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Revisiting Ranking of Academic Institutions: An Overview

A.K. Nassa* and Jagdish Arora

National Board of Accreditation, New Delhi - 110 003, India

**E-mail: akn.edu@gmail.com*

ABSTRACT

The article provides an overview of ranking systems including its historical evolution, use of rankings by different stakeholders, ranking indicators, merits and demerits of different ranking systems and performance of Indian universities in in past one decade in global ranking systems. The article briefly describes nine global ranking systems and compares them based on weightage assigned to different categories of indicators and source of data used for ranking of HEIs. Lastly, article provides statistical inter-correlation amongst various ranking systems as well as intra-correlation within ranking systems at interval of five years (2011:2015; and 2016:2020) and 10 years (2011-2020).

Keywords: University ranking; Global university ranking systems; Correlation coefficient; Indian higher education institutions

1. INTRODUCTION

The HEIs rankings are lists of the academic institutions in order of their positions determined on the basis on a number of criteria that supposed represent their excellence. Ranking is a convenient and easily understandable evaluation and assessment method. A good ranking system should measure the excellence of universities on criteria that actually represent excellence and are not mare symptoms of excellence[1, 2]. Primary purpose of ranking of HEIs it to facilitate stakeholders including students, their parents, policy makers, funding agencies and HEIs themselves to take an informed decision about qualities of HEIs and their performance on various indicators. Indicators, variable called as parameters, criteria, variables, framework, etc. are believed to be objective indicators that serve as true surrogate of excellence and project a true account of an institution of higher education and its excellence. Students are increasingly consulting national and international rankings as a selection tool to choose a university or a college for their higher studies. The HEIs themselves use their present rankings as a marketing tool to attract students, research funds as well as a decision-support tool to improve their own standing on various ranking indicators. Governments, funding agencies and policy makers use ranking for allocation of funds, benefits, scholarships, etc. It is, however, opined that the rankings system should be considered as a source of information for guiding policies, which, in turn, should be decided according to the needs of a university's own community, traditions, market niche, national role and so on. In any case, it should not dictate university policy, either at a national or institutional level[1].

The phrase "world-class university" caught attention of academicians, policy makers and political leaders around the world with release of Academic Ranking of World University by Shanghai Jiao Tong Institute in 2003 and QS-Times Higher Education (THE) rankings in 2004. The phrase "world-class university" does not only represent excellence in teaching and research, but it also signifies capacity of a university to compete in the global higher education marketplace. As such, special initiatives are being taken at national and institutional level in different countries to promote and support creation of world-class university and upgradation of the existing universities to the world class. Several universities have included "world-class" as a target to achieve in their mission statements and have begun implementing various measures.

The Indian universities and HEIs are not doing well in most of the international rankings in spite of the fact that India hosts a few islands of excellence in education world. Although, some of these institutions have marked their presence in international rankings, but none of the Indian HEIs could make it to the 100 top-ranked universities in any of the international rankings system. The article provides an overview of ranking systems including its historical evolution, use of rankings by different stakeholders, indicators used by ranking systems covered in this study for ranking HEIs, merits and demerits of different ranking systems and performance of Indian universities in various global rankings in past one decade. It briefly describes nine global ranking systems and compares them based on weightage assigned to different categories of indicators used by these ranking systems. Lastly, article provides statistical inter-correlation amongst various ranking systems as well as intra-correlation within the same ranking system at interval of five years (2011:2015; and 2016:2020) and 10 years (2011-2020) for global rankings covered in this study.

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Table 1. Selected global and national ranking systems

Name of Ranking System	Publisher	No. of HEIs Analysed	No. of HEIs Ranked	Publishing Country	Year of Inception
	Global Rankings				
Academic Ranking of World University	Shanghai Ranking Consultancy	1,800	1,000	China	2003
THE World University Rankings	Time Higher Education	1,900	1,397	UK	2004
QS World University Rankings	QS Quacquarelli Symonds Ltd.	5,500	1,000	UK	2004
NTU Ranking	National Taiwan University	900	826	Taiwan	2007
Leiden Ranking	Leiden University	1,176*	1,176*	Netherland	2007
Scimago Institutions Rankings	SCImago Research Group	**	3897	Spain	2009
RUR World University Rankings	RUR Rankings Agency	1,100	829	Russia	2013
US News Best Global University Rankings	US News	1,748	1,500	USA	2014
Webometrics Ranking of World Universities	Cybermetrics Lab, Spanish National Research Council	^	30,000	Spain	

(Data taken from web sites of ranking systems for the year 2020)
*The Leiden Ranking 2020 includes 1176 universities worldwide that have produced at least 800 Web of Science indexed publications during 2015–2018.
**SciMago Ranking 2020 included all institutions (including research organizations) that have at least 100 Scopus indexed publications during the last year.
^All web sites of eligible institutions

Table 2. Indicators used for ranking by the academic ranking of world universities

Indicator Type	Indicator Name	Data Source	Weight %	Weight % (Total)
Research – Output	1. Papers published in Nature & Science	WoS	20.0	100.0
	2. Papers indexed in SCI and SSCI	WoS	20.0	
	3. Highly Cited Researchers	WoS	20.0	
Research- Excellence	4. Nobel Prizes and Fields Medals – Staff	Web sites of Awardees	20.0	
	5. Nobel Prizes and Fields Medals – Alumni		10.0	
	6. Per Capita Academic Performance of an Institution	All Above	10.0	
Total	6 indicators		100	100

2. HISTORY OF RANKINGS

Rankings of institutions of higher education is a global phenomenon with history that dates back to 1870s when the very first attempt towards ranking of academic institutions was made by the Commission of the US Bureau of Education with publication of an annual report of statistical data that was used for classification of universities in the report[3]. The first reputation rankings of graduate-level degree programs in the primary academic disciplines offered by universities in US was done in 1925 by Prof. Raymond Hughes, a professor of chemistry on behest of North Central Accrediting Association[4]. Such multidisciplinary reputational rankings were repeated on behest of accreditation and assessment bodies first by Prof. Hughes in 1925 and 1934, then by Hayward Kinston in 1959, and by Alan Carrter in 1966. This tradition of multidisciplinary rankings of graduate degree programs based upon reputational surveys was continued in the USA by the National Research Council (NRC). The NRC conducted its first assessment of Research Doctorate Programs in 1982 followed by second assessment in 1995. On release of 1995 reputation based study, there was a widespread reaction pointing out inadequacy of reputation-based measure which cannot describe and assess several important characteristics of US doctoral programs. As such, third assessment entitled "Data-Based Assessment of Research-Doctorate Programs" conducted by the NRC differed significantly from earlier reputation-based studies wherein objective data on twenty variables was collected from 212 universities for 5,000 doctoral programs for the academic year 2005-2006 in 62 major fields to estimate overall quality of doctoral programs. While the result of data analysis was published as a report by the National Academy Press in 2011[5], the raw data was made available for further analysis to promote widespread use and analysis of many characteristics of doctoral programs.

The, ranking, however, gained mass appeal in 1983, almost after one century of its first introduction in 1870s, when the US News published first rankings of undergraduate academic institutions based on survey of university presidents[6-7]. While the first ever ranking of academic institutions was based on perceptions of university presidents, ranking of academic

institutions based on multidimensional performance indicators and methodology was done in 1987 for the first time by the US News. This, in turn, triggered publications of several ranking tables in various subject domains in different countries across the world. Over the last three decades, ranking tables in various subject domains have emerged not only from newspapers and media houses but also from private bodies, professional associations and governments.

The credit for the first ever global university ranking goes to Shanghai Jiao Tong University for release of Academic Ranking of World Universities (ARWU) or Shanghai Rankings in 2003 followed by the Times Higher Education (THE)-QS Ranking in 2004. Times Higher Education collaborated with Quacquarelli Symonds (QS) to publish joint THE–QS World University Rankings from 2004 to 2009. From 2010 onwards, THE and QS are publishing world university ranking independently.

