram showing the subject-wise presence of Chinese universities and research-focused institutions which have published more than 500 papers in the respective areas during 2008 to 2012, as compared to its share of world nominal GDP (ref. 3).

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Table 1. Subject-wise presence of Indian and Chinese universities and research-focused institutions which have published more than 500 papers in the respective areas during 2008 to 2012

	Numbers			Percentages			% Share of GDP	
Subject area	India	China	Total	India	China	Total	India	China
Agricultural and biological sciences	9	53	670	1.34	7.91	100.00	2.65	13.40
Arts and humanities	0	2	192	0.00	1.04	100.00	2.65	13.40
Biochemistry, genetics and molecular biology	15	82	961	1.56	8.53	100.00	2.65	13.40
Business, management and accounting	0	4	70	0.00	5.71	100.00	2.65	13.40
Chemical engineering	10	53	301	3.32	17.61	100.00	2.65	13.40
Chemistry	25	101	748	3.34	13.50	100.00	2.65	13.40
Computer science	18	162	954	1.89	16.98	100.00	2.65	13.40
Earth and planetary sciences	3	48	415	0.72	11.57	100.00	2.65	13.40
Energy	3	38	147	2.04	25.85	100.00	2.65	13.40
Engineering	27	249	1248	2.16	19.95	100.00	2.65	13.40
Environmental science	4	48	371	1.08	12.94	100.00	2.65	13.40
Health professions	0	0	58	0.00	0.00	100.00	2.65	13.40
Immunology and microbiology	3	19	274	1.09	6.93	100.00	2.65	13.40
Materials science	24	129	805	2.98	16.02	100.00	2.65	13.40
Mathematics	10	75	579	1.73	12.95	100.00	2.65	13.40
Medicine	22	81	1593	1.38	5.08	100.00	2.65	13.40
Neuroscience	0	9	241	0.00	3.73	100.00	2.65	13.40
Nursing	0	0	59	0.00	0.00	100.00	2.65	13.40
Pharmacology, toxicology and pharmaceutics	6	27	214	2.80	12.62	100.00	2.65	13.40
Physics and astronomy	34	127	1088	3.13	11.67	100.00	2.65	13.40
Psychology	0	0	150	0.00	0.00	100.00	2.65	13.40
Social sciences	0	19	431	0.00	4.41	100.00	2.65	13.40
Total units of assessment	213	1326	11569	1.84	11.46	100.00	2.65	13.40

materials science (2.98%), and pharmacology, toxicology and pharmaceutics (2.80%). For China, the areas and numbers are: GDP share (13.40%): energy (25.85%), engineering (19.95%), chemical engineering (17.61%), computer science (16.98%), materials science (16.02%), and chemistry (13.50%). This picture is captured more effectively when radar diagrams are drawn (Figures 1 and 2). India's share of 1.89% in computer science belies the notion that it is a superpower in that area. In many areas, it is lower than expected. At this level of perfromance, India is absent in seven areas, and in the areas in which it is present, its weakest performance is in earth and planetary sciences (0.72%) and environmental sciences (1.08%), which indicates that it is poorly placed to face the impending impact of climate change and global warming. In terms of units of assessment, both India (1.84%) and China (11.46%) do not match their respectives shares of world GDP.

Thanks to the generosity of its creators, we now have web applications[1,2] available in the public domain which visualize scientific excellence worldwide in several subject areas. We have carried out an exercise to see how Indian universities and research-focused institutions fare in the world of high end research. Only in five out of twenty-two subject areas does India have a presence among global institutions that is larger than its share of nominal GDP. These are in the traditional areas of physics, chemistry and applications of the same like materials science and chemical engineering. It has a poor presence in life and medical sciences, an even poorer participation in earth and environmental sciences, and has no institution which can be counted globally in seven areas: arts and humanities, business, management and accounting, health professions, neuroscience, nursing, psychology and social science.

1. http://www.excellencemapping.net/#/view/measure/top10/calculation/a_ohne_kovariable/field/materials-science/significant/false/org/
2. http://www.excellence-networks.net/#_/network/_/probability/true
3. https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)

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