Methodology, meaning and usefulness of rankings

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University rankings are having a profound effect on both higher education systems and individual universities. In this paper we outline these effects, discuss the desirable characteristics of a good ranking methodology and document existing practice, with an emphasis on the two main international rankings (Shanghai Jiao Tong and THES-QS). We take a critical look at where Australian universities rank internationally.

Introduction

Globalisation, assisted by deregulation, has created the demand for international rankings. The demand originates from a range of stakeholders: students, employers, supranational institutions, scholars, funding agencies, and governments. In addition, there is public interest in rankings for their own sake, whether it be the world's most liveable city or an international ranking of the quality of financial newspapers. At the same time as this expansion in demand, developments in technology, most noticeably the World Wide Web, have facilitated the supply of information to meet demand.

International rankings are influencing decision making within institutions and even affecting national systems of education. France and Germany suffer in international rankings because quality research performance is spread over many institutions; these are often specialised and a significant number are not universities. The rankings have provided much motivation for the current policy in these countries of linking or consolidating institutions to establish larger entities.

Salmi and Saroyan (2007) note that in some countries authorities restrict scholarships for studies abroad to students admitted to highly ranked institutions. Donor agencies and foundations also look at international rankings to inform their decision making.

Within universities, Hazelhorn (2007) reports that in her international survey of leaders and senior university administrators, fifty-six per cent indicated that their institution had a formal internal mechanism for reviewing their rank. Respondents also indicated that league tables played an important role in deciding on international collaborations.

An obvious marketing benefit accrues to a university that is highly ranked in a study. But as with all forms of external appraisal there are a number of more indirect benefits. Rankings provide an incentive for better data collection within institutions, they can expose pockets of institutional weakness and confirm areas of strength, and they are useful for benchmarking against like institutions. Rankings encourage institutions to re-examine mission statements. For the university system as a whole, poor performance can be used to prod governments into action.

The effect of league tables on student choice is more complex. The consensus seems to be that for rankings targeted at school leavers their direct influence is greatest for high achievers. It seems it is overall reputation which matters for undergraduate student choice and rankings are one factor feeding in to that perception. However, Marginson (2007b) notes that market research and anecdotal evidence from educational agents indicate that the international rankings published by Shanghai Jiao Tong University are feeding directly into student choice at all levels, even though the rankings are based solely on research performance. Increasingly the international rankings are being interpreted as measuring the international standing of an institution.

In Australia, over the last two decades, the lifting of restrictions on the enrolment of fee-paying international students combined with a freezing of funding for government subsidised students has made universities heavily dependent for growth on income from international students. These students, being located far from the supplying source, need independent advice on which to base their choice of university. International rankings supply some of this need.

Ranking methodologies

At its 2006 meeting the International Rankers Expert Group (IREG) drew up the so-called Berlin principles (Sadlak and Liu, 2007, pp 25-28), a set of good practice guidelines for rankers. The principles include: use outputs rather than inputs, be transparent, use verifiable data and recognise diversity of missions.

What attributes should be used in rating or ranking a university's performance? Candidates include research output and its influence, the quality of teaching and research training, and contribution to the formulation and implementation of national policy. Different groups of stakeholders will have different interests; this implies that ratings should be undertaken separately for the different attributes before they are combined into a single measure.

The methods used to measure *research performance* in universities form a spectrum: from a survey of peers at one end to the use of quantitative measures of output only, such as publications and citations, at the other end. In the middle of the spectrum lies evaluation obtained by providing peers with representative publications and detailed quantitative information.

In evaluating the *quality of teaching* the methodology spectrum ranges from surveys of students and employers to quantitative measures such as progression rates, job placements and starting salaries of graduates. There is, however, much less agreement about the appropriate quantitative performance measures for teaching and learning than there is for research.