3. GLOBAL UNIVERSITY RANKING SYSTEMS

The Academic Ranking of World Universities (ARWU), the Times Higher Education (THE) World University Rankings, and the Quacquarelli Symonds (QS) World University Rankings are considered as the "big three" of global rankings. These three rankings are the most popular, well-established, and provide league tables and comparable data for nearly two decades. These three global rankings differ in terms of their scope, methodology and sources of data, as well as their institutional affiliation. While THE and QS are products of media houses and commercial establishments, ARWU, initially an initiative of the Centre for World-Class Universities and the Institute of Higher Education of Shanghai Jiao Tong University is now operated and executed by Shanghai Ranking Consultancy, an off-shoot of Shanghai Jiao Tong University[8]. International Observatory on Academic Ranking and Excellence (IREG) maintains "IREG Inventory of International Rankings" which lists 19 Global university ranking system on its web site[9]. In addition, IREG website also provide global ranking system by subject, regional rankings and national higher education ranking systems.

This article provides a brief account of nine global university ranking systems mentioned in Table 1. Indicators used by each ranking system are given in a tabular form with weightage assigned to each of them. These indicators are grouped under various categories so as to facilitate their comparison based on weightage given to different categories of indicators. The broad categories of indicators devised for this study are: Teaching and learning environment, research (including research - influence, - excellence, innovation, - funding), internationalisation, reputation / perception, societal and miscellaneous.

3.1 Shanghai Jiao Tong University Academic Ranking of World University

The academic ranking of world universities (ARWU) (http://www.shanghairanking.com/), also known as Shanghai ranking, was first published in June 2003 by the Centre for World-Class Universities and the Institute of Higher Education of Shanghai Jiao Tong University, China making it the first global university ranking using multi-dimensional indicators. The ARWU is being published by Shanghai Ranking Consultancy since 2009. It is often lauded for its objectivity, stability and transparency of methodology. The ARWU is recognised as the most widely used annual ranking of the world's research universities[10.] Burton Bollag, a reporter at Chronicle of Higher Education wrote that ARWU is considered as the most influential international ranking[11]. The ranking compared 1800 HEIs worldwide and ranked the top 1,000 HEIs in the year 2020. ARWU uses six objective indicators mentioned in Table 2 to rank global HEIs.

Table 2 reveals that ARWU takes 100 per cent data required for ranking from publicly available third party sources and does not depend for the data on universities that it ranks. ARWU is often criticised on the following accounts:

- ARWU and THES both are criticised for their tendencies to be biased towards English-speaking and hard-science oriented institutions[12-13].
- Use of size-dependent parameters that benefit larger institutions. Out of six indicators used for ranking of HEIs by ARWU mentioned in Table 2, five indicators are size dependent (representing 90 % of total weightage), only the last indicator (listed at 6) considers "per capita academic performance"[14] of an institution[13].
- ARWU is biased towards science and technology as is evident by the fact that 80 per cent weightage is given to indicators that measure research-output (See Table 2, Sl. No. 1-4).
- Heavy weightage given to nobel and fields medals. While it is agreed that Nobel and field medals measure research excellence in a few traditional disciplines, it is unclear as to how universities with nobel or fields winning alumni provide the best education[15]. Moreover, Nobel prize and field medals can at the best measure the past excellence and not current[15]. Moreover, majority of institutions do not have staff or faculty that have ever won a nobel prize or a field medal. As such, majority of institutions do not qualify to get any score for this indicator.
- ARWU gives very little or no attention to teaching excellence. Liu and Cheng[16] admitted that the ARWU gives relatively little weight to teaching because it is difficult to find objective and internationally comparable measures of teaching quality.

The ARWU represents interest of China as "buyers of education" and thus provides accurate picture of quality of education[1].

3.2 Times Higher Education World University Rankings

The times higher education world university rankings (https://www.timeshighereducation.com/world-university-rankings) is an international ranking of the world's top universities published by times higher education (THE) magazine annually. The publisher collaborated with quacquarelli symonds (QS) to publish joint THE–QS World University rankings from 2004 to 2009. From 2010 onwards, THE signed-

Table 3. Indicators used for ranking by the the world university ranking

Indicator Type	Indicator Name	Data Source	Weight %	Weight (Total) %
T & L Environment	1. Staff-to-Student Ratio	HEIs	4.5	12.75
	2. Doctorate-to-Bachelor's Ratio	HEIs	2.25	
	3. Doctorates-Awarded-to-Academic-Staff Ratio	HEIs	6.0	
Research-Output	4. Research Productivity	Scopus	6.0	44.5
Research - Innovation	5. Industry Income	HEIs	2.5	
Research-Funding	6. Research Income	HEIs	6.0	
Research-Influence	7. Citations (research influence)	Scopus	30.0	
Internationalisation	8. Proportion of International Students	HEIs	2.5	7.5
	9. Proportion of International Staff	HEIs	2.5	
	10. International Collaboration	HEIs	2.5	
Reputation	11. Research-Reputation Survey	Survey	15.0	33.0
	12. Teaching-Reputation Survey		18.0	
Miscellaneous	13. Institutional Income	HEIs	2.25	2.25
Total	13. indicators			100.0

* THE's Annual Academic Reputation Survey (2019 & 2020).

Table 4. Indicators used for ranking by the QS world university rankings

Indicator Type	Indicator Name	Data Source	Weight %	Weight (Total) %
T & L Environment	1. Faculty/Student Ratio	HEIs	20.0	20.0
Research-Influence	2. Citations per faculty	Scopus / HEIs	20.0	20.0
Internationalisation	3. International faculty ratio	HEIs	5.0	10.0
	4. International student ratio	HEIs	5.0	
Reputation	5. Academic Reputation	QS Academic Survey	40.0	50.0
	6. Employer Reputation	QS Employer Survey	10.0	
Total	6. Indicators			100.0

up with Thomson Reuters (now Clarivate Analytics) for a new ranking system based on data from Web of Science from 2010-2013. From 2014 onwards, THE signed up with Elsevier which provides them data from Scopus to compile the rankings. THE uses 13 indicators for ranking universities across the globe as mentioned in Table 3.

Table 3 reveals that THE takes 36 per cent of data from publicly available third party source (Scopus), 33 per cent data from research and teaching reputation survey and its dependence on HEIs that its ranks for submission of data is 31 per cent. THE is often criticised on the following accounts:

- For relying heavily on subjective reputation surveys (33 %) - Reputation or perception is a highly subjective criteria of assessment and evaluation since academicians are likely to get influenced with established reputation of institutions, called ''halo'' effect[17-19]. The process of selection of experts for survey and their geographical distribution is not available on the website.
- THE (as well as QS) see themselves as a tool for entrepreneurial universities to strengthen their position and an information system for stakeholders[(20)]. THE originates from UK where the emphasis is to attract students to universities in western world. As such, THE targets universities and economy of countries in Western world as indicated by use of three indicators on internationalisation (listed at Sl. No. 8 to 10 in Table 3) with cumulative aggregate weightage of 7.5 per cent[1].
- THE undermines non-science and non-English institutions and for its bias towards institutions in Europe and America as is evident from THE league tables.

3.3 QS World University Rankings

Quacquarelli Symonds (QS) published THE-QS World University Rankings (https://www.topuniversities.com/) from 2004 to 2009 initially in collaboration with Times Higher Education. From 2010 onwards, QS assumed sole rights to the methodology used at that time and split with Times Higher Education to bring out the QS World University Rankings from 2010 onwards. QS uses 6 indicators for ranking universities across the globe as mentioned in Table 4.

