World university rankings and subject ranking in engineering and technology (2015–2016): a case for greater transparency

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There has been a great deal of interest in the ranking of academic and research universities across the world, especially in developing economies including India. Ranking lists are periodically released by many for-profit agencies, including Times Higher Education (THE) and Quacquarelli Symonds (QS). All universities vie for a ranking in them, and wish to be listed in the top 100. These ranking exercises are based partly on hard data and partly on the perception of the university. Ranking helps students choose universities and funding agencies supporting research, and add to the overall reputation of universities. Lack of transparency in providing access to the critical data used in the ranking exercise for public scrutiny/verification has drawn intense criticisms on the accuracy and credibility of the process. In this paper, fallacy of recent ranking exercise carried out by THE is illustrated with a study of two institutions in Asia.

On 30 September 2015, Times Higher Education (THE) released the World University Rankings (WUR) based on 13 parameters grouped under 5 areas: teaching (learning environment), research (volume, income and reputation), citations (research influence), international outlook (staff, research and students) and income from industry (knowledge transfer). Each of these areas was assigned a weightage of 30%, 30%, 30%, 7.5%, 2.5% respectively, in a score of 100 each. Further, out of 30% assigned to teaching component, 15% was to academic reputation of the university assessed through the survey. Similarly, out of 30% assigned to research, 18% was accorded to university reputation for research excellence assessed through the survey, thus assigning a total weightage of 33% based on two surveys. This is perception-based and is highly subjective. The remaining 67% weightage was shared amongst the remaining 11 parameters with varied indicator weights. Hard data for these parameters were compiled by THE through its own procedures, including eliciting from institutions. Thus the compiled data are listed under the label of key statistics on the THE website.

This exercise was done for 825 institutions across the world and they were ranked based on the total score of 100. According to WUR published on 30 September 2015, California Institute of Technology (USA), Indian Institute of Science (IISc, India) and Zhejiang University (China) rank 1, 265 and 299 respectively, with an overall score of 95.2/100, 42.23/100 and 41.79 respectively. On 12 November 2015, THE released the ranking of universities in the subject of engineering and technology (ETR). This ranking exercise was limited to only the top 100 universities across the world. The subject ranking exercise is again based on the same 13 parameters grouped under 5 areas, as mentioned earlier. Interestingly, the key statistics of universities/institutions used in the ranking exercise, including ratio of students to academic staff and the percentage of international students is the same both in WUR and ETR. Further, the weightage assigned to each of these 5 areas and associated 13 parameters (indicator weight) is different. THE recalibrates weightages of ETR. Is the recalibration done to reflect engineering and technology ranking more succinctly or for any other reason? Table 1 lists weightages assigned to 13 parameters grouped under 5 areas both in WUR and ETR. An examination of Table 1 offers the following insights.

(1) Weightage assigned for an institute's reputation for teaching and research in ETR has been increased in WUR to 19.5% and 21% from 15% and 18% respectively, by decreasing the same to other 6 parameters effectively enhancing it for reputation component to 40.5% from 33% in ETR. This weightage is highly perception-based and subjective, and hence would appear to provide enough leeway to experiment with ranking numbers in ETR. It is instructive to note that specific score for these two survey components is not available in the public domain.

(2) Weightage for citations (research impact) has been reduced from 30% in WUR to 27% in ETR. It is baffling to comprehend how reduced weightage for citations reflects excellence with other relevant parameters such as number of patents filed/licensed (which reflect engineering and technology excellence) remaining the same.

(3) Weightage for both the ratio of scholarly papers to academic staff, and research income to academic staff has been reduced from 6% to 4.5% in ETR, while that for industry income to academic staff has been increased from 2.5% in WUR to 5% in ETR.

In summary, do these recalibrated weightages bring out excellence in engineering and technology more markedly or just only play with ranking numbers? Under the revised scheme, Stanford University (USA) ranks number one with an overall score of 95.7/100, whereas Zhejiang University and IISc rank 47 and 99 having an overall score of 65.3/100 and 49.34/100 respectively.