A university should be ranked highly if it is very good at what it does. This implies that in order to recognise institutional differences whole-of-institution rankings should either be conducted separately for different types of institutions or be obtained by aggregation of rankings at a sub-institutional level. The Carnegie Foundation in the US and Maclean's in Canada categorise universities into types. In Australia, because all universities offer PhD programs and have similar mission statements, categorisation is more problematical.

We are then left with the option of first ranking by sub-institutional unit, most commonly discipline, and then aggregating. Rankings by discipline are of value in themselves, especially to academics, postgraduate students and funding agencies. The downside of the aggregating up approach is that it requires much more detailed information, including measures of the importance of each discipline (or some other sub-institutional unit) in the university. However, not to allow for scope will bias overall rankings in favour of institutions which have disciplines where the number of publications produced per academic is large, such as in medicine. To illustrate, over the last ten years, 22 per cent of Australian publications in Thomson ISI were in clinical medicine. How much of the desire by universities to have a medical school is driven by the knowledge that this is a sure way of providing a large boost to research output with resultant dollar flows from research funding formula? In our work at the Melbourne Institute on ranking Australian universities (Williams, 2008) we found that allowing for scope improves the ranking of the more technologically oriented universities and ANU.

Disaggregation can be at various levels: research groups, disciplines, departments and faculties. It is inevitable that international rankings will be at the discipline or institutional level, especially if the rankings are based on publicly available information. Only at this level can the independent ranker sitting at a laptop obtain data on a consistent basis. In general, departments and faculties do not translate well across national frontiers: organisational structures differ too much and departmental affiliations of authors are not always known. While there are international rankings of MBA programs, these require

most information to be collected from institutions, which raises issues of consistency. While national research funding agencies may rate research groups, this requires too much detailed information for international comparisons.

The federal government Excellence in Research for Australia (ERA) initiative proposes to use discipline as the sub-institutional unit for measuring research. It will have the added benefit of encouraging universities to look at their internal departmental structures.

Categories of data

There are three categories of data: survey data, data supplied by universities, and data from third party sources such as government agencies and private sector citation data banks. The weakness of collecting data direct from universities without external moderation is that definitions may vary across institutions (for example, how part-time students are counted or whether honorary staff are included in staff numbers) and the data are subject to game playing.

Data deficiencies exist in many areas and conceptual differences exist, especially in the evaluation of teaching. This is not a reason for refusing to take rankings seriously, rather it should act as a spur to develop better measures and collect additional data.

To be useful, survey data must meet statistical standards with respect to choice of population, questionnaire design and response rate. When using surveys for evaluating standing, the validity of the results depends critically on the knowledge possessed by the respondent. Respondents with little direct knowledge of an institution will be reflecting reputation as much as current performance. Those most informed about research performance are scholars in the same discipline. At the Melbourne Institute (Williams and Van Dyke, 2008), we compared such responses with quantitative measures of research performance for seven discipline groups in Australian universities; the rankings were broadly similar by the two methods.

Quantitative measures of research performance

The obvious point to make is that the nature of research output varies greatly across disciplines. Most rankings give particular importance to publications in refereed journals, which can impart a discipline bias to rankings. *Table 1* contains estimates of the percentage of weighted output of the Australian self-designated 'Group of Eight' (Go8) research-intensive universities in selected disciplines in 2003–04. The percentages range from 95 per cent for medicine and chemistry to 25 per cent in computer science and electrical engineering (where conference papers dominate). The degree to which these differences matter in a straight count of articles published depends on the extent to which, for a given discipline, the ratio of articles to other publications differs across institutions. In any event, for a national ranking it is feasible to obtain discipline-based data on each form of output. The greatest difficulties lie in areas that are not represented in Table 1, particularly the creative and performing arts. New measures need to be developed here, preferably by those in the disciplines.

Table 1: Estimates of percentage share of weighted output in the form of journal articles, Go8 universities, 2003-2004.