Table 4 reveals that QS takes 20 per cent of data from publicly available third party source (Scopus), 50 per cent data from academic and employer reputation survey and its

Table 5. Indicators used for US news best global university rankings

Indicator type	Indicator name	Data source	Percent	Cumulative %
Research- Output	Publications	Web of Science	10.0	15.0
	Books		2.5	
	Conferences		2.5	
Research – Influence	Normalized Citation Impact		10.0	17.5
	Total citations		7.5	
Research – Excellence	Number of publications that are among the 10% most cited	Essential Science Indicators	12.5	32.5
	Percentage of total publications that are among the 10% most cited		10.0	
	Number of highly cited papers that are among the top 1% most cited in their respective field		5.0	
	Percentage of total publications that are among the top 1% most highly cited papers		5.0	
Internation-alisation	International collaboration – relative to country	Web of Science	5.0	10.0
	International collaboration		5.0	
Reputation	Global Research Reputation	Clarivate's Academic Reputation Survey	12.5	25.00
	Regional Research Reputation		12.5	
Total	13 Indicators			100.0

Table 6. Indicators used for RUR world university rankings

Indicator type	Indicator name	Data source	%	Cumulative (%)
T & L Environment	1. Academic Staff per Students	Global Institutional Profiles Project (GIPP)	8	40.0
	2. Academic Staff per Bachelor Degrees		8	
	3. Doctoral Degrees per Academic Staff		8	
	4. Doctoral Degrees per Bachelor Degrees		8	
	5. Doctoral Degrees per Admitted Ph.D.		8	
	6. Papers per Academic and Research Staff		8	
Research – Output	7. International Co-authored Papers	Scopus	2	12.0
	8. Papers per Research Income		2	
Research-Influence	9. Citations per Academic & Research Staff		8	16.0
	10. Normalized Citation Impact		8	
Research - Funding	11. Research Income per Academic and Research Staff		2	4.0
	12. Research Income per Institutional Income		2	
Internationalisation	13. International Academic Staff	Global Institutional Profiles Project (GIPP)	2	6.0
	14. International Students		2	
	15. International Level		2	
Reputation	16. World Teaching Reputation		8	18.0
	17. World Research Reputation		8	
	18. Reputation Outside Region		2	
Miscellaneous	19. Institutional Income per Academic Staff	GIPP	2	4.0
	20. Institutional income per students		2	
Total	20 Indicators			100

dependence on HEIs that its ranks for submission of data is 30 per cent. QS is often criticised on the following accounts:

- Over-reliance on reputation surveys (50 %) which is considered as highly subjective criteria for evaluation and assessment.[21]
- Consistency and integrity of the data used for ranking of HEIs - It is observed that QS source its data from web sites of universities for ranking if a university itself does not provide data to the QS. Such data could be misleading.[22]
- QS (as well as THE) see themselves as a tool for entrepreneurial universities to strengthen their position and an information system for stakeholders[20]. QS, like THE originates from UK where the emphasis is to attract students to universities in western world. As such, QS targets universities and economy of countries in Western world as indicated by use of two indicators on internationalisation (listed at Sl. No. 3 to 4 in Table 4) with cumulative aggregate weightage of 10 per cent.
- QS (as well as THE) undermines non-science and non-English institutions and for its bias towards institutions in Europe and America.

3.4 US News Best Global University Rankings

The US news was the first commercial and media house to publish rankings (https://www.usnews.com/education/best-global-universities/rankings?int=top_nav_Global_Universities) of undergraduate academic institutions based on survey of university presidents in 1983[6-7]. Over the years, the US News continued expanding its ranking activities with addition of new categories and subject domains confined to HEIs in USA. However, in 2014, U.S. News published its inaugural global ranking, assessing 500 universities in 49 countries. The US News best global university rankings uses 13 indicators given in Table 5.

Table 5 reveals that US News BGUR takes 75 per cent of data from publicly available third party sources, i.e. scopus and essential science indicators, 25 per cent through academic reputation survey carried out by the clarivate, the publishers of Web of Science and Essential Science Indicators.

3.5 The RUR World University Rankings

The RUR World University Rankings, by Round University Ranking (RUR) agency (https://roundranking.com/), Moscow evaluate performance of 1100 world's leading higher education institutions by 20 indicators grouped into 4 key areas of university activity: Teaching, research, international diversity and financial sustainability. Considering the fact that there are no scientific basis and universally accepted criteria for assigning weightage to indicators, RUR assigns equal weightage within each indicator groups. The name of the ranking is driven from the concept of "rounding" the weightage assigned to indicators denoting symmetry of methodology[23].

All raw data, including statistical data, bibliometric data and reputation data for RUR rankings is provided by Clarivate Analytics through Global Institutional Profiles Project (GIPP) and through Web of Science core collection. RUR rankings cover the period from 2010 to the present. It is designed as an evaluation system aimed to provide sufficient information about university performance to address stakeholder's personal tasks: students, academic community, university management, policy makers. The RUR World University Rankings uses 20 indicators given in Table 6.

Table 6 reveals that RUR takes 28 per cent of data from publicly available third party source (Scopus), 18 per cent data from teaching, research, regional and international reputation survey and its dependence on HEIs that its ranks for submission of data is 54 per cent through Global Institutional Profiles Project (GIPP). It was observed that RUR did not rank institutions that did not submit its data required for ranking.

3.6 NTU Ranking

The NTU Ranking (http://nturanking.csti.tw/) (formerly HEEACT Ranking), also known as performance ranking of scientific papers for world universities, ranks 800 world

Table 7. Indicators used for NTU ranking

Indicator type	Indicator name	Data source	Weight %	Weight (Cumulative) %
Research - Output	1. Number of articles in the last 11 years (2009-2019)	SCI, SSCI and Essential Science Indicators	10.0	25.0
	2. Number of articles in the current year (2019)		15.0	
Research-Influence	3. Number of citations in the last 11 years (2009-2019)		15.0	35.0
	4. Number of citations in the last two years (2018-2019)		10.0	
	5. Average number of citations in the last 11 years (2009-2019)		10.0	
Research- Excellence	6. h-index of the last two years (2018-2019)		20.0	40.0
	7. Number of Highly Cited Papers in the Last 11 years (2009-2019)		15.0	
	8. Number of Articles in the Current Year in High-Impact Journals (2018-2019)		5.0	
Total	8. Indicators			100.0

universities annually based on bibliometric parameters using data drawn from Science Citation Index-Expanded, Social Science Citation Index and Essential Science Indicators. the ranking was first published in 2007 by the Higher Education Evaluation and Accreditation Council of Taiwan (HEEACT) with an aim to evaluate and rank universities in terms of their academic publication performance. From 2012 onwards, responsibility of publishing and hosting the ranking was taken-up by National Taiwan University and was named as NTU Ranking. The NTU ranking provides overall ranking, ranking by six fields and 24 selected subjects[24]. The NTU ranking uses 8 indicators given in Table 7.

NTU takes data on all its indicators through publicly available third party sources, i.e. SCI, SSCI and Essential Science Indicators. It does not depend for data on HIEs that it ranks.

3.7 Leiden Ranking

The first edition of Leiden ranking (https://www.leidenranking.com/ranking/) developed by the Centre for Science and Technology Studies at Leiden University was released in 2008. However, it was discontinued and resumed its activities in 2012 and is now updated on an annual basis. The Leiden Ranking provides multiple ranking tables based on individual criteria grouped under the following three broad categories:

- Scientific or Research Impact Indicators;
- Collaborative Indicators;
- Open Access Indicators.

The Leiden Ranking takes data on all indicators through publicly available third party sources, i.e. Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. Leiden ranked the top 1176 HEIs in the world in its 2020 edition on individual ranking indicators[25]. The leiden ranking uses 9 indicators for ranking institutions by Scientific or Research Impact. These indicators are:

- Total No. of Publications;
- Total Citation Score;
- Mean Citation Score;
- Total Normalised Citation Score;
- Mean Normalised Citation Score;
- Proportion of Top 1 per cent most-cited publications;
- Proportion of Top 5 per cent most-cited publications;
- Proportion of Top 10 per cent most-cited publications;
- Proportion of Top 50 per cent most-cited publications.