Ranking of IISc in WUR and ETR

I have accessed data for the year 2013 provided to THE by IISc for the purpose of ranking. One should examine (Table 2) how the scores in all the five areas under both WUR and ETR have brought it up from 265th rank in WUR to 99th rank in ETR. Marks for each of these areas listed by THE (see website) under the label 'performance breakdown' is for a total of 500, and actual scores are obtained by multiplying them with the corresponding weightages. An examination of Table 2 clearly shows that in the case of IISc, a difference of 7.11 exists between the scores obtained under ETR (49.34) and WUR (42.23). It is instructive to know the manner in which a score of

Table 1. Weights assigned to 5 areas of performance and 13 parameters used in the World University Rankings (WUR) and ranking in the subject of engineering and technology (ETR) by Times Higher Education (THE)

	Teaching (learning environment)					Research (volume, income and reputation)			Citation (research influence)	Industry income (knowledge transfer)	International outlook (staff, students and research)		
Ranking	Total students/ academic staff (%)	Ph D awards/ bachelor's (%)	Ph D/ academic staff (%)	Reputation survey (%)	Institute income/ academic staff (%)	Scholarly papers/ academic staff (%)	Research income/ academic staff (%)	Reputation survey (%)	Citation per paper (%)	Income from industry/ academic staff (%)	Ratio of international student/academic staff (%)	International co-authorship (%)	Ratio of international to domestic students (%)
WUR	4.5	2.2	6	15	2.25	6	6	18	30	2.5	2.5	2.5	2.5
ETR	3	1.5	4.5	19.5	1.5	4.5	4.5	21	27.5	5	2.5	2.5	2.5

Table 2. Marks for five areas of performance assigned by THE and the actual scores for Indian Institute of Science under WUR and ETR

Ranking basis	Marks/actual score	Teaching	International outlook	Research	Citations	Income from industry	Overall score	IISc ranking
WUR	Marks for area-wise performance by THE	42.7	16.81	47.2	42.81	52.81	42.23	265
	Actual score	12.81	1.23	14.16	12.72	1.31		
ETR	Marks for area-wise performance by THE	60.71	21.2	46.7	47.6	48.8	49.34	99
	Actual score	18.21	1.59	14.01	13.09	1.44		
Difference in the actual score		5.4	0.36	–0.15	0.37	1.13	7.11	

Table 3. Applicable data for various parameters for IISc used in the scheme of ranking under both WUR and ETR and the corresponding indicator weights assigned by THE

	Performance criterion	WUR	ETR
Teaching	Total students/academic staff (a)	8.2	10.57
	Indicator weight for (a) (%)	4.5	3
	Ph D students/bachelor's students (b)	5.3	0
	Indicator weight for (b) (%)	2.25	1.5
	Ph D awarded/academic staff (c)	0.47	0.31
	Indicator weight for (c) (%)	6	4.5
	Institutional income/academic staff (d)	N/A	N/A
	Indicator weight for (d) (%)	2.25	1.5
	Reputation survey (e)	N/A	N/A
	Indicator weight (e) (%)	15	19.5
Research	Scholarly papers/academic staff (f)	31.41	16.49
	Indicator Weight for (f) (%)	6	4.5
	Research income/academic staff (g)	6663368	7291269
	Indicator weight for (g) (%)	6	4.5
	Reputation survey (h)	N/A	N/A
	Indicator weight for (h) (%)	18	21
Citation impact	Citation per paper (i)	5.2	4.06
	Indicator weight for (i) (%)	30	27.5
Income from industry	Income from industry/academic staff (j)	NA	NA
	Indicator weigh for (j) (%)	2.5	5
International outlook	International student/domestic staff (k)	0.044	0.031
	Indicator weight for (k) (%)	2.5	2.5
	Institutional co-authorship (l)	N/A	N/A
	Indicator weight for (l) (%)	2.5	2.5
	International students/domestic students (m)	0.0055	0.0030
	Indicator weight for (m) (%)	2.5	2.5

7.11 has accrued to IISc under the subject ranking catapulting it to 99th position from 265th under WUR. For insights into the manner in which a score of 7.11 has been added in ETR, available institutional data have been used to compute many of the ratios (Table 3). THE has also used the same data of IISc for the year 2013 in assessing the 5 areas of performance. Table 3 also lists indicator weights for 13 parameters assigned by THE.