Discipline	*% output articles*
Chemistry	95
Medicine	95
Mathematics/Statistics	85
Accounting	80
Physics	80
Behavioural Science	80
Finance	75
Earth Science	75
Chemical Engineering	70
Law	70
Economics	65
Philosophy	60
Education	50
Civil Engineering	40
English	40
History	40
Political Science	35
Computer Science/Electrical Engineering	25

Citation counts play an important role in most ranking schemes, either directly through citation counts or indirectly by using them to define high quality journals. Again, this methodology is most useful in the sciences where impact is more immediately clear and publication lags are short. Publication delays are a major prob-

lem in other areas: in accounting and economics, for example, citations in the top journals are not common under three or four years from the time of submission of the original article, although these lags are diminishing with greater access through the web to working papers and forthcoming articles.

Measures of learning and teaching

Few measures of performance in learning and teaching are available on a comparable basis internationally. The ratio of academic staff to students has been a traditional measure of resources devoted to teaching but is becoming less useful with technological change; the ratio also depends on the discipline mix within an institution and in Australia the presence of offshore campuses presents difficulties in measurement. Technological change also limits the value of other input measures such as library holdings. Resources devoted to teaching and research training is probably the best input measure but is one that requires some standardization of budgets to make it operational.

Output measures such as progression of undergraduate students to higher degrees and placement of PhD graduates have merit as indicators of international academic standing. The former measure is an important one for US liberal arts colleges that act as feeder schools for graduate programs in research-intensive institutions. Employment rates and remuneration on graduation are output measures used in some rankings, but these data can be seriously affected by regional factors.

Surveys of current and past students and of employers are useful provided they satisfy statistical standards in design and responses. Write-in evaluations of teachers by students, such as is available in the US at *www.RateMyProfessors.com*, provide some information to prospective students in a course but are not suitable for cross-institutional comparisons.

International comparisons of the quality of graduates are best done by international agencies such as the OECD or World Bank. The OECD is well placed to undertake this work because of its experience in measuring student performance at the school level through the Programme for International Student Assessment (PISA).

One fundamental difficulty will always remain: the quality of graduates will be reflected in their development over several decades, but this reveals little about the current quality of teaching.

Presentation of results

Some critics object to the calculation of whole-of-institution rankings on the grounds that they do not adequately reflect different institutional characteristics. A few evaluators, most notably the Centre for Higher Education (CHE) in Germany, do not give overall rankings. The validity of the criticism depends on the methodology used; aggregating up performance at the discipline level goes a long way to meeting this objection. In practice, there is a large market for a simple rating or ranking of an institution that can be obtained without additional calculation by the user. It is important however that rankers give details of the ratings/rankings on different attributes and be quite explicit about the weights so that users can use alternative forms of aggregation.

Unless evaluation is entirely by survey, an overall ranking requires the use of weights. In order to provide some objectivity in choosing weights we surveyed CEOs of the world's leading research universities and all Australian and New Zealand universities (Williams and Van Dyke, 2007). The average response gave a weight of nearly one-half to research and research training. The exact weights were: 40 per cent on quality of staff as measured by research performance, 16 per cent on quality of graduate programs, 14 per cent on quality of undergraduate programs, 11 per cent on each of quality of undergraduate intake and resource levels, and 8 per cent on peer opinion.

Rankings exaggerate small differences in performance scores and for this reason some prefer to band results as is done in the allocation of the Learning and Teaching Performance Fund in Australia. The downside of banding is that it exaggerates differences between the lowest ranked institution in one grade and the top institution in the grade below. Rating performance on a scale of say 1 to 5 is another banding technique.

The rankers

National rankings were originally supplied by newspapers and journals, particularly *US News and World Report* in the US, *The Times* ranking in the UK, *Maclean's* in Canada and *CHE/Stern/Die Zeit* in Germany. Ranking of national institutions and international comparisons have in the past few years spread to many countries including those with relatively weak higher education sectors. Surveys and evaluations of the main rankings are provided by Marginson, 2007a, Taylor and

Braddock, 2007, Van Dyke, 2005, and Usher and Savino, 2007. Salmi and Saroyan, 2007, list 34 countries for which national rankings are available; European and Asian countries predominate. Independent research groups and government agencies have undertaken much of the recent expansion in country rankings.