The Leiden Ranking restricts itself to using bibliometric indicators available through third party sources that indisputably indicate scientific performance of HEIs, however, it, may not necessarily reflect their teaching performance. Unlike other ranking systems, Leiden University does not assign a single rank to a university since it refrains from arbitrarily combining multiple dimensions of university performance in a single aggregated indicator[26]. As such, instead of assigning a single rank to universities, Leiden facilitates users to rank universities on individual indicators that are used for ranking. For example, on scientific impact, users can rank universities

Table 8. Indicators used for SCImago institutional rankings

Indicator type	Indicator name	Data source	%	Cumulative (%)
Research – Output	1. Scientific Leadership (L)	Scopus	**5.0**	70.0
	2. Scientific Talent Pool (STP)		2.0	
	3. Excellence with Leadership (EwL)		8.0	
	4. Output (O)		8.0	
Research-Influence	5. Normalized impact (NI)		13.0	
Research - Innovation	6. Innovative Knowledge (IK)	PATSTAT	10.0	
	7. Patents (PT)		10.0	
	8. Technological Impact (TI)		10.0	
Research-Excellence	9. Excellence (Exc)	Scopus	2.0	
	10. High Quality Publications (Q1)		2.0	
Internationalisation	11. International Collaboration (IC)		2.0	2.0
Societal	12. Altmetrics (AM)	PlumX and Mendeley	10.0	20.0
	13. Inbound Links (BN)	Google and Ahrefs	5.0	
	14. Web Size (WS)		5.0	
Miscellaneous	15. Open Access (OA)	Unpaywall database	2.0	8.0
	16. Not Own Journals (NotOJ)	Scopus	3.0	
	17. Own Journals (OJ)		3.0	
Total	17. Indicators			100.0

on four indicators, i.e. PP Top1 per cent; PP Top 5 per cent; PP Top 10 per cent and PP Top 50 per cent.

It is opined that Leiden Ranking is not a ranking in the strict sense but rather a bibliometric information system, containing data for about more than 1000 universities bibliometric data extracted from Web of Science related to publication output, citation impact and scientific collaboration[27].

In this study the ranking based on the PP10 per cent indicator was considered for comparison purposes, since Leiden considers it as the most stable and important impact indicator.

3.8 The SCImago Institutional Rankings

The Scimago Institutions Rankings (SIR) (https://www.scimagoir.com/), launched in 2009, was developed by SCImago research group, a Spain-based research organisation consisting of members from the Spanish National Research Council (CSIC) and other education institutions in Spain. SCImago evaluates universities that have 100 or more articles in journals indexed by the Scopus. SCImago provides four rankings namely overall rank, research rank, innovation rank and societal rank for six major sectors, namely all sectors, Government, health, universities, companies and non-profit. Any of these rankings can be viewed by regions (such as Pacific Region, Asiatic Region, Eastern and Western Europe, Arab Countries), groups of countries (such as BRICS, EU-28, OECD) as well as individual countries. For this study, HEIs ranked under "University" sector was used. The SCImago Institutional Rankings uses 17 indicators mentioned in Table 8.

SIR takes data on all its indicators through publicly available third party sources, i.e. Scopus, PATSTAT, PlumX, Mendeley, Google and Ahrefs and Unpaywall database. It does not depend for data on HIEs that it ranks.

3.9 Webometrics

Webometrics (http://www.webometrics.info/en), an initiative of the Cybermetrics Lab (Spain), brings out the "World Universities Ranking on the Web" since 2004, measuring the web presence of universities around the world and comparing the size and scale of their web presence against expectations based on other rankings. The major aim of the ranking is to

Table 9. Indicators used for Webometrics - World Universities Ranking on the Web

Indicator type	Indicators	Source	Weight	Total weight
Research- influence	Transparency: Number of citations from Top 210 authors	Google Scholar Profiles	10.0	10.0
Research- excellence	Excellence: Number of papers amongst the top 10% most cited in each one of the 26 disciplines of the full database for five years (2014-2018)	Scimago	35.0	35.0
Societal	Presence: Size and number of pages of the main web-domain and subdomains	Google	5.0	55.0
	Visibility: Number of external networks linking to the institution's webpages	Ahrefs Majestic	50.0	
Total	4 Indicators			100.0

Table 10. Weightage given to different categories of indicators by ranking systems

Ranking system	Ranking Indicators									
	T & L Environ.	Research						Internation-alization	Reputation	Societal & Misc.
		Output	Influence	Excellence	Innovation	Funding	Total (Research)			
	Weightage (in %)									
ARWU		40.00		60.00			100.00			
THE	12.75	6.00	30.00		2.50	6.0	44.50	7.50	33.00	2.25
QS	20.00		20.00				20.00	10.00	50.00	
US News		15.00	17.50	32.50			65.00	10.00	25.00	
RUR	40.00	12.00	16.00			4.00	32.00	6.00	18.00	4.00
Bibliometric-based Ranking										
SIR		23.00	13.00	4.00	30.00		70.00	2.00		28.00
NTU		25.00	35.00	40.00			100.00			
Webometrics			10.00	35.00			45.00			55.00
Leiden	Leiden provides for ranking of institutions based on individual indicators. Institutions are not ranked based on cumulative score of different indicators.									

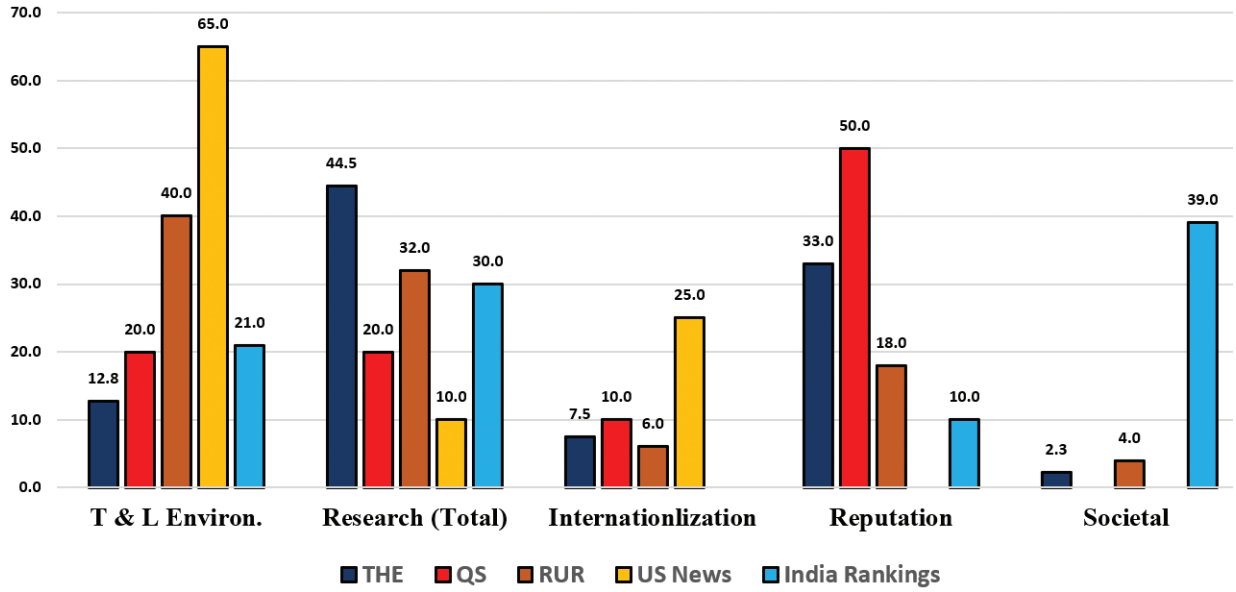

Figure 1. Weightage given to different categories of indicators by ranking systems.

