Comparing university rankings

**Isidro F. Aguillo · Judit Bar-Ilan ·
Mark Levene · José Luis Ortega**

Abstract   Recently there is increasing interest in university rankings. Annual rankings of world universities are published by QS for the Times Higher Education Supplement, the Shanghai Jiao Tong University, the Higher Education and Accreditation Council of Taiwan and rankings based on Web visibility by the Cybermetrics Lab at CSIC. In this paper we compare the rankings using a set of similarity measures. For the rankings that are being published for a number of years we also examine longitudinal patterns. The rankings limited to European universities are compared to the ranking of the Centre for Science and Technology Studies at Leiden University. The findings show that there are reasonable similarities between the rankings, even though each applies a different methodology. The biggest differences are between the rankings provided by the QS-Times Higher Education Supplement and the Ranking Web of the CSIC Cybermetrics Lab. The highest similarities were observed between the Taiwanese and the Leiden rankings from European universities. Overall the similarities are increased when the comparison is limited to the European universities.

I. F. Aguillo (✉)
Cybermetrics Lab, CCHS – CSIC, Albasanz, 26-28, 28037 Madrid, Spain
e-mail: isidro.aguillo@cchs.csic.es

J. Bar-Ilan
Department of Information Science, Bar-Ilan University, 52900 Ramat Gan, Israel
e-mail: barilaj@mail.biu.ac.il

M. Levene
School of Computer Science and Information Systems, Birkbeck University of London,
London WC1E 7HX, UK
e-mail: m.levene@dcs.bbk.ac.uk

J. L. Ortega
Scientific Programming Division, VICYT – CSIC, Serrano, 113, 28006 Madrid, Spain
e-mail: jortega@orgc.csic.es

Introduction

There is increasing interest worldwide in university rankings, as can be witnessed by the growing number of annual rankings being published and by the number of conferences/workshops being held on the topic (http://www.ireg-observatory.org/). The success of these rankings is due to globalization of the higher education in which a university may internationally compete for economic and human resources. Higher education institutions are using these rankings as a promotion tool that shows their educational, research or business excellence. The number of visitors to the Rankings' websites is in the order of millions per year and many candidate students use them as a guide for choosing to which (especially foreign) institutions to apply. These advertising activities are also addressed towards increasing the potential for receiving educational funding and employing high quality scholars which allow improving the university's position in the educational market (Dill and Soo 2005; Eccles 2002). From a scientific point of view, universities need these rankings in order to increase their research performance by taking part in international research projects and attracting doctoral students and researches.

The different rankings take into account different parameters including publication and citation counts, student/faculty ratio, and percentage of international students, Nobel and other prizes, number of highly cited researchers and papers, articles published in Science and Nature, the h-index and web visibility. van Raan (2005) discussed the conceptual and methodological problems when ranking universities by bibliometric methods. These issues and methodologies were also discussed by Liu and Cheng (2005). There is an ongoing debate related to criteria for inclusion (the role of medical centers and hospitals), weightings (a priori models), variable interdependencies (correlation among bibliometric measures) and size components (classification of universities) among other topics. Scimago group is preparing a new World Ranking to be published before 2010. Some recent proposals in the European Union for developing Report Cards instead of League Tables are interesting but the costs involved are huge and the coverage proposed very limited (about one or two hundred EU universities). As an example, Webster (2001) analyzed an earlier (national) ranking published by the US News and World Report, and showed that the actual weights assigned to the different criteria are not as published, because of the interdependence of the ranking parameters.

As a result of ongoing methodological discussions and taking into account that important ranking editors are private companies (linked to newspapers or popular magazines), in 2006, the Berlin Principles on Ranking of Higher Education Institutions were published (CEPES 2006). The aim of these principles was to guarantee the quality and independence of the Rankings, but some rules raise difficulties for the adoption of methodological innovations. Liu and Cheng (2008) examine the application of these principles to some of the rankings.

