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Status of Indian Universities: A study based on all India survey on higher education data

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Abstract
The complex, dynamic and multi-faceted quality of higher education institutions (HEIs) has been a consistent criticism of university rankings. Ranking of universities by different methodology may give different relative positions of HEIs. Two methods namely QS and U-Map have been considered for 656 Indian universities with defining index for each university using principal component analysis. The universities have been grouped into different categories. The distribution over states and locations have also been studied. The correlation between two methods of ranking has also been calculated.

Keywords: ranking, QS method, u-map method, principal component analysis, correlation

1. Introduction

The general interest in university rankings began to change in 1983 with the publication of 'America's Best Colleges' by the US News and World Report. A decade later, in 1993, the first 'Times Good University Guide' was published in the United Kingdom. The 1990s later witnessed diverse lists, league tables and rankings around the world, numbering everything from specialist subject schools, to MBA programmes and private institutions, provoking as a result increasing wrangling and scrambling for positions on such lists, as well as scepticism from those institutions that appeared or did not appear on them.

The complex, dynamic and multi-faceted quality of higher education institutions has been a consistent criticism of university rankings. The simplicity of rankings has promoted the accountability of 'ranking houses', impelling them to explain their methodologies with mature and critical introspection. The range of complementary methodologies for assessing, comparing, communicating and even improving the quality of universities. Rankings 'have led to a revolution in the availability of data on higher education institutions and intelligence to guide institutional and government strategies for higher education'.

Moving from the institutional to the systemic level, the World Bank proposes a benchmarking approach to run a 'health check' on tertiary education systems around the world. A way for national higher education systems to compare themselves to others of similar design, disposition and context, and from this starting point to develop strategies for improvements. Looking at the system as a whole rather than its constituent institutions the suggestion is that policymakers can elaborate a long-term vision for their tertiary strategy. Such a holistic-therapy approach to the health of a system does, however, run the risk of bypassing fundamental shortcomings at the institutional patient level – treatable conditions that still need to be addressed in concert with other complementary quality assessment tools if the body system is to function properly. If indeed benchmarking is a 'cure', the reader should take it with the full knowledge of its potential side effects.

Rankings and league tables of higher education institutions (HEIs) is a global phenomenon. It has many purposes – it satisfies the demand for easy interpretable information of higher education institutions; it stimulates the healthy competition among them; it may provide some of the rationale for allocation of funds; and it helps to differentiate among different institutions. In addition, when correctly understood and interpreted, it may contribute to the definition of "quality" of higher education institutions and review performed by public and independent accrediting agencies. The rankings of HEIs have become at present a part of the framework of national accountability and quality assurance processes. Ranking provides a market-based perspective that can complement the work of government, accrediting authorities and independent review agencies. Ranking should be transparent in calculating indicators. The choice of data should have the ability to measure quality, academic and institutional strength.

There are different methodology for ranking. The popular and well-accepted are Academic ranking of world universities(Shanghai) (ARWU), Times Higher Education World University Ranking, Quacquarelli Symonds (QS) World Universities ranking, US News & World ranking with QS, Lieden ranking, Taiwan Ranking of research papers (HEEACT), CHE University Ranking, U-Map classification (CHEPS), European Multidimensional University ranking System (U-Multirank).

This study titled "university quality indicators: a critical assessment" was jointly produced by the German Academic Exchange Service (DAAD) and the Academic Cooperation Association (ACA) on behalf of the European Parliament. It takes stock of the latest developments in higher education quality approaches, i.e. quality assurance (QA) and (global) rankings. The research team conducted extensive desk research on QA and rankings as well as systematic text analysis of policy documents, websites and literature. QA and university rankings have existed for decades. However, external QA was historically a responsibility of the ministry in charge of higher education, and rankings existed only at a national level. Global university rankings first appeared in 2003 when a team of researchers in China produced the Academic Ranking of World Universities to 'benchmark'

Chinese universities against top universities worldwide. The growth of global rankings coincides with the advance of globalisation, the new role of higher education as a beacon for mobile capital and talents, marketization of higher education, and the advancement of digital media. As of 2014, ten global rankings were identified. The European response to this phenomenon is a multi-dimensional EU-funded university mapping and ranking project – U-Multirank. Both independent QA agencies and global university rankings have become prevalent today.