Table 11. Source of data for multidimensional performance indicators-based ranking systems

Ranking System	Source of Data					
	Third Party Sources				Universities	Reputation Surveys
	Scopus*	WoS**	Thomson / PATSTAT	Total		
THE	36.00			36.00	31.00	33.00
QS	20.00			20.00	30.00	50.00
US News		75.00		75.00		25.00
RUR	28.00			28.00	54.00	18.00

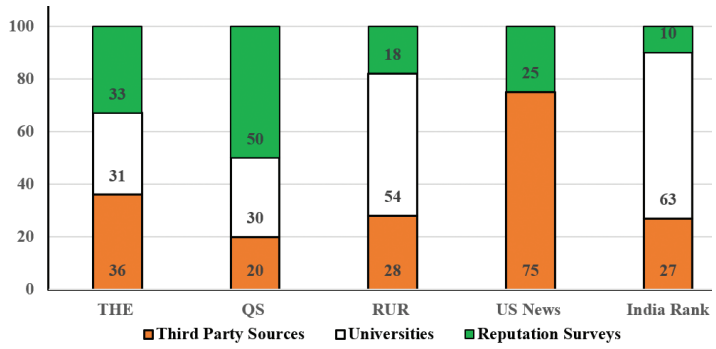

Figure 2. Source of data for multidimensional performance indicators-based ranking systems.

promote academic web presence, support open access initiatives for transfer of scientific and cultural knowledge generated by the universities to the society. The indicators correlate web measures with traditional scientometric and bibliometric indicators used in other rankings[28]. The Webometrics - World Universities Ranking on the web uses 4 indicators mentioned in Table 9.

Webometrics takes data on all its indicators through publicly available third party sources, i.e. Google, Google Scholar, SciMago, Arefs and Majestic. It does not depend for data on HIEs that it ranks.

Webometrics ranking has its own share of issues which include HEIs having multiple web-domains, web sites for multiple campuses within and outside the country, active old domains, alternative domains for different languages, frequent changes in domains of HEIs, etc. Such changes affect Webometrics ranking severely. Likewise, fake universities or non-accredited or non-approved universities may also appear in Webometrics unintentionally. Moreover, HIEs without web servers available 24/7 basis are excluded by Webometrics.[28]

4. COMPARISON OF RANKING SYSTEMS BASED ON WEIGHTAGE GIVEN TO RANKING INDICATORS

Table 10 and Fig. 1 given below provide comparison of global ranking systems described above based on weightage given to different categories of indicators used by them for ranking of HEIs. As mentioned before, indicators used by ranking systems are grouped under different categories to facilitate comparison of these ranking systems on weightage given to different categories of indicators. Major categories of indicators used for comparison are: Teaching and learning environment, research (including research-influence,-excellence,-innovation, and-funding), internationalisation, reputation / perception, societal and miscellaneous.

Table 12. No. of Indian HEIs ranked in various global ranking systems from 2010 to 2020

Ranking System	Rank Band	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ARWU*	101-500	2	1	1	1	1	1	1	1	1	1	
	500+								6	15	15	15
	Total (TNIR)	2 (500)	1 (500)	1 (500)	1 (500)	1 (500)	1 (500)	1 (500)	7 (800)	16 (800)	16 (1000)	15 (1000)
THE*	101-500			1	3	5	4	5	5	2	5	6
	500+							12	26	40	44	50
	Total (TNIR)	0 (200)	0 (200)	1 (402)	3 (400)	5 (400)	4 (401)	17 (800)	31 (800)	42 (1000)	49 (1250)	56 (1400)
QS*	101-500	8	7	10	7	7	7	9	8	8	9	9
	500+	3	2	4	4	2	5	5	6	12	15	15
	Total (TNIR)	11 (700)	9 (700)	14 (800)	11 (800)	9 (800)	12 (800)	14 (800)	14 (916)	20 (959)	24 (1000)	24 (1002)
RUR	1-100									1	1	1
	101-500	11	11	10	8	7	7	6	8	9	7	8
	500+	1	1	4	5	8	14	3	4	**7**	6	4
	Total (TNIR)	12 (567)	12 (564)	14 (635)	13 (672)	15 (687)	21 (750)	9 (693)	12 (763)	17 (783)	14 (834)	13 (829)
NTU*	101-500	2	2	2	3	2	1	1	1	1	1	
	500+								10	11	10	12
	Total (TNIR)	2 (530)	2 (531)	2 (520)	3 (532)	2 (526)	1 (529)	1 (526)	11 (814)	12 (837)	11 (835)	12 (826)
SIR*	101-500	3	2	3	5	5	5	4	8	3		
	500+	94	112	127	148	154	162	168	174	194	212	241
	Total (TNIR)	97 (2350)	114 (2481)	130 (2597)	153 (2732)	159 (2829)	117 (2890)	172 (2892)	182 (2966)	197 (3233)	212 (3471)	241 (3897)
Webometrics	101-500			1	2						1	
	500+			4	4	4	6	9	7	8	7	10
	Total (TNIR)			4 (1000)	4 (1000)	4 (1000)	6 (1000)	9 (1000)	7 (1000)	8 (1000)	8 (1000)	10 (1000)
Leiden (PP10%)$	Total (TNIR)	N/A	04 (500)		04 (500)	16 (750)	17 (750)	19 (842)	20 (903)	24 (938)	25 (963)	3 (1176)

TNIR: Total Number of Institutions Ranked

Indicators that measure teaching and learning environment (TLE) and research are considered as the most objective indicators used for capturing excellence of an HEIs for ranking them. RUR ranking allocates maximum weightage of 40 per cent to TLE followed by 20 per cent by QS. ARWU allocates 100 weightage to research followed by US News (44.50 %) and RUR (32 %).

Internationalisation (including international faculty and students) is considered as a subjective indicator and weightage assigned to this indicator by various ranking systems vary from 6 per cent to 10 per cent. Reputation or perception is considered as the most subjective indicator that can attract biased and manipulated opinions. QS allocate maximum weightage of 50 per cent to reputation (including research and teaching reputation) followed by 33 per cent, 25 per cent and 18 per cent weightage allocated by the THE, US News and RUR respectively. Lastly, RUR and THE gives 4.0 per cent and 2.25 per cent weightage to institutional income (Miscellaneous) respectively.

Bibliometric-based ranking systems, namely SIR, NTU, Webometrics and Leiden, largely calculate their rankings based on research indicators with exception of SIR and Webometrics. SIR provides 70 per cent weightage to research-based indicator, remaining 28 per cent and 2 per cent weightage is given to "Societal" indicators and internationalisation respectively. Webometrics provides 45 per cent weightage to research-based indicator, remaining 55 per cent weightage is given to "Societal" indicators including size and number of pages of

the main web-domain and subdomains, number of external networks linking to the institution's webpages.

4.1 Source of Data for Ranking of Universities

All the first four ranking systems based on multidimensional performance indicators (Table 11 and Fig. 2), except for US News depend heavily on universities for ranking exercise although data sourced from universities themselves that are to be ranked cannot be considered as reliable. It can be observed that US News source maximum of 75 per cent of data required for ranking of best global universities from third party sources followed by 36 per cent by THE and 28 per cent by RUR. While all the four ranking systems use reputation or perception survey as a ranking indicator to measure excellence of HEIs, QS assigns maximum weightage of 50 per cent to reputation survey followed by 33 per cent by THE, 25 per cent by US News and 18 per cent by RUR. The dependence of RUR for sourcing data from university is the highest, i.e. 52 per cent followed by 30 per cent by QS and 31 per cent by THE. Bibliometric-based ranking systems i.e. NTU, SIR, Leiden and Webometrics do not depend upon universities for providing data required for ranking purposes.