In this study we consider the following rankings

- ARWU—the rankings of the Shanghai Jiao Tong University for the years 2005–2008 (http://www.arwu.org/).
- THE-QS—the rankings of the Times Higher Education Supplement for the years 2005–2008 (http://www.topuniversities.com/home/).
- WR—Web Ranking of World Universities by the Cybermetrics Lab at CSIC for the years 2006–2008 (http://www.webometrics.info/).
- HEEACT—the rankings of the Higher Education and Accreditation Council of Taiwan for the years 2007–2008 (http://ranking.heeact.edu.tw).

For ranking European universities, we also consider

• CWTS—the ranking of the Centre for Science and Technology Studies at Leiden University. We use their orange ("brute force") ranking (http://www.cwts.nl/ranking/LeidenRankingWebSite.html).

The university rankings methods

The Academic Ranking of World Universities (ARWU) is published annually by the Institute of Higher Education, Shanghai Jiao Tong University, since 2003 (http://www.arwu.org). It is the first ranking with an intended worldwide coverage that focuses in the academic or research performance of universities. The indicators include the alumni and staff winning Nobel or similar prestigious prizes, highly cited researchers in major research fields, articles published in selected top journals, articles indexed by the citation indexes produced by Thomson-ISI and performance per capita.

The THE-QS World University Rankings (THE-QS) is the only world ranking produced by a private company, Quacquarelli Symonds Limited that started to publish the rankings in 2005. The ranking (http://www.topuniversities.com) is compiled based in six distinct indicators: academic prestige according to a large survey (over 6,000 respondents in 2008), results from an employer survey, the student faculty ratio, citations per capita according to the Elsevier Scopus database, and the proportions of international professors and international students. Before 2007, they derived the citation counts from the ISI Citation indexes.

The Ranking Web of World Universities or Webometrics Ranking (WR) is done since 2004 (Aguillo et al. 2006, 2008) by the Cybermetrics Lab, a research group of the Spanish National Research Council (CSIC). They use web data extracted from commercial search engines, including the number of webpages, documents in rich formats (pdf, doc, ppt & ps), papers indexed by Google Scholar (indicator added in 2006) and the number of external inlinks as a measure of link visibility or impact (http://www.webometrics.info).

The Performance Ranking of Scientific Papers for World Universities is edited by the Higher Education Evaluation and Accreditation Council of Taiwan (HEEACT) since 2007. It is based on the number of publications and citations according to the Thomson ISI citation databases (Science Citation Index, Social Science Citation Index, Essential Science Indicators) giving special attention to the recent publications (http://www.ranking.heeact.edu.tw).

The Leiden Ranking is the result of the bibliometric research done at Centre for Science and Technology Studies (CWTS), Leiden University. First published in 2007, it started covering only European Universities (http://www.cwts.nl/ranking/LeidenRankingWebsite.html), based on the number of publications and a normalized citation ratio (a size-independent, field-normalized average impact). That means that they are using a crown indicator and not a composite index like the others Rankings. In the 2007 version only 100 European universities were ranked, but the lists published in 2008 are of length 250. They provide several rankings, here we consider their orange ("brute force") ranking based on publication counts multiplied by their field-normalized impact (van Raan 1996).

The specifics of the different rankings displayed in Tables 1 and 2 summarizes the emphases of the different rankings, it also includes the (national) rankings published by the magazines US News and World Report (USA) and McLean's (Canada). ARWU, HEEACT and CWTS are strongly based on research data, while THE-QS depend of the goodness and representativeness of a survey (strongly biased according to several sources). The main weakness of Webometrics ranking is that many universities do not have a strict web

Table 1 Methods for ranking universities

Criteria	ARWU		THE-QS		WR		HEEACT		CWTS	
Univ's analyzed	3000		2000		16000		3500		600+	
Univ's ranked	500		500+		5000+		500		250 (Europe)	
Quality of education	Alumni Nobel & Field	10%	Students/staff ratio	20%						
Internationalization			Int'l students	5%						
			Int'l staff	5%						
Size	Size of institution	10%			Web size	20%				
Research output	Nature & science	20%			Rich files	15%	Research productivity	20%	Research productivity	20%
	SCI & SSCI	20%			Google Scholar	15%				
Impact	Highly cited res'ers	20%	Citations (Scopus)	20%	(Link) visibility	50%	Research impact	30%	Normalized citations	30%
Prestige	Staff Nobel & Field	20%	Academic reputation	40%			Prestige	50%		50%
			Reputation employers	10%						