QA and rankings have fundamentally different purposes. The (stated) purpose of most rankings sampled for the Study is to identify 'excellence', in terms of the best higher education institutions (HEIs). In addition, rankings have often (unstated) commercial purposes. In contrast, the main purposes of external QA are to guarantee compliance with (minimum) standards and to support quality enhancement. By providing independent information, QA is to help building trust in higher education, which is expected to provide a better basis for recognition and thus to facilitate mobility.

QA agencies are independent non-profit organisations and their work does have legal consequences. In most EU countries all study programmes are subject to external quality assessments; in some the agencies assess entire HEIs. A successful QA is often a requirement to operate a programme or an institution and, in some countries, affects public funding. Despite many differences between countries, the European Standards and Guidelines for Quality Assurance (ESG) provide a shared framework. The European Quality Assurance Register for Higher Education (EQAR) contains ESG-compliant national QA agencies. Most European agencies comply with the ESG which is, at EU level, considered a precondition for operating abroad. But legal and political hurdles at national level still hamper the emergence of a genuine European QA market.

The mainly private institutional set-up of global rankings in contrast to the public framework of QA is also linked to the quality criteria applied: Global rankings primarily apply research-related criteria for which data are available, whereas QA tends to focus on teaching and learning for which data have to be collected. The majority of global rankings use data from one single data broker. Since a similar data set on teaching-related indicators does not exist, QA criteria have a more qualitative nature. They are presented in a self-assessment report drafted by the HEI, verified and enhanced by an external peer review, and published in an external assessment report.

Several methodological shortcomings limit the usefulness of rankings in measuring 'quality' of higher education. These include the reliance on a single data source, the focus on publications and citations, the exclusion of certain academic fields as well as the limitation to English publications. Further, student surveys used for rankings are not representative. Finally, the differences between ranked institutions are often only marginal. To address these shortcomings different initiatives have been set up: The International Ranking Expert Group (IREG) has introduced a ranking audit, although the methodology of the audit itself is still in need of improvement. Another attempt is the creation of U-Multirank to do justice to the diversity of higher education. However, U-Multirank requires major resource input and its high degree of differentiation also stands in the way of easy readability.

Hard evidence is in short supply concerning the impacts of both QA and rankings. QA largely aims at securing compliance with minimum standards and quality enhancement. Negative consequences include the unattractive reporting and, in some cases, excessive bureaucracy, which may have a negative impact on the development of a quality culture. Rankings are viewed as creating a whole set of intended and unintended effects. Evidenced impacts of rankings have been found on student recruitment and admission, higher education marketing, reputation and legitimacy of HEIs, governance and operation of HEIs, and academic publication practices. Undesirable impacts of rankings include 'data massage' to improve the ranking position, homogenisation of higher education provisions, and academic drift.

Despite their differences, there are tendencies of QA learning from rankings and vice versa. Some QA agencies apply quality ratings which indicate a quality that is better than required (e.g. 'excellent' or 'exceeding'). Thereby they enter the area of 'excellence', which rankings classically view as their habitat. Global rankings, on the other hand, are also moving in the University quality indicators: a critical assessment

