

Competing in a Globalising World: International Ranking of South African Universities

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Abstract

Rankings of higher education institutions are important for students, research administrations, industry and academics. A number of rankings are published internationally, most of which aim to identify the top universities in the world.

Developing countries are also interested for relevant rankings that could assist them to develop appropriate higher education policies.

In this article we develop a ranking approach based on citations received for articles produced by universities in a variety of scientific disciplines. The approach is relatively simple and has the potential to guide policy.

In this context this article identifies the international standing of the South African universities in the various scientific disciplines, compares them with their standing over time and elaborates on the consequences relevant to higher education and science and technology policy.

Keywords: University ranking; globalising world; citations; disciplinary assessment.

1. Introduction

There are a number of different national and international rankings of higher education institutions. Examples include those produced by the Times Higher Education Supplement (THES, 2005), by the US News and World Report (US News, 2006) and the Shanghai Jiao Tong University (2009) amongst others. Such rankings are of interest to students and others looking for universities in order to study or find employment. More importantly however, rankings have marketing and assessment characteristics. In a globalising world, students, staff and funders would prefer to associate themselves with high-ranking universities rather with low-ranking ones. Similarly, national policy-related authorities can use rankings to assess (officially or unofficially) the performance of the management of the various institutions they support.

The rankings are not without their criticisms (Bowden 2000; Dill et al 2005, Taylor et al. 2007), but their popularity and visibility remains undiminished. One criticism is that complex multi-indicator rankings are not able to assist in the development of policy/strategy guidelines. For example, in the Shanghai Jiao Tong ranking 30% of the weighing is allocated for alumni and staff of the university who have won Nobel Prizes and Fields Medals.

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Obviously university administrators will have a difficult time to identify management instruments that will bring the desirable effect in this instance – to improve their ranking.

In this article we report, and apply, a university ranking based on a single indicator – citations. While single indicator rankings may not reflect all desirable characteristics of universities, they are amenable to manipulation through appropriate management instruments.

2. Methodology

For this investigation we use the Essential Science Indicators (ESI) database of the Institute for Scientific Information (ISI) - Thomson. In its Essential Science Indicators (ESI) database ISI-Thomson provide information of the most cited institutions worldwide during the most recent 10 years. The database identifies 22 scientific fields. To compensate for varying citation rates across scientific fields, different thresholds are applied to each field. The thresholds are set in such a way as to select the top 1% of entities from each scientific field. Hence institutions appear in the dataset only if they receive citations over and above a threshold. The thresholds of the different scientific disciplines for two different 10 year periods (ending April 2005 and April 2009) appear in Table 1.

From Table 1 it is obvious that different disciplines have substantially different thresholds and that for most disciplines the thresholds are increasing over time.

Table 1: Scientific field citation threshold for institutions

Scientific field	Threshold (April 2005)	Threshold (April 2009)
Agricultural sciences	550	769
Biology & biochemistry	3 759	3 774
Chemistry	2 540	2 918
Clinical medicine	1 121	1 496
Computer science	496	845
Economics & business	1 015	1 597
Engineering	525	765
Environment/ecology	1 181	1 585
Geosciences	1 812	2 295
Immunology	3 670	3 708
Materials science	757	1 204
Mathematics	1 102	1 584
Microbiology	2 972	2 969
Molecular biol. & genetics	6 597	6 413
Multidisciplinary	516	496
Neuroscience & behaviour	3 679	3 946
Pharmacology & toxicology	1 771	1 995
Physics	3 633	4 397
Plant & animal science	959	1 223
Psychiatry/psychology	1 312	2 070
Social sciences, general	335	507
Space science	6 754	10 089

3. Rankings of South African Universities

The ESI database was interrogated in order to identify which of the South African higher education institutions were included. Seven out of the 23 South African universities were found to be present in the database.