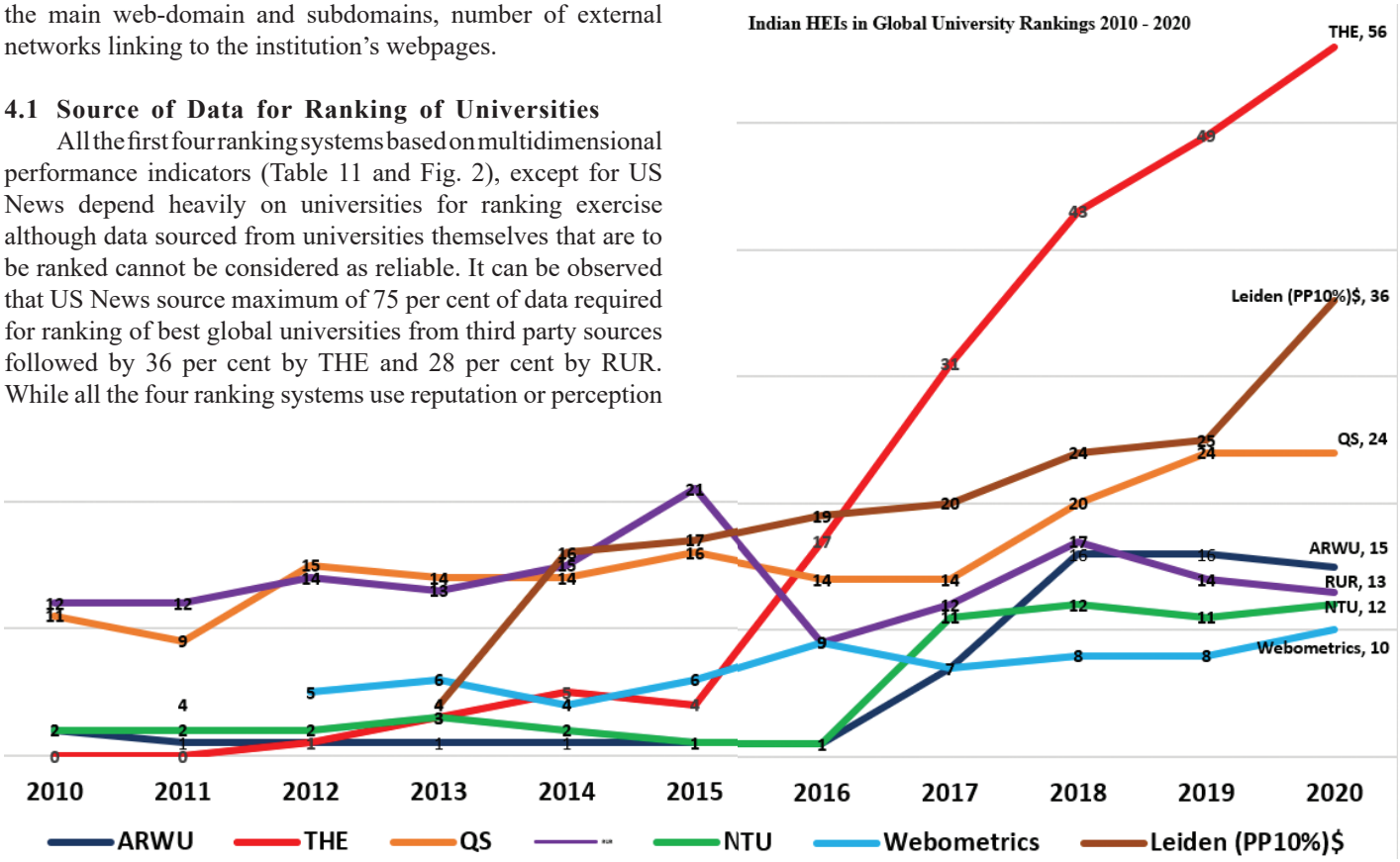

Figure 3. Number of institutions ranked in various global ranking systems from 2010 to 2020.

Web of Science (WoS) comprising of Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI) and Essential Science Indicators are used as third party sources for sourcing data on publications, citations and highly cited publications by four ranking systems, namely US News, ARWU, NTU and Leiden. Remaining four ranking systems, namely THE, QS, RUR and SIR use Scopus and InCites. Webometrics, in contrast, use Google Scholar, Google, SciMago and other third party open access resources. Only SIR use Thomson Innovation and PATSTAT for sourcing data on patents.

All bibliometric-based rankings, i.e. SIR, NTU, Leiden and Webometrics, use publicly available sources for acquiring data on publications, citation, highly-cited publications, patents, Noble laureates, links, hyperlinks, etc. Bibliometric-based ranking systems rank universities solely based on bibliometric indicators and do not depend on universities or on reputation surveys for data required for ranking purpose.

5. INDIAN UNIVERSITIES IN GLOBAL RANKING

Table 12 list number of Indian HEIs ranked in various global ranking systems from 2010 to 2020. It may be observed that the number of HEIs ranked in various global ranking systems have increased from around 200 to 700 to around 1000 to 1400 from the year 2010 to 2020, except for Webometrics and SIR that rank much larger number of HEIs. Moreover, with increase in number of HEIs ranked in global rankings systems, number of Indian HEIs ranked in these ranking systems have also increased incrementally (Fig. 3) except for RUR (Table 12, Sl. No. 4).

6. STATISTICAL CORRELATIONS AMONGST WORLD RANKING SYSTEMS

Statistical correlation amongst ranking systems described above was carried out to examine correlation amongst different ranking systems using Spearman's Rank Correlation. Statistical correlation was carries at two level, namely i) inter-correlation among different ranking systems described in this article; and ii) intra-correlation within ranking systems at intervals of five years and ten years, i.e. 2011- 2016; 2016-2020 and 2011-2020. Top 100 HEIs in each of the ranking systems were compared for their corresponding ranks in i) remaining seven ranking systems in the entire range of ranked institutions to find inter-correlation; and ii) in different years of ranking within ranking system in the entire range of ranked institutions to find intra-

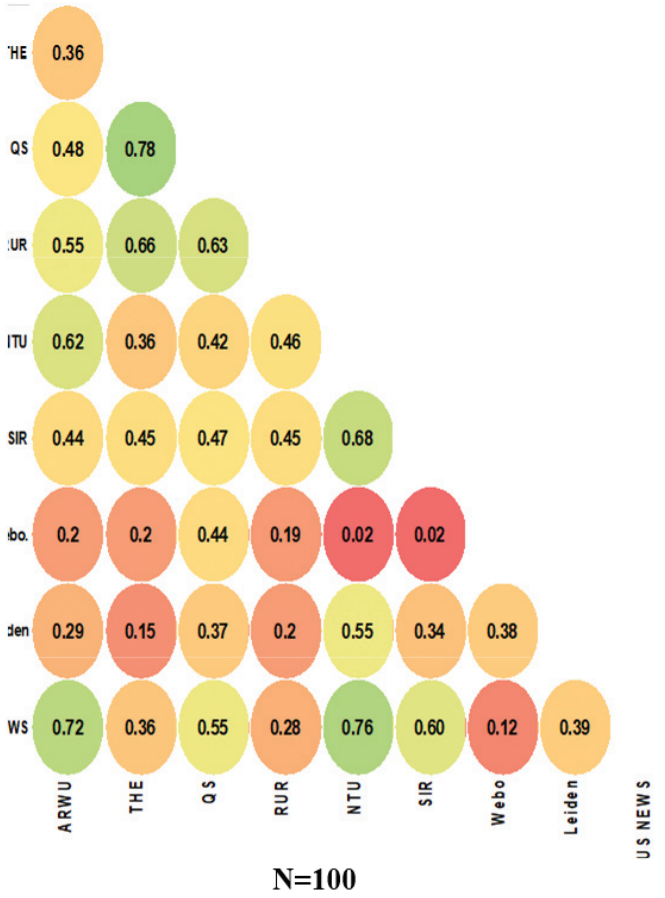

Figure 4. Spearman's correlation amongst various ranking system for the top 100 ranks.