The nature of the rankings reflects the interests of the suppliers. Commercial newspapers and magazines concentrate on measuring the quality of teaching and learning at the undergraduate level because of the large market for this information. Governments on the other hand tend to be most interested in university research performance as they see this feeding into national economic performance. International rankings permit a calibration of national standings against the world's best universities.

Shanghai Jiao Tong

The first world ranking of universities by Professor Lui at the Institute for Higher Education at Shanghai Jiao Tong University (SJTU) in 2003 was designed to benchmark Chinese universities. The emphasis was on research performance in science and technology because it is an area in which China wishes to be strong; this emphasis also reflects the characteristics of the available databases. The bias towards English language publications in the database was not a concern – these publications have greatest influence. The SJTU annual rankings, supplemented by discipline rankings since 2007, remain the most quoted and respected international rankings. They have weaknesses, but as with the QWERTY keyboard it is hard to replace first movers even if the developers had a specific purpose in mind.

The SJTU rankings essentially measure research standing in the sciences and social sciences as measured by journal articles. The journal coverage in these areas is adequate, especially following the inclusion of more Australian journals in the last two years. However, the SJTU rankings ignore most Australian output in law and the humanities.

The criteria used all relate to research: Nobel prizes in sciences and economics and Field medal winners (20 per cent weight if on staff of institution when awarded, 10 per cent if alumni), high citation researchers (20 per cent); articles in Thomson ISI journals in science and social science (20 per cent), articles in *Science* and *Nature* (20 per cent), research performance per head of academic staff (10 per cent).

The SJTU index performs well against the Berlin principles. The index measures outputs, it is transparent, and data are verifiable. There have been limited changes in the attributes and weights used: compared with the original 2003 index, the Field medal has been added, the weight on performance per head has been reduced from 20 per cent to 10 per cent with the weight transferred to a new category of number of alumni who have been awarded the Nobel Prize or Field medal. In addition, publications in the social sciences are now given a double weight to reflect the lower publication rates in these disciplines. But research in the humanities is still effectively excluded.

The SJTU discipline rankings are in six areas: natural sciences and mathematics; engineering/technologies and computer science; engineering and IT; biomedicine, life and agricultural sciences; clinical medicine and pharmacy; and social sciences. The attributes included are similar to those used in the whole-of-institution rankings except that there is no measure of size-adjusted performance and an additional quality measure of publications is included (publication in top 20 per cent of journals as measured by citations per paper).

Times Higher Education Supplement – QS

The other main international ranking is published by *The Times Higher Education Supplement* in associated with QS career and education consultants (THES-QS). In this index 50 per cent of the weight is given to surveys of academics (40 per cent) and employers (10 per cent). Internationalisation is measured by the proportion of students and staff that are foreign (each with a weight in the index of 5 per cent). Staff-student ratios are used as a proxy for teaching quality (20 per cent) and research citations per head are given a weight of 20 per cent. The THES-QS disciplines rankings, based on peer review, are in five areas: Arts & Humanities, Engineering & IT, Life Sciences and Biomedicine, Natural Sciences and Social Sciences.

The THES-QS methodology is less transparent than SJTU although it is improving. By surveying academics and employers, the THES-QS World University Rankings cover more than research. Nevertheless, the sur-

veys suffer from a number of limitations: the response rates are low at around 1 per cent (Sowter, 2007) and the respondents not representative. For example, in 2007 peer respondents from New Zealand were the fourth highest in number and together with Australia made up 7.5 per cent of the total compared with 16.5 per cent from the USA *(www.topuniversities.com).* Respondents are asked to list the world's top universities and our research (Williams and Van Dyke, 2007, 2008) shows a home country bias.