Tables 2 and 3 show the number of citations received by the various universities in the different disciplines and the number of publications authored by those institutions respectively. Only the universities achieving the relevant thresholds, in at least one discipline, appear in the Tables.

Table 2: Number of citation of SA higher education institutions in the ESI database (Jan 1999–April 2009)

Discipline	University of Cape Town	University of Pretoria	University of the Free State	University of the Witwatersrand	KwaZulu Natal University	University of Stellenbosch	Rhodes University
Biology & biochemistry	6 788						
Chemistry	3 864			4 661		3 845	
Clinical Medicine	21 346	4 496		14 808	5 968	11 405	
Engineering	875	1 533		1 121			
Environment/ecology	8 312	3 823			2 858	4 120	
Geosciences	5 665			4 816			
Plant & animal	7 755	9 546	1 362	2 473	3 465	4 388	2 925
Social sciences general	2 748	637		2 653	729	564	
Agricultural sciences		1 001				1 182	
Immunology	5 822						
Microbiology						3 329	
Psychiatry/Psychology						2 303	

Table 3: Number of publications of SA institutions in ESI database (Jan 1999–April 2009)

Discipline	University of Cape Town	University of Pretoria	University of the Free State	University of the Witwatersrand	KwaZulu Natal University	University of Stellenbosch	Rhodes University
Biology & biochemistry	470						
Chemistry	483			537		3 845	
Clinical Medicine	2 079	555		1 509	555	11 405	
Engineering	250	533		361			
Environment/ecology	636	492		217	195	4 120	
Geosciences	617			682			
Plant & animal	1 077	1 914	340	405	403	4 388	586
Social sciences general	627	319		656	142	564	
Agricultural sciences		202				1 182	
Immunology	266						
Microbiology						3 329	
Psychiatry/Psychology						2 303	

The ranking of the higher education institutions that were included in the database and their particular disciplines appear in Table 4. The Table also indicates the number of the higher education institutions in each discipline in the database. It is shown this way that the different universities have varied presence to different disciplines. For example, the University of Cape Town has a presence in nine scientific disciplines with best ranking in environment/ecology where is ranked 114th in the World. On the other hand, Rhodes University and the University of the Free State have a presence only in the discipline of plant and animal sciences.

The Table can be read horizontally for the identification of disciplines emphasised by the majority of higher education institutions in the country (e.g. plant and animal sciences are emphasized by all universities). In comparison to Table 1, Table 4 can also identify disciplines which are underemphasised by the higher education institutions in the country.

For example, computer sciences and material sciences are absent from the list, indicating that no university in the country has reached the relevant thresholds and thus excluded from the list.

Table 4: International rankings (January 1, 1999 – April 30, 2009)

Discipline	University of Cape Town	University of Pretoria	University of the Free State	University of the Witwatersrand	KwaZulu Natal University	University of Stellenbosch	Rhodes University	Total number of institutions in ESI
Biology & biochemistry	448							687
Chemistry	771			684		774		907
Clinical Medicine	456	1 335		593	1 124	726		2 904
Engineering	955	637		802				1 039
Environment/ecology	114	286		353	353	259		515
Geosciences	202			245				429
Plant & animal	166	122	771	509	389	307	443	835
Social sciences general	197	541		204	499	594		640
Agricultural sciences		326				278		413
Immunology	192							294
Microbiology						288		313
Psychiatry/Psychology						352		367

Comparisons of the individual rankings, with the total number of institutions in the database, provide an indication of the extent to which the institutions run the danger to be dropped from the database in the foreseeable future.

4. Discussion

Indicators of scientific performance and impact are integral parts of research management and policy development internationally. In a recent article (Pouris 2006) a number of indicators have been developed positioning universities in their national context. Through those indicators research authorities can identify the concentration of particular scientific research in a particular institution, the research emphasis of the various universities and similar. The present article presents an approach according to which research authorities can get a global view of the performance of the institutions that they oversee.