- The majority of global university rankings source comparable research-related data from one single data broker – Thomson Reuters. The use of data from data brokers and other readily available information sources may be a cost efficiency consideration for the rankers. This also implies that data brokers shape the various influential global rankings systematically, notably the exclusion of non-English publications.
- The proliferation of global university rankings, and customised rankings, is closely linked to the rapid development of online digital media, which are highly visible globally.
- The proliferation of rankings calls into question the quality assurance of rankings. A ranking audit has been introduced by the International Ranking Expert Group (IREG) as a "self-regulatory" system. However, the methodology of the audit itself is still in need of improvement, before being widely used to set the standards for rankings.
- There are clear differences in the list of ranking indicators, as well as their respective weightings, between global rankings and national rankings. Global rankings, regardless of their stated purposes, rely heavily on research-related indicators. National rankings tend to focus on teaching/student-related indicators, with little or no place at all for research indicators.
- Compared to research indicators, teaching indicators vary to a much greater extent. While it is possible to collect comparable teaching-related data globally, largely through surveys, it may be hard to justify the resource input into such massive data collection. So far none of the global rankings explicitly announced the representativeness and response rates of the teaching-related surveys.
- Traditional rankings are becoming more inclusive (ranking at least 400 universities). However, the larger number of universities ranked in ordinal numbers only

exaggerates the marginal, often unverifiable, differences among those ranked below the 100th position.
- Traditional rankings are moving in the direction of "multiranks", allowing users to sort the rankings by their own choices. However, such sorting option does not always call up a different dataset.

Institutional framework

Very little research has been conducted on the institutional framework of university rankings, although such rankings are increasingly affecting political decisions on higher education development at all levels. Questions like: Who are the key players behind university rankings? Why do rankings exist and flourish in the past one decade? How do global rankings operate and spread around the globe? Are no less important to answer than questions about the deficiencies and benefits of rankings. Within the limited timeframe of the Study, we have conducted a brief but systematic analysis of the operational aspects of the ten sampled rankings (see chapter 2 on sampling rationales) based on publicly available information on the ranking providers' websites and related information sources. Some of the key observations are highlighted below for discussion and future investigation.

QS Methodology takes into account four areas – research, teaching, employability and internationalisation. It is based on six performance indicators – academic reputation, employer reputation, student-to-faculty ratio, citations per faculty, international faculty ratio and international student ratio. The indicators have their own weights to compile. The weights are 40, 10, 20, 20, 5 & 5 percentages respectively.

ARWU comprised of 4 areas like quality of education, quality of faculty (staff Nobel prizes & fields medals), research output (papers in nature and sciences, citation index) and per capita performance with weights respectively 10, 20, 20, 20, 20 and 10 percent respectively.

US News ranking system considered indicators vizly graduation and retention rate, undergraduate academic reputation, faculty resources, student selectivity, financial resources, graduation rate performance and alumni giving rate with weights 22.5, 22.5, 20, 12.5, 10 7.5 and 5 percent respectively.

U-Map ranking method considered the areas like teaching & learning (student-to-faculty ratio, graduation rate, quality of academic staff), student profile, research activity (number of research output, external research income, citation index), knowledge exchange (percentage of income for third party), international orientation (international area staff, international student ratio, international publication) and regional engagement (graduation rate, internship, co-publication). The new development is Assessment of Learning Outcomes in Higher Education (AHELO). It is OECD's AHELO project. It considered 3 testing instruments within AHELO – one for measuring generic skills and two for testing discipline-specific skills.

Times Higher Education (THE) World University Ranking considered criterion like citations-research influence, teaching-the learning environment, research-volume, income, reputation, international mix-staff, students, industry income-innovation with weights 30, 30, 30, 7.5, 2.5 percent respectively.