In the quantitative data there is no control for the quality of international students or staff; there is also scope for game playing by institutions when providing data on numbers of international staff.

The THES-QS rankings show great fluctuations from year to year. This is not unexpected when 50 per cent of the weight is for survey results based on very low response rates. There is just too much noise in these data. In addition, in 2007 two important changes were introduced. First, the source of the citations data was changed from Thomson ISI to Scopus, the data bank developed by Elsevier Publishing. It is unclear how this changes the rankings, but it probably works to the advantage of European universities.

Second, and more significantly, instead of measuring performance relative to the best institution, it is now measured by looking at standard deviations about the mean value (z-transforms are used on all variables). The disadvantage of this measure is that individual scores depend on the number and nature of the universities included. For the peer surveys the responses will be bunched, with top institutions receiving high scores but with many lesser institutions scoring quite poorly. The effect when standardised is to reduce the range within the top institutions – in 2007, twenty-one institutions scored 100 whereas in 2006 there were only four universities that scored above 90. In effect the peer ranking, that has a weight of 40 per cent, is much less important for discriminating between the top institutions in the 2007 rankings than in early years.

Where do Australian institutions rank?

In the 2007 SJTU rankings, no Australian university is in the top 50 and only two, ANU and Melbourne, are in the top 100. A similar result occurs in the new rankings produced by the Higher Education Evaluation & Accreditation Council of Taiwan *(www.heeact.edu.tw)*, except that Sydney replaces ANU in the 51 to 100 group. (The Taiwan methodology is similar to that of SJTU but Nobel Prize winners are excluded.) If we look only at publications (other than *Nature* and *Science*) in the SJTU rankings, two Australian universities are in the top 50 and 4 in the top 100.

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The Melbourne Institute ranking of Australian universities (Williams and Van Dyke, 2007) uses not only research performance but also measures of teaching and research training. These rankings also try to

Table 2: SJTU country rankings 2007-08, number of institutions in top 100

Country	Science	Engineering	Life Sciences	Medicine	Social Science	Overall
USA	59	49	62	61	77	54
UK	9	7	11	12	11	11
Germany	7	1	6	6	0	6
Japan	7	7	3	2	0	6
Canada	2	6	5	6	7	4
France	5	2	1	1	0	4
Sweden	2	3	2	2	0	4
Switzerland	3	2	4	2	0	3
Netherlands	1	3	2	5	4	2
Australia	1	3	4	3	1	2

Source: http://ed.sjtu.edu.cn/ranking.htm

capture more general measures of standing through attributes such as membership of learned academies. The Melbourne Institute rankings are very similar to those produced by SJTU. The congruence of the two rankings is due to two main factors: (i) different quantitative measures of research performance are highly correlated and (ii) the variability in research performance across institutions is much greater than the variability in available measures of teaching performance so that research performance tends to dominate.

The SJTU discipline results released in February 2008 show three entries for Australian universities in the top 50: ANU in Science, and ANU and UWA in Life and Agricultural Sciences. In twelve cases, covering six universities, Australian disciplines are ranked in the top 100 in the world. Selected SJTU country rankings are given in Table 2. The Melbourne Institute rankings (Williams and Van Dyke, 2006) are broadly similar in areas that can be compared and place three Australian universities in the top 100 in the humanities.

The positions of Australian universities in the THES-QS rankings are biased upwards owing to the sample bias in the surveys and the inclusion of international student and staff numbers without quality control. To illustrate, on the transformed peer survey results, Harvard scores 100.0, ANU 99.8 and Melbourne 99.6. Five Australian universities are listed in the top 50 in the world, but none appear in the top 100 on the only quantitative research criterion used, namely, citations per academic staff member.

How should Australian universities respond to rankings?

Rankings are here to stay and will continue to gain in importance. Australian universities need to respond in two sets of ways: work to improve outcomes in the existing rankings and encourage new types of rankings.