Teaching

THE assigned a value of 42.7 to IISc for its teaching reputation under WUR in the list released on 30 September 2015. Interestingly, within a short period of 2 months THE has assigned 60.7 marks for teaching quality in engineering and technology, an increase of 18% over WUR (Table 2). This huge difference in teaching quality as arrived by THE poses two questions: First, is teaching reputation in engineering and technology at IISc markedly higher compared to other subjects, including physics, chemistry, mathematics, etc. Further, in the area of teaching, for the five parameters data for IISc are available for only three (Table 3): (a) ratio of total students to academic staff, (b) ratio of Ph D students, and (c) ratio Ph Ds awarded to academic staff. The values for WUR and ETR respectively, are (a) 8.2 and 10; (b) 5.3 and 0, since it has no UG programme in engineering, and (c) 0.47 and 0.31. All these parameters (a)–(c) should have contributed to reduce the score for teaching in ETR in comparison to WUR. Of the remaining two parameters, the ratio of institutional income per academic staff will not be different between ETR and WTR, and hence its score remains the same for both. Hence, based on the analysis, it is clear that 19.5% survey component appears to have been heavily used in enhancing the score for teaching in ETR by a value of 5.11.

Research

According to THE, there is a marginal decrease in ETR in the marks for research from 47.2 to 46.7 (Table 2). Here again, of the three parameters used in assessing research, data are available only for two: ratio of number of scholarly papers to academic staff (f), and ratio of research income to academic staff (g). Ratio (f) is calculated based on the data provided by Scopus office in New Delhi. According to these data, the total number of publications of IISc during the period 2010–2015 is 14472, of which 3612 pertain to engineering and technology. Ratio (f) works out to be 31.4 for WUR and 16.49 for ETR (Table 3), signifying nearly 100% decrease in the ratio for ETR. Further, there is only 10% increase in ratio (g) for ETR. One would have expected lower net score from these two parameters combined. However, 21% weightage for reputation survey for research excellence appears to have been utilized in increasing the net score by 0.37 in ETR, despite negative contributions due to ratios (f) and (g). This raises a fundamental question on the superiority of research reputation in engineering and technology vs rest of disciplines at IISc. As the score for survey data is not shown on the THE website, the positive addition of the score of 0.37 for research in ETR is certainly difficult to account for.

Further while computing these ratios, THE claims the use of process of normalization. However, neither the methodology of normalization nor the post-normalization ratios are shown in

public domain. Further, if normalization has affected all the ratios to be more favourable to ETR, how fortuitous is the process of normalization?

Citations

In the area of citations, research impact (influence) is assessed by the ratio of number of citations per paper (i), and the data for IISc can be accessed either from *Scopus* or from the *Web of Science* (*WoS*). In practice, although the magnitude of numbers in these two sources would differ by less than 20%, there may not be significant change in the relative ratios based on these two databases. As THE has used *Scopus* data, I sought and collected data from *Scopus* office in New Delhi. Accordingly, the total number of publications and citations for IISc in all subjects are 12,692 and 66,494 respectively. Corresponding numbers in engineering and technology are 3612 and 14,472. These numbers translate respectively, into a ratio of 5.2 and 4.06 to the entire institute and to the subject of engineering and technology. This amounts to nearly 25% reduction in the citation per paper in engineering and technology compared to that of the entire institute and should have resulted in significant decrease in the marks for research impact in ETR compared to WUR. However, THE has come out with higher score of 47.6 for research impact in ETR as against 42.4 in WUR, and this certainly is not easy to appreciate. Eventually these changes have resulted in a net score (actual) of 0.37 for citations in ETR and have been embedded in overall made-up score of 7.11. Here though THE claims the use of FWCI (field weighted citation index) score of 0.21 for total citations for IISc, and a score of 0.23 for citations in Engineering and Technology in its computation methodology, it is not possible to account for the increase in the net score despite such a huge difference in the ratio.