Table 2 Different emphases of the rankings

Students oriented			Research oriented		
US News & WR McLeans	THE-QS	Webometrics WR	Shanghai ARWU	Taiwan HEEACT	Leiden CWTS
Costs	Scientific output				
Opinions		Web Visibility	Impact Prizes	Impact	
Services	Prestige	Web presence	Excellence		

naming policy, frequently change web domains, use duplicate URLs and faculties or hospitals affiliated with the university are hosted by a different domain.

Comparing rankings

The above-mentioned rankings are compared using three measures, where the measures complement each other. The measures were developed by Bar-Ilan et al. (2007). The measures are the size of the overlap, the Spearman's footrule, and the *M* measure.

The simplest of the three measures is the size of the overlap (OC). It ignores the rankings and counts the number of items that appear in both lists. One of the problems when comparing two ranked lists is that the items ranked in the two lists are not identical, i.e., items that appear in list *A* do not necessarily appear in list *B* as well. When, for example, we compare the top-ten items in two ranked lists, an item ranked at position 2 in list *A* might not be in list *B* at all or it may appear after position 10. In both cases it is not considered to be an overlapping element when comparing the rankings of the top-ten positions only.

The footrule (*F*) is a well-known measure for comparing two ranked lists where the set of items in both lists are identical. Thus this measure can be applied to the set of over-lapping items only. The relative rank is assigned to each item in both lists. Thus, for example if originally both lists contained 10 elements, but only three of them, *a*, *b* and *c* appeared in both lists, and in list *A* these elements were ranked 7, 2 and 8, in the list used for computing the footrule, *a* will be ranked second, *b* first and *c* third.

The result of the re-rankings is two permutations σ_1 and σ_2 on $1 \ldots Z$ where $|Z|$ is the number of overlapping publications. Spearman's footrule on these transformations (Diaconis and Graham 1977; Dwork et al. 2001) is computed as

$$Fr^{|Z|}(\sigma_1, \sigma_2) = \sum_{i=1}^{|Z|} |(\sigma_1(i) - \sigma_2(i))|$$

When the two rankings are identical on the set Z, $Fr^{|Z|}$ is zero, and its maximum value is $\frac{1}{2}|Z|^2$ when $|Z|$ is even, and $\frac{1}{2}(|Z| + 1)(|Z| - 1)$ when $|Z|$ is odd. When the result is divided by its maximum value, $Fr^{|Z|}$ will be between 0 and 1, independent of the size of the overlap. This measure is undefined for $|Z| = 0,1$. Thus we compute the *normalized Spearman's footrule*, *NFr*, for $|Z| > 1$

$$NFr = \frac{Fr^{(|Z|)}}{\max Fr^{(|Z|)}}$$

NFr ranges between 0 and 1; it attains the value 0 when the relative ranking of the publications in the set *Z* is identical. Since we are interested in similarity measures, we define *F* as

$$F = 1 - NFr$$

The weakness of this measure is that it totally ignores the non-overlapping elements and only takes into account the relative rankings, thus for example if $|Z| = 2$, and these two items are ranked at ranks 1 and 2 in list *A*, while in list *B* they are ranked at 9 and 10 (and the first eight items are not ranked in list A), the value of *F* will be 1, just like the case where both *A* and *B* rank these two publications at ranks 1 and 2 respectively.