In this context this article presents the results of an effort to rank the South African higher education institutions according to an indicator that can be useful for institutional and national policy. The ESI database is commercially available and contains data for 4 050 institutions from around the world.

Inclusion in the database means that the particular institution meets the minimum citation threshold and that the institution is part of the top 1% of institutions in the world in the particular discipline. Obviously university administrations will like to have a presence in as many disciplines as it is possible and as high a ranking as possible. Similarly, national authorities will wish that the institutions under their management have expertise across all scientific disciplines.

The advantage of the followed approach is that it can provide a picture of the particular institutions over time. For example Table 5 shows the South African higher education institutions during 2005 that had a ranking in the database. Comparing Tables 4 and 5 we can have a valuable inter-temporal assessment. For example the University of Cape Town had a presence in six scientific fields. During 2009 its presence increased to nine fields. Assessment can take place even within particular disciplines. For example the same university was ranked 497 in clinical medicine in 2005 whilst in 2009 it was ranked 456 in the same discipline, showing a slight improvement.

Similar observations can be relevant for national policy. For example while during 2005 there was one South African university which was ranked 521 in the world in material science whilst during 2009 there was no such university from South Africa in the database. Obviously the national authorities can undertake relevant action if they wish to have such an expertise in one of the country's higher education institutions.

Table 5: International Ranking (Jan 1995–April 2005)

Scientific discipline	University of Cape Town	University of Pretoria	University of the Free State	University of the Witwatersrand	KwaZulu Natal University	University of Stellenbosch
Biology & biochemistry	444					
Chemistry				604		
Clinical medicine	497	1 136	2 511	560	984	764
Engineering		573		778		
Environment/ecology	103	265			366	
Geosciences	207			166		
Materials science				521		
Plant & animal	188	200	489	533	271	427
Social science gen.	279			244	565	

Source: Pouris 2007

Furthermore, the ranking is per discipline, hence research administrations can have a detailed understanding of their strengths and weaknesses. Universities in developing countries have limited resources and hence they cannot advance all scientific disciplines and develop relevant profiles. The proposed approach can facilitate focused, disciplinary approaches as research authorities have the opportunity to monitor their success in particular disciplines.

It should be emphasised that the proposed approach is in accordance to the scientometric principle that citation counts can be used for evaluative purposes only after proper standardisation. As Garfield (1979) suggests “Instead of directly comparing the citation count of say, a mathematician against that of a biochemist, both should be ranked with their peers, and the comparison should be made between rankings. Using this method, a mathematician who ranked in the 70 percentile group of mathematicians would have an edge over a biochemist who ranked in the 40 percentile group of biochemists, even if the biochemist’s citation count was higher.”

A possible improvement in the intelligence that the approach provides would be the expansion of the ESI database to identify the number of citations that various universities receive in different disciplines when they are just below the relevant threshold. Such an expansion will facilitate university authorities to identify the scientific disciplines quantify the additional emphasis that they should place in order to make the grade and be included in the top one percent of the world’s universities.

As South Africa is characterised by small research groups dispersed in various universities it will be interesting to identify how possible amalgamation of research groups can alter the international ranking of the country’s institutions.

Conclusions

University rankings have found their way in institutional and national authorities internationally despite their limitations and shortcomings. A limitation of the well known rankings is that they are not discipline oriented and that they are focusing in a small tier of top universities. In this article we outline an approach which ranks more than 4000 universities internationally. An advantage of the proposed ranking is that it is discipline oriented and has direct management and policy consequences. Research authorities can identify the strengths and weaknesses of their institutions and take appropriate actions.

Application of the approach in the South African universities identifies that only 7 of the 23 universities in the country reach the relevant threshold to be among the top one percent of the world’s top universities in at least one scientific discipline. Similarly South African institutions have a presence in only 12 of the 22 scientific disciplines distinguished in the database. Finally intertemporal comparisons identify the performance of the various universities over time.

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