Income from industry

THE indicates marks of 48.8 and 52.4 (Table 2) for income from industry per faculty in ETR and WUR respectively. This should have reduced the score (actual) for ETR by 0.09 compared to WUR. However, due to doubling of weightage from 2.5% to 5% to income from industry, a score of 2.44 has accrued to IISc in the subject ranking resulting in net score addition of 1.13 and eventually contributing to an overall increase of 7.11, thus helping IISc achieve a total score of 49.34 and rank of 99 in the top 100 universities in engineering and technology.

International outlook

Scores for international outlook have been enhanced from 16.5 to 21.2 (Table 2) with concomitant increase in actual score by 0.36 (from 1.23 to 1.59) in ETR. Once again, it is instructive to note from Table 3, that among the parameters used in assessing international outlook, data are available only for two parameters. These are ratios for international students to academic staff (k), and international students to domestic students (m). Both these parameters are lower (0.031 and 0.0030) in engineering and technology (Table 3) compared to the entire institute (0.044 and 0.031). However, it is difficult to understand how a score of 0.36 is added for this parameter in ETR despite their lower ratios. The other parameter in international outlook is international co-authorship (l). This parameter is expected to be the same for both WUR and ETR.

Ranking of Zhejiang University in WUR and ETR

For Zhejiang University, THE has assigned a score of 72.4/100, 71.3/100 and 58.2/100 for teaching, research and citations in ETR as against 44.43/100, 46.0/100 and 36.1/100 in WUR respectively, thus increasing by a whooping 28% for teaching, 25.3% for research and 22.1% for citations in ETR compared to those in WUR. An examination of the performance indices data of six universities in China in ETR listing shown in the THE website indicates that such remarkable increase (28%) in teaching quality in engineering and technology is recorded only for Zhejiang University. Apparently, this is one of the major contributing factors for it to attain the 47th ranking in ETR compared to 299th position in WUR. Further, the *WoS* indicates that the number of citations per paper for the entire university is 6.1 in contrast to 4.20 citations per paper in the subject of engineering and technology. This should have resulted in lower marks for citations in ETR compared to WUR, even after accounting for the FWCI score. However, THE has assigned a score of 58.2 for citations in ETR as against 36.1 in WUR. It is difficult to comprehend how Zhejiang University was catapulted to the 47th rank in ETR from 299th in WUR.

Conclusion

An analysis of ranking exercise by THE in the subject of engineering and technology in relation to WUR clearly points to a lack of credibility and transparency due to not posting the actual scores for all the 13 parameters mentioned above in the public domain under the guise of propriety. Further, marks compiled for each of five areas by THE is at variance with true data computed based on available institutional data included in the public domain. THE has employed enhanced weightage (40.5%) for survey-based reputation that is entirely subjective. This has catapulted IISc to the 99th rank in the subject of Engineering and Technology from the 265th position in WUR. While as a faculty member of IISc, it is a heartening development; however, I am not sure whether it is a true reflection of the situation. This has also created widespread irrational exuberance in the minds of unsuspecting public including higher echelons of political and administrative authorities in India. It has attracted the attention of the media as well. It is perhaps high time that the academic and scientific community in India wakes up and thoroughly examines the ranking exercise done over the years by these agencies. There is greater need on part of these agencies to be more transparent with respect to the actual input and output data, and the sources of data to make ranking of universities more credible and realistic.

ACKNOWLEDGEMENT. I thank Prof. Gangan Prathap, Prof. H. S. Mukund and Mr. K. Sreenivasa Rao for their valuable inputs.

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