To overcome the problem that non-overlapping elements are totally ignored, Fagin et al. (2003) introduced a new measure. The idea is to extend the footrule, by assigning a rank to the non-overlapping elements as well. If we are comparing two rankings of size *k* then each element that appears in list *A* but does not appear in list *B* (either totally missing from *B* or ranked at position $> k$), then the element is assigned rank *k* +1. The Fagin-measure was shown to give excessive weight to non-overlapping element. In order to correct his problem, Bar-Ilan et al. (2007) introduced their *M* measure.

Let

$$N^{(k)}(\sigma_1\sigma_2) = \sum_{i \in Z}\left|\frac{1}{\sigma_1(i)} - \frac{1}{\sigma_2(i)}\right| + \sum_{i \in S}\left|\frac{1}{\sigma_1(i)} - \frac{1}{(k+1)}\right| + \sum_{i \in T}\left|\frac{1}{\sigma_2(i)} - \frac{1}{(k+1)}\right|$$

where *k* is the length of the ranked lists, *Z* is the set of overlapping elements, *S* is the set of non-overlapping elements in list *A* and *T* is the set of non-overlapping elements in list *B*.

This measure has to be normalized as well, thus

$$M^{(k)} = 1 - \frac{N^{(k)}}{\max N^{(k)}}$$

where

$$\max N^{(k)} = 2\sum_{i=1}^{k_1}\left(\frac{1}{i} - \frac{1}{k+1}\right)$$

There are several cases where there are ties in the university rankings. In this study each tied item was assigned the mid-position, i.e., if there were two items ranked 78, each was assigned rank 78.5 and if there were three items at rank 2, each of them was assigned rank 3 for the computations.

The *M* measure is a normalized similarity measure; the strength of the similarity can be interpreted similarly to the strength of the correlation measures (Black 1994). Thus we consider values below 0.2 to be negligible, values between 0.2 and 0.4 low, values between 0.4 and 0.7 medium, between 0.7 and 0.9 as high and above 0.9 as very high.

Results

Comparing the 2008 rankings for world universities

As can be seen from Table 3, for most pairs the similarity measure *M* is of medium strength. The values become higher as we consider longer lists. Most similar are Shanghai

Table 3 Similarity measures for 2008 world university rankings

2008	ARWU			THE-QS			WR			HEEACT		
	OC	*F*	*M*	OC	*F*	*M*	OC	*F*	*M*	OC	*F*	*M*
Top 10												
ARWU				7	0.58	0.60	4	0.25	0.46	4	1	0.62
THE-QS	7	0.58	0.60				2	0	**0.21**	2	1	0.46
WR	4	0.25	0.46	2	0	**0.21**				5	0.33	0.40
HEEACT	4	1	0.62	2	1	0.46	5	0.33	0.40			
Top 100												
ARWU				67	0.60	0.62	63	0.52	0.52	77	0.69	0.68
THE-QS	67	0.60	0.62				53	0.39	**0.31**	62	0.53	0.51
WR	63	0.52	0.52	53	0.39	**0.31**				59	0.53	0.48
HEEACT	77	0.69	0.68	62	0.53	0.51	59	0.53	0.48			
Top 200												
ARWU				140	0.55	0.63	129	0.57	0.53	172	0.68	0.70
THE-QS	140	0.55	0.63				123	0.40	**0.35**	138	0.53	0.53
WR	129	0.57	0.53	123	0.40	**0.35**				130	0.56	0.50
HEEACT	172	0.68	0.70	138	0.53	0.53	130	0.56	0.50			
Top 500												
ARWU				372	0.23	0.65	361	0.59	0.57	444	0.75	0.73
THE-QS	372	0.23	0.65				335	0.19	**0.40**	367	0.24	0.56
WR	361	0.59	0.57	335	0.19	**0.40**				362	0.55	0.54
HEEACT	444	0.75	0.73	367	0.24	0.56	362	0.55	0.54			

ARWU—Shanghai Jiao Tong University ranking

THE-QS—Times Higher Education Supplement ranking

WR—Web Ranking of World Universities

HEEACT—Higher Education and Accreditation Council of Taiwan ranking

Bold values indicate low similarity between QS-THE and WR

and Taiwan rankings, for lists of length 200 or more, the similarities between these two lists are considered to be high. When considering the top-500 universities these two rankings overlap on 444 items and the agreement on the ranking of the overlapping elements is also high—the *F* value is 0.75.