Data

All India Survey on Higher Education (AISHE) has been taken as main source of data. AISHE data for the latest available year 2015-16 has been taken. As there is no specific survey or source of data which directly or indirectly can give data for all the indicators of any ranking method, this communication has considered some simplification to estimate indicators of two methods QS and U-Map. Simplifications are due to match with the data as available in AISHE. In some cases, data for few variables related to indicator have been even dropped. The scarcity of data restricted to build an exact ranking index. It is an attempt to quantify the development and quality indicator towards ranking of Indian universities. Here, indicators as mentioned in QS and U-Map methods are being considered for 656 universities in 32 states - Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhatisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Puducherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttar Pradesh, Uttrakhand and West Bengal. The variables considered here for QS method are – percentage of seats filled up in 2015-16(X_1), total enrolment in 2015-16(X_2), Gender Ratio (female/male) in 2015-16(X_3) [as academic reputation]; percentage of teaching staff in position for 2015-16(X_4), out-turn for 2015-16(X_5) [as employer reputation]; student-to-faculty ratio for 2015-16(X_6); number of journals & books in library for 2015-16(X_7); number of foreign students enrolled for 2015-16(X_8); percentage of out-turn for 2015-16(X_9). The variables considered towards U-Map methodology are - student-to-faculty ratio for 2015-16(Y_1); graduation rate (under-graduate enrolment / total enrolment) for 2015-16(Y_2); total enrolment for 2015-16(Y_3); gender ration for 2015-16 (female/(male+female)(Y_4); quality of academic staff (out-turn in Ph.D. and M.Phil.) for 2015-16(Y_5); number of international/foreign students for 2015-16(Y_6); number of journals & books in the library for 2015-16(Y_7); expenditure to receipts for 2015-16 [as external research income & income from third party](Y_8).

Analysis

It is true that the variables considered are not exactly capable of measuring the traits as mentioned in the methodologies. For simplicity, it has been considered to quantify the index for ranking the universities using AISHE data. Let X_{ij} be the ith variable for jth university; j=1(1)656. It is true that the variables are in different scales and units.

The transformation is X to Z**,**

Where $Z_{ij} = [X_{ij} - \text{minimum}(X_{ij})]/[\text{maximum}(X_{ij}) - \text{minimum}(X_{ij})]$; j=1(1)656 for fixed i.

$$\text{Index}(QS_j) = 0.4*(Z_{1j}+Z_{2j}+Z_{3j})/3 + 0.1*(Z_{4j}+Z_{5j}+Z_{9j})/3 + 0.2*Z_{6j} + 0.2*Z_{7j} + 0.1*Z_{8j} \text{ ; } j=1(1)656 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Weights are as per methodology. One may try to calculate objectively using Principal Component Analysis (PCA) factor scores.

The transformation is Y to U**,**

Where $U_{ij} = [Y_{ij} - \text{minimum}(Y_{ij})]/[\text{maximum}(Y_{ij}) - \text{minimum}(Y_{ij})]$; j=1(1)656 for fixed i.

Index $(UMap_j) = \sum W_{ij}*U_{ij}$, where W_{ij} is the PCA factor loading (Varimax) for ith variable, j=1(1)656.

Table 1: showing factor loading as weights for the U_{ij}'s

Variable	Factor
U1	0.832438
U2	0.106359
U3	0.775264
U4	0.092964
U5	0.851382
U6	0.081382
U7	-0.076842
U8	-0.009367

i.e. Index ($UMap_j$) =

$0.832438*U_{1j} + 0.106359*U_{2j} + 0.775264*U_{3j} + 0.092964*U_{4j} + 0.081382*U_{5j} + 0.081382*U_{6j} - 0.076842*U_{7j} - 0.009367*U_{8j}$; j=1(1)656 …. …. …. (2)

The distribution of ranks for the universities has been allotted separately using QS & UMap. So, all 565 universities have been obtained using both the methods. Greater the index more is the rank, i.e. max ($index_j$)=1, etc.

The ranks of universities are grouped into 6 categories as

Table 2: showing groups for ranks of the universities

Ranks	Group
1 to 20	A
21 to 50	B
51 to 100	C
101 to 200	D
201 to 400	E
401 to 656	F

The distribution of the universities according to groups over the states are as

Table 3: showing the distribution of universities according to ranks over the states under QS