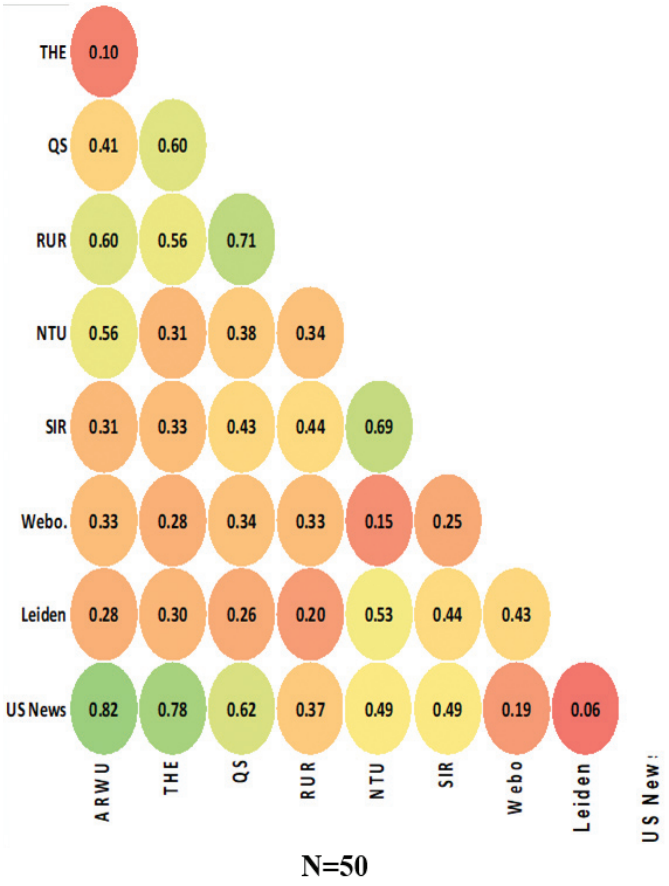

Figure 5. Spearman's correlation amongst various ranking system for the top 50 ranks.

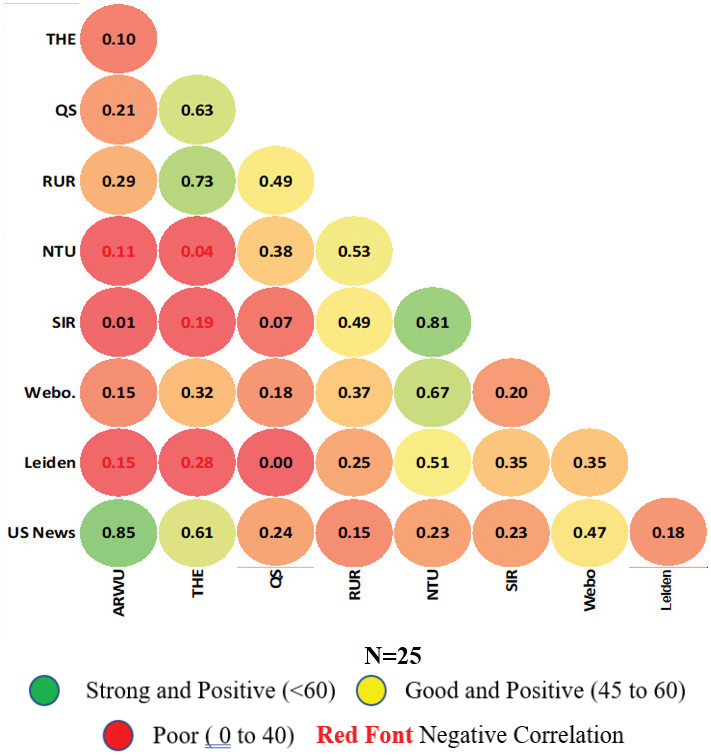

Figure 6. Spearman's correlation amongst various ranking system for the top 25 ranks.

correlation within a ranking system across years at five / ten year's interval. For example, 100 institutions ranked in ARWU in the year 2020 were compared for their corresponding rank in 1396 HEIs ranked in THE, 1002 HEIs ranked in QS and 829 HEIs ranked in RUR and so on. Likewise, top 100 institutions ranked in ARWU in the year 2011 were compared for their corresponding ranks in 500 HEIs ranked in ARWU in the year 2011 (Five years) and 1000 HEIs ranked in ARWU 2020 (ten years). Moreover, institutions ranked in rank bands were assigned the top most rank in the band i.e. HEIs ranked in rank band 101-150 was assigned "101" rank to facilitate calculation of correlation coefficient.

The rankings data for this study was taken from the web sites of different ranking system. However, Way Back Machine of the Internet Archive (https://archive.org/web/) was used for getting ranking data for ranking systems such as Webometrics and US News that do not maintain rankings for previous years on their web sites.

6.1 Inter-correlation Among Different Ranking Systems

Figure 4, Fig. 5 and Fig. 6 provides Spearman's rank correlation coefficient matrix amongst top nine global rankings systems covered in this study for first 100, 50 and 25 HEIs ranked by these ranking systems for the year 2020. Top 100 HEIs in each of the ranking systems were compared for their corresponding ranks in remaining eight ranking systems in

Table 13. Spearman's correlation within global ranking systems at interval of five years: 2011 and 2016

Ranking system	ARWU	THE	QS	SIR	Leiden	RUR	NTU	Webometrics
				Ranking years 2011-2016				
Rho	0.92	0.73	0.86	0.74	0.71	0.80	0.59	0.25
N	100	100	100	103	99	93	100	101
101-150	20	22	9	15		15	12	7
151-200	1	4	1	1		4	3	6
>201		6		1		1	1	2

Table 14. Spearman's correlation within global ranking systems at intervals of five years: 2016 and 2020

Ranking system	ARWU	THE	QS	SIR	Leiden	RUR	NTU	Webometrics	USNBGUR
					Ranking years 2016-2020				
Rho	0.95	0.89	0.97	0.72	0.04	0.77	0.80	0.64	0.88
N	100	99	101	110	98	90	99	100	96
101-150	15	13	9	19		8	8	12	12
151-200		1		5		1	1	2	
>201								2	

Table 15. Spearman's correlation within global ranking systems at intervals of ten years: 2011 and 2020

	ARWU	THE	QS	SIR	Leiden	RUR	NTU	Webometrics
				Ranking years 2011-2020				
Rho	0.89	0.69	0.83	0.63	0.08	0.70	0.64	0.35
N	100	98	99	103	99	88	101	101
101-150	20	15	14	20		14	9	12
151-200	1	4				3	2	5
>201		6	1	1		3	7	7
Average Rho	0.92	0.77	0.89	0.70	0.28	0.75	0.60	0.41

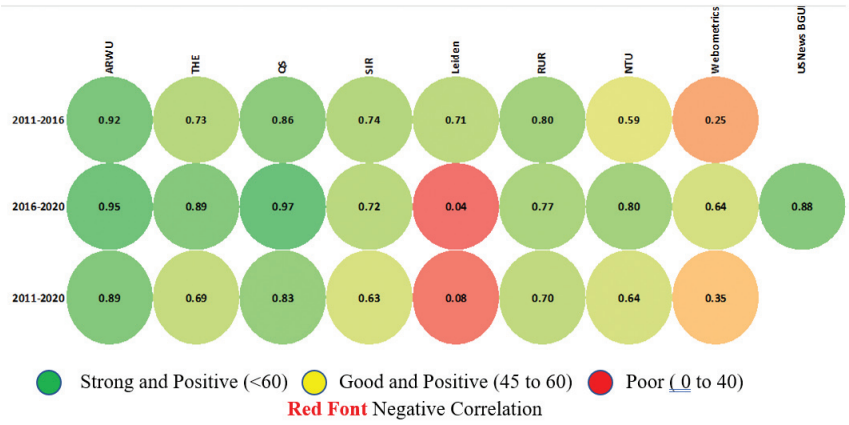

Figure 7. Spearman's correlation within global ranking systems at intervals of five years (2011 and 2016 & 2016 and 2020) and ten years (2011 and 2020).

its entire range of ranked institutions using methodology described above. As shown in Fig. 4 to Fig. 6, out of 36 instances of correlation analyses performed on the first 100 HEIs, correlation coefficient was more than 0.5 only in 12 instances (including r=0.75 only in two instances) and was less than 0.5 in remaining 21 instances. When this exercises was restricted to the top 50 institutions, slight improvement in correlation can be observed. The correlation coefficient was more than 0.5 in 26 instances (including r=0.75 in two instances) and was less than 0.5 in remaining 10 instances. It was presumed that correlation between the top 25 HEIs ranked in all global ranking systems would be positive and very strong. However, on the contrary, out of 36 instances of correlation analyses performed on the top 25 HEIs for all the nine rankings systems, only in eight instances correlation coefficient was more than 0.5 whereas in remaining 28 instances value of correlation coefficient was less than 0.5 including five cases where value of correlation coefficient is negative.