The two least similar rankings are the THE-QS ranking and the Webometrics ranking. Note the very small overlap between THE-QS and WR and THE-QS and HEEACT. Only two universities are common to the THE-QS and WR top-ten lists (Harvard, ranked 1st and 2nd respectively, and MIT ranked 9th and 1st respectively) and to the THE-QS and HEEACT top-ten lists (Harvard and MIT—Harvard ranked no. 1 on both lists, MIT ranked 9th and 8th respectively).

Longitudinal patterns

For the two rankings, ARWU and THE-QS there are four published rankings from four consecutive years. For these rankings, we also computed the similarity measures between the rankings published in the different years. The similarity values indicate the internal

Table 4 Similarity values for the different years in which the ARWU and the THE-QS ranking was published

Top 100	2005			2006			2007			2008		
	OC	F	M	OC	F	M	OC	F	M	OC	F	M
ARWU												
2005				97	0.94	**0.99**	96	0.93	**0.93**	95	0.91	**0.92**
2006	97	0.94	**0.99**				99	0.95	**0.93**	96	0.92	**0.92**
2007	96	0.93	**0.93**	99	0.95	**0.93**				97	0.95	**0.99**
2008	95	0.91	**0.92**	96	0.92	**0.92**	97	0.95	**0.99**			
THE-QS												
2005				82	0.75	**0.83**	74	0.64	**0.73**	73	0.64	**0.71**
2006	82	0.75	**0.83**				80	0.70	**0.81**	79	0.69	**0.78**
2007	74	0.64	**0.73**	80	0.70	**0.81**				90	0.79	**0.89**
2008	73	0.64	**0.71**	79	0.69	**0.78**	90	0.79	**0.89**			

ARWU—Shanghai Jiao Tong University ranking

THE-QS—Times Higher Education Supplement ranking

WR—Web Ranking of World Universities

HEEACT—Higher Education and Accreditation Council of Taiwan ranking

Bold values indicate low similarity between QS-THE and WR

consistency of the different rankings. In Table 4 we provide the similarity values when considering the top-100 lists.

The similarities between the ARWU rankings for the different years are very high. On the other hand the similarities between the different THE-QS rankings are much lower. The low similarities may have been caused to some extent by the switch from ISI to Scopus data for citations. We see that for the last 2 years, when Scopus data were used, all three similarity measures are higher than in previous years. Still compared to the values in Table 4, we see less internal consistency in the THE-QS rankings versus the ARWU rankings. An additional explanation could be the representativeness of the survey population that changes from year to year. Probably there is strong correlation between the number of a certain country universities and the number of this country scholars that contribute to the survey.

Top-ten universities

To illustrate the difference between the different rankings and years, all universities that were ranked among the top-ten universities for any of the rankings and any of the years are presented in alphabetical order in Table 5. There are 27 universities in Table 5, showing the diversity of the rankings. Only five are European Universities and the rest of the continents are not represented. Even the presence of the only one non-Anglo-Saxon (Ecole Polytechnique) is questionable. For limitations of the some of the rankings, and the extremely high visibility of the US universities in the rankings, see for example the discussion by Marginson and van der Wende (2007). Billaut et al. (2010) present a critical analysis of the ARWU rankings.

Table 5 Top-ten world universities (European ones in italics)—list of the universities that were ranked among the top-ten institutions in at least one of the rankings