State\Group	A	B	C	D	E	F	Total
Andhra Pradesh	2	3		5	13	3	26
Arunachal Pradesh				2	1	3	6
Assam			4	2	2	6	14
Bihar				4	10	5	19
Chandigarh		1				2	3
Chhatisgarh				3	6	9	18
Delhi	2	2	2	3	4	8	21
Goa			1			1	2
Gujarat		3	3	7	10	19	42
Haryana	1	1	2	3	11	14	32
Himachal Pradesh		1	1	3	7	9	21
Jammu and Kashmir			1	4	3	2	10
Jharkhand			1	3	2	7	13
Karnataka	1	5	4	8	18	5	41
Kerala	2	1	3	3	4	3	16
Madhya Pradesh		2	1	1	12	21	37
Maharashtra	2	2	7	8	9	10	38
Manipur				1		2	3
Meghalaya			1	1	1	2	5
Mizoram					1	2	3
Nagaland				1	1	1	3
Odisha			1	5	12	3	21
Puducherry					2	1	3
Punjab	1		1	5	7	9	23
Rajasthan	4		1	3	8	31	47
Sikkim		1			3	1	5
Tamil Nadu	2	3	8	7	13	14	47
Telangana		1		6	6	4	17
Tripura	1			1		1	3
Uttar Pradesh	1	2	4	3	18	33	61
Uttrakhand		1	1	4	8	12	26
West Bengal	1	1	3	4	8	13	30
Total	20	30	50	100	200	256	656

Table 4: showing the distribution of universities according to ranks over the states under UMap

State\Group	A	B	C	D	E	F	Total
Andhra Pradesh	2	2	3	3	5	11	26
Arunachal Pradesh				1	2	3	6
Assam		1		3	3	7	14
Bihar		3		1	3	12	19
Chandigarh			1		1	1	3
Chhatisgarh		1	1	1	9	6	18
Delhi	2	1	1		5	12	21
Goa					1	1	2
Gujarat	1		4	8	13	16	42

Haryana			4	7	10	11	32
Himachal Pradesh	1	1	2	4	12	1	21
Jammu and Kashmir			1	1	3	5	10
Jharkhand					6	7	13
Karnataka		2	2	6	10	21	41
Kerala	1		2	3	4	6	16
Madhya Pradesh	2	2		5	17	11	37
Maharashtra	2	1	7	4	3	21	38
Manipur				2		1	3
Meghalaya				1	2	2	5
Mizoram				1	1	1	3
Nagaland					2	1	3
Odisha		2	1	4	2	12	21
Puducherry				1	1	1	3
Punjab	1	1	3	3	9	6	23
Rajasthan	1	4	2	7	17	16	47
Sikkim			2	2		1	5
Tamil Nadu	6	5	6	11	10	9	47
Telangana		2	2	1		12	17
Tripura					2	1	3
Uttar Pradesh			3	12	31	15	61
Uttrakhand		2	3	6	8	7	26
West Bengal	1			2	8	19	30
Total	20	30	50	100	200	256	656

The distribution of universities according to groups over locations are as

Table 5: showing the distribution of universities in groups over location under QS

Location\Group	A	B	C	D	E	F	Total
Rural	5	9	19	39	87	104	263
Urban	15	21	31	61	113	152	393
Total	20	30	50	100	200	256	656

Chi-square with 5 df = 1.006

Table 6: showing the distribution of universities in groups over location under U Map

Location\Group	A	B	C	D	E	F	Total
Rural	5	13	24	38	90	93	263
Urban	15	17	26	62	110	163	393
Total	20	30	50	100	200	256	656

Chi-square with 5 df = 1.011

It is interesting to note that the ranking by these two methods has correlation 0.317. The correlation is significant but it is positive and low.

Remarks

Ranking of universities using both the methods QS and U-Map do not differ much. In both the methods, the total number of universities are more in urban areas (59.9%) but good universities (within rank 100) among urban areas are 14.7% only. Uttar Pradesh has more than universities in lower groups and Tamil has maximum number of universities in higher groups. This system is to be revisited as it is dynamic over time and data for all indicators are not available for universities. It is an analysis only for 2015-16 based on AISHE data.

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