Correlation coefficient for the top 100 ranked HEIs amongst nine ranking systems ranges from minimum of 0.02 to maximum of 0.78. Maximum correlation coefficient of 0.78 can be observed between THE and QS followed by 0.76 between NTU and US News BGUR and 0.72 between US News and ARWU which reveals fairly strong correlation amongst these ranking systems. Strong correlation coefficient of 0.78 between THE and QS, the two commercial and media-owned ranking, is not surprising given the fact that both the rankings share common origin and provide maximum weightage to perception (50 per cent in case of QS and 33 per cent in case of THE) and international orientation (weightage 7.5 % in THE and 10 % in QS). Likewise, strong correlation between two ranking systems namely NTU and US News (0.76) can be attributed to the fact that while NTU ranking is based entirely on bibliometric-based indicators, US News provide 75 per cent of weightage to bibliometric based indicators. Correlation between institutions ranked by NTU and Webometrics as well as SIR and Webometrics is very weak as revealed by correlation coefficient of 0.02. It may be noted that ranking by Webometrics correlates the least with any other ranking. The correlation coefficient value for Webometrics ranking with other ranking system was >0.5 in all instances of correlation analyses conducted for the top 100, top 50 and top 25 -ranked HEIs, except for correlation coefficient of 0.67 in case correlation between Webometrics and NTU for the top 25 HEIs as given in Fig. 6. As such, it can be

concluded that correlation between various ranking system is weak with a few exceptions.

6.2 Intra-correlation within Ranking Systems

Intra-statistical correlation within nine global ranking systems at intervals of five years and ten years, i.e. 2011-2016; 2016-2020 and 2011-2020 was carried out to examine correlation amongst rankings done by the same ranking systems over a gap of five and ten years using Spearman's rank correlation. Three sets of intra-correlation exercises were carried out for all 9 ranking systems wherein the 100 top-ranked institutions in a given ranking systems in the year 2011 (base year) were compared for their corresponding rank in all institutions ranked by the same ranking system in years 2016 and 2020. Likewise, the 100 top-ranked institutions in 2016 (base year) were compared for their corresponding rank of all the institutions ranked by the same ranking system in year 2020. Since US News Best Global University Ranking (USN-BGUR) was launched in 2014, correlation analyses for USN-BGUR could be done only for the year 2016 and 2020.

Table 13, Table 14 and Table 15 and Fig. 7 provide value of correlation coefficient of nine rankings system for ranks assigned to HEIs in 2011 and 2016 and corresponding ranks assigned to these HEIs at intervals of five years and ten years, i.e. 2011- 2016; 2016-2020 and 2011-2020.

From the value of correlation coefficient given in the Table 13 to Table 15 and Fig. 7, it can be observed that intra-correlation within each ranking system is positive and very strong in most of the cases. Out of 25 instances of intra-correlation analysis conducted for various ranking systems, the value of correlation coefficient (r) in 19 cases is more than 0.5 including 10 cases where the value of r is more than 0.75, whereas value of r in 2 cases is less than 0.5. The strongest correlation exists between ranking of HEIs by QS in the years 2016 and 2020 with correlation coefficient (r) of 0.97 followed by correlation between ranking of HEIs by ARWU for the years 2016 and 2020 with correlation coefficient (r) of 0.95. The average correlation coefficient for all the three rankings, i.e. 2011-2016; 2016-2020 and 2011-2020 (r=0.92) is the highest in case of ARWU followed by QS with correlation coefficient (r) of 0.89. The lowest correlation exists between Leiden Ranking by HEIs for the Years 2011 and 2020 and for the years 2016 and 2020 with correlation Coefficient (r) of 0.08 and 0.04 respectively.

It can also be observed that average value of correlation coefficient (r) is very high for all ranking systems that rank institutions based on multidimensional performance indicators, i.e. ARWU, THE, QS and RUR. The r value for these four ranking system ranges from 0.75 in case of RUR to the maximum average of 0.92 in case of ARWU. On the contrary, average rank correlation in case of bibliometric-based ranking is lower in comparison to ranking based on multidimensional performance indicators. The value of correlation coefficient (r) for bibliometric-based ranking system ranges from the minimum of 0.08 in case of Leiden Ranking to the highest of 0.70 in case of SIR. It may also be noted that the value of N (total number of institutions that were ranked in both the years) ranges from 99 to 100 in most cases which means that same sets of HEIs are being ranked even after a gap of 5 to 10 years although their actual rank may vary. The value of N in case of RUR is 88 (2011 to 2020), 90 (2016-2020) and 93 (2011-2016). It may be noted that row no. 3 to 5 in Table 13 to Table 15 list number of institutions that were ranked amongst the 100 top-ranked institutions in 2011 (Table 13), 2016 (Table 14) and 2016 (Table 15) were pushed down to ranks ranging from 101-150, 151-200 and >201 onwards in 2016 and in 2020 respectively.

7. CONCLUSIONS

The article provides an overview of ranking systems including its historical evolution, use of rankings by different stakeholders, ranking indicators, merits and demerits of different ranking systems and performance of Indian universities in global rankings covered in this study in past one decade. The article briefly describes nine global ranking systems and compares them based on weightage assigned to different categories of indicators and source of data used for ranking of HEIs. Lastly, article provides statistical inter-correlation amongst various ranking systems as well as intra-correlation within the same ranking system at interval of five years (2011:2015; and 2016:2020) and 10 years (2011-2020) for nine global ranking systems covered in this study.

The study reveals that all ranking system are distinct in their objectives, target groups, indicators and weightage assigned to them. An analyses of ranking systems based on weightage given to different categories of indicators used by them for ranking of HEIs reveal that RUR Ranking allocates maximum weightage of 40 per cent to Teaching and Learning Environment followed by 20 per cent by QS. The USN-BGUR allocates maximum weightage of 65 per cent to Research followed by 44.50 per cent and 32 per cent by THE and RUR respectively. Reputation, considered as the most subjective indicator that can attract biased and manipulated opinions, is allocated maximum weightage of 50 per cent by QS followed by 33 per cent, 25 per cent and 18 per cent weightage allocated by the THE, USN-BGUR and RUR. Internationalisation (including international faculty and students) is considered as a subjective indicator and weightage assigned to this indicator by various ranking systems vary from 6 per cent to 10 per cent.

It is observed that Indian universities and HEIs are not doing well in most of the International rankings, moreover, it has also been observed that the number of Indian institutions appearing in different global rankings have increased over the year with increase in number of universities that are ranked by global universities rankings covered in this study.

The inter-correlation analyses done on nine global ranking system for the year 2020 reveals lack of correlation. Moreover, correlation amongst ranking systems based on bibliometric indicators is weakest amongst themselves as well as with ranking systems based on multi-dimensional indicators. However, intra-correlation within each ranking system is positive and very strong in most of the cases. Moreover, average value of correlation coefficient (r) is very high for all ranking systems that rank institutions based on multidimensional performance indicators, i.e. ARWU, THE, QS and RUR. On the contrary, average rank correlation in case of bibliometric-based ranking

is lower in comparison to ranking based on multidimensional performance indicators.

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CONTRIBUTORS

Dr Anil Kumar Nassa is currently working as Member Secretary, National Board of Accreditation, Delhi and Honorary DG of Indian Rankings Society (IRS), Delhi. His area of interest is Accreditation, Ranking and Education Administration.
In this study he has contributed to conceptualisation the idea and selection of international ranking system and statistical interpretation of analysis done in this study.

Dr Jagdish Arora is currently working as Advisor at National Board of Accreditation, Delhi. His areas of interest are Consortia-based subscription, e-Resources, Digital Library, Library Automation, e-learning, MOOCs and Rankings of HEI’s.
In this study he has contributed designing the research concept and research methodology.