Institution	ARWU				THE-QS				WR			HEEACT	
	2005	2006	2007	2008	2005	2006	2007	2008	2006	2007	2008	2007	2008
California Institute of Technology	6				8	7	7–8	5	35	42	40	32	31
Carnegie Mellon University	54	56	60	63	44	35	20+	21	10	13	14	177	170
Columbia University New York	7				20	12	11	10	16	15	15	9	13
Cornell University	12				14	15	20+	15	7			18	18
Ecole Polytechnique France	252	249	252	283+	10	37	28	34+	469	384	313	311	265
Harvard University	1				1				2	4	2	1	
Imperial College	23	23	23	27	13	9	5	6	137	649	215	28	27
Johns Hopkins University	19	20	19	20	27	23	15	13+	61	72+	39	2	2
MIT	5				2	4–5	10	9	3	2	1	10	8
Pennsylvania State University	39	42	43	42	64	99+	90+	105	13	5	5	31	29
Princeton University	8	8–9	8	8	9	10	6	12	39	38	25	48	42
Stanford University	3	3	2	2	5	6	19	17	4	1	3	4	3
University College London	26	26	25	22	28	25	9	7	67	55	64	24	20
University of California Berkeley	4	4	3	3	6	8	22	36	1	3	4	7	6
University of California Los Angeles	14	14	13	13	37	31	41	30+	17	20	17	5	5
University of California San Diego	13	13	14	14	42	44	58	58	26	39	34	8	10
University of California S. Francisco	18				18				136	144+	142	15	9
University of Cambridge	2	2	4	4	3	2	2–5	3	2	21	26	17	16
University of Chicago	9	8–9	9	9	17	11	7–8	8	12	14	19	26	24
University of Illinois UC	25	25	26	26	59	77	73	71	5	11	11	41	44
University of Michigan	21				36	29+	38+	18	6			6	7
University of Minnesota	32	32	33	28	150+	188	142+	87	15	12	8	22	23
University of Oxford	10				4	3	2–5	4	22	40	47	19	19
University of Texas Austin	36	39	38	39	26	32	51+	70	9	9	10	66	71+

Table 5 continued

Institution	ARWU				THE-QS				WR			HEEACT	
	2005	2006	2007	2008	2005	2006	2007	2008	2006	2007	2008	2007	2008
University of Washington	17	17	16	16	88+	84	55+	59	11	10	13	3	4
University of Wisconsin Madison	16	16	17	17	73+	79+	55+	55	8	8	9	20	21
Yale University	11				7	4–5	2–5	2	37+	37+	44	14	15

ARWU—Shanghai Jiao Tong University ranking

THE-QS—Times Higher Education Supplement ranking

WR—Web Ranking of World Universities

HEEACT—Higher Education and Accreditation Council of Taiwan ranking

Table 6 Similarity measures for rankings of European universities

2008	CWTS			ARWU			THE-QS			WR			HEEACT		
	OC	*F*	*M*	OC	*F*	*M*	OC	*F*	*M*	OC	*F*	*M*	OC	*F*	*M*
Top 10															
CWTS				7	0.75	0.86	5	0.83	0.83	6	0.33	0.63	8	0.81	**0.91**
ARWU	7	0.75	0.86				6	0.78	0.82	5	0.67	0.66	7	0.67	0.85
THE-QS	5	0.83	0.83	6	0.78	0.82				5	0.50	0.61	6	0.78	0.83
WR	6	0.33	0.63	5	0.67	0.66	5	0.50	0.61				6	0.44	0.62
HEEACT	8	0.81	**0.91**	7	0.67	0.85	6	0.78	0.83	6	0.44	0.62			
Top 100															
CWTS				83	0.67	0.81	69	0.61	0.74	66	0.48	0.56	90	0.80	**0.90**
ARWU	83	0.67	0.81				74	0.51	0.73	63	0.42	0.55	83	0.64	0.80
THE-QS	69	0.61	0.74	74	0.51	0.73				60	0.44	0.54	68	0.58	0.72
WR	66	0.48	0.56	63	0.42	0.55	60	0.44	0.54				62	0.49	0.54
HEEACT	90	0.80	**0.90**	83	0.64	0.80	68	0.58	0.72	62	0.49	0.54			
Top 200															
CWTS				174	0.73	0.82	164	0.34	0.74	150	0.52	0.58	186	0.82	**0.90**
ARWU	174	0.73	0.82				171	0.36	0.74	149	0.51	0.57	174	0.73	0.81
THE-QS	164	0.34	0.74	171	0.36	0.74				152	0.25	0.55	164	0.36	0.72
WR	150	0.52	0.58	149	0.51	0.57	152	0.25	0.55				145	0.47	0.56
HEEACT	186	0.82	**0.90**	174	0.73	0.81	164	0.36	0.72	145	0.47	0.56			

ARWU—Shanghai Jiao Tong University ranking

THE-QS—Times Higher Education Supplement ranking

WR—Web Ranking of World Universities

HEEACT—Higher Education and Accreditation Council of Taiwan ranking

Bold values indicate low similarity between QS-THE and WR

Rankings limited to the European universities

Next we limit the discussion to European universities only. This allows us to include the CWTS rankings as well in our comparisons. Here we provide the similarity values for the rankings published in 2008. The similarity measures were computed again for top-ten, top-100 and top-200 and they appear in Table 6. In the datasets the non-European universities were excluded and the remaining lists were re-ranked to provide a continuous ranking of the European universities. Turkish universities were excluded from the Leiden ranking.

Comparing the results presented in Table 3 with the results in Table 6, it is easy to see that the similarity measures when the datasets are limited to European universities are much higher than for world universities. The two most similar rankings in this case are the CWTS ranking and the Taiwanese ranking. This could be expected, because these are the two rankings that put the most emphasis on citation and publication counts and they use exactly the same bibliometric tools (ISI Thomson databases). The CWTS is based only on these two, while the HEEACT in addition to publication and citation counts takes into account the h-index, the number of highly-cited papers and the number of articles published in high-impact journals. The additional parameters used by HEEACT are also

Table 7 Top-ten European universities (grouped by country) in 2008—list of the universities that were ranked among the top-ten institutions in at least one of the rankings

University	CWTS	ARWU	THE-QS	WR	HEEACT
Catholic University of Leuven	6	54	24	59	11
Utrecht University	5	9	21	7	8
Ecole Normale Superieure Paris		22	8	79	114
Université Paris 6 Pierre and Marie Curie	11	7	58		12
Université Paris XI Sud	25	10	113		27
Imperial College	4	5	3	68	4
King's College London	20	25	5	162	21
University College London	3	3	4	6	3
University of Bristol	23	16	10.5	67	30
University of Cambridge	1	1	1	1	1
University of Edinburgh	17	13	6	8	17
University of Manchester	12	6	9	124	9.5
University of Oxford	2	2	2	4	2
Karolinska Institute	9	11	10.5	189	5
Royal Institute of Technology Sweden	96	106	71	9	131
Ludwig Maximilians Universität München	13	14	36	56	6
Swiss Federal Institute of Technology Zurich	8	4	7	2	9.5
Universität Wien	34	72	41	10	63
University of Copenhagen	10	8	13	32	22
University of Helsinki	7	19	35	3	7
University of Oslo	41	17	72.5	5	52

ARWU—Shanghai Jiao Tong University ranking

THE-QS—Times Higher Education Supplement ranking

WR—Web Ranking of World Universities

HEEACT—Higher Education and Accreditation Council of Taiwan ranking

indirectly based on publication and citation counts. It is also important to take into account that one of the sources used by HEEACT is the Essential Science Indicators, a database build using automatic identification of affiliations, a system more prone to errors than the one (manual, human controlled) used by CWTS. The other rankings consider additional aspects related to university reputation and non-research activities as well.

Top-ten European universities

In spite of the higher similarity measures for the European universities, the list of top-ten universities (i.e. universities that ranked among the first ten positions in any of the rankings) still contains 21 entries as can be seen in Table 7. When the lists are limited to the European universities only, there is total agreement between all the rankings for the top position: the best European university is Cambridge. Eleven different countries are represented in that table.

Conclusions

In this paper, we compared different world university rankings using a set of similarity measures. Taking into account that some of them are strongly based on bibliometric data (ARWU, HEEACT) and so measuring mainly research performance while others (THE-QS, Webometrics) consider also other aspects, it is not surprising that the high similarities are between the citation based measures. The THE-QS is based on a not large and not representative enough survey that means the results are biased towards certain countries (over-representation of UK or Australian universities). The Webometrics ranking is the least similar, probably because of bad practices in the web naming of universities (two or more domains, URL changes, mergers) and other activities than research are measured by their set of parameters.

From a methodological point of view, two aspects should be taken into account also in the analysis. Similarity techniques are far more demanding than correlation, so probably the figures are higher when using rank correlation. The use of ranks instead of values and the different ways these values are normalized can also explain why the tests do not provide more similar results. The second aspect relates to the inclusion criteria, as the lists of universities used by the different Rankings are not the same. For example, CWTS has a very advanced merging policy and excludes organizations with low publication performance. On the other hand, THE-QS excludes from its global ranking the biomedicine-only institutions (about 30 in the Top 500).

In the future we plan to study similarities between the rankings limited to additional subsets, e.g. Northern America, Asia and to specific countries with large number of universities.

References

Aguillo, I. F., Granadino, B., Ortega, J. L., & Prieto, J. A. (2006). Scientific research activity and communication measured with cybermetric indicators. *Journal of the American Society of Information Science and Technology, 57*(10), 1296–1302.

Aguillo, I. F., Ortega, J. L., & Fernández, M. (2008). Webometric ranking of world universities: Introduction, methodology, and future developments. *Higher Education in Europe, 33*(2/3), 234–244.

Bar-Ilan, J., Levene, M., & Lin, A. (2007). Some measures for comparing citation databases. *Journal of Informetrics, 1*, 26–34.

Billaut, J., Bouyssou, D., & Vinke, P. (2010). Should we believe the Shanghai ranking? An MCDM view. *Scientometrics.* doi:10.1007/s11192-009-0115-x.

Black, T. R. (1994). *Evaluating social science research: An introduction.* London: SAGE Publications.

CEPES. (2006). The Berlin principles on ranking of higher education institutions. Retrieved January 11, 2009 from http://www.cepes.ro/hed/meetings/berlin06/Berlin%20Principles.pdf.

Diaconis, P., & Graham, R. L. (1977). Spearman's footrule as a measure of disarray. *Journal of the Royal Statistical Society. Series B (Methodological), 39*, 262–268.

Dill, D. D., & Soo, M. (2005). Academic quality, league tables and public policy: A cross national analysis of university ranking systems. *Higher Education, 49*, 499–533.

Dwork, C., Kumar, R., Naor, M., & Sivakumar, D. (2001). Rank aggregation methods for the Web. In *Proceedings of the 10th World Wide Web Conference*, May 2001, Hong-Kong, (pp. 613–622).

Eccles, C. (2002). The use of university rankings in the United Kingdom. *Higher Education in Europe, 27*(4), 423–432.

Fagin, R., Kumar, R., & Sivakumar, D. (2003). Comparing top k lists. *SIAM Journal on Discrete Mathematics, 17*(1), 134–160.

Liu, N. C., & Cheng, Y. (2005). The academic ranking of world universities—methodologies and problems. *Higher Education in Europe, 30*(2), 127–136.

Liu, N. C., & Cheng, Y. (2008). Examining major rankings according to the Berlin principles. *Higher Education in Europe, 33*(2/3), 201–208.

Marginson, S., & van der Wende, M. (2007). To rank or to be ranked: The impact of global rankings in higher education. *Journal of Studies in International Education, 11*(3/4), 306–329.

van Raan, A. F. J. (1996). Advanced bibliometric methods as quantitative core of peer review based evaluation and foresight exercises. *Scientometrics, 36*, 397–420.

van Raan, A. F. J. (2005). Fatal attraction—conceptual and methodological problems in the ranking of universities by bibliometric methods. *Scientometrics, 62*(1), 133–143.

Webster, T. J. (2001). A principal component analysis of the US News & World Report tier rankings of colleges and universities. *Economics of Education Review, 20*(3), 235–244.