Existing rankings are biased towards publications and citations in journals. It is therefore important that Australian journals that are comparable to those included for other countries are represented in the databases; this is a responsibility of academic editors in conjunction with publishing houses. A bias towards foreign journals will have the effect of biasing Australian research away from domestic issues.

Where other forms of publication are important, such as books in the humanities and refereed conference papers in engineering, the disciplines need to come up with robust measures that can be suggested to rankers. Electronic downloads of published and working papers are being included in some rankings, but the methodology needs improvement.

The downside of the current international rankings is that they tend to enshrine the existing homogeneity of mission statements amongst Australian universities. Realistically, only a handful of Australian universities can aspire to be in the top 100 as ranked by SJTU although a larger number can aspire to be in the top 100 in selected disciplines. Discipline rankings should be supported as they encourage vertical specialization within institutions.

Australian universities should support the development of rankings that first classify universities into groups by characteristics, especially by income. For most countries other than Australia classification by horizontal specialization, such as liberal arts colleges, research-intensive comprehensive universities etc, is very useful. When these rankings become international, it will be interesting to see the effect on the mission statements of those Australian universities that are unlikely to reach the Shanghai top 500.

There is a need in Australia for an ongoing ratings research group, at arms length from the universities and government, perhaps as a component of some form of tertiary education council. Such a group could develop methodologies that governments and universities could call upon when they wished to introduce financial incentives or gauge performance, whether in monitoring and fostering research, good teaching, evaluation of disciplines, and so on. The group could also influence the methodologies used in international rankings.

What is a world class university?

A related strand of research to ranking is: What is a World Class University (WCU) and how do you get one? To quote from the Tertiary Education Coordinator at the World Bank, Jamil Salmi (2007):

> In the past decade, the term world-class university has become a catch phrase for not simply improving the quality of learning and research in tertiary education but more importantly for developing the capacity to compete in the global tertiary education marketplace through the acquisition and creation of advanced knowledge.

In defining the attributes of a WCU, Salmi collapses the range of performance measures into a set of three factors:

> .. the superior results of these [world class] institutions (highly sought graduates, leading edge research, technology transfer) can essentially be attributed to three complementary sets of factors that can be found at play among most top universities, namely (i) a high concentration of talent (faculty and students), (ii) abundant resources to offer a rich learning environment and conduct advanced research, and (iii) favourable governance features that encourage strategic vision, innovation and flexibility, and enable institutions to make decisions and manage resources without being encumbered by bureaucracy.

How well would Australian universities fare on these criteria? On criterion (i) some Australian universities do well overall, and there are stand out discipline performers that are in the top 50 in the world. But the scores on criteria (ii) and (iii) would not be high. For example, two North American public universities ranked by SJTU in 2007 in the top 25 in the world, Wisconsin and Toronto, had income in 2006 that was much above that of the Australian university with the highest revenue (Melbourne) —Wisconsin by 90 per cent, Toronto by 60 per cent.

Salmi also notes that the very best universities are modest in size (often less than 20,000 students) and have a large percentage of students at the graduate level with very selective entry. Many Australian PhD programmes lack the critical mass that promotes peer discussion and contributes so much to the strength of US programmes. These attributes are usually missing from ranking measures.

Australia should be striving for a world class *system* of higher education. This would include some world-class universities in research, other universities with pockets of world-class disciplines, and some institutions opting to specialise in the provision of world-class undergraduate programs.

With the additional resources now being directed towards higher education in Asia and Europe it is hard to see Australian universities maintaining their relative positions internationally without an improvement in funding – from government, students and private benefactors. Does this matter? Might it be more economic, at least in some disciplines, for research students to train overseas and to buy in overseas research findings? The returns to research suggest not, and it would lead to a reduced ability to solve peculiarly Australian problems. Crucially, a slide in the international research rankings would reduce international connectedness and the quick access to new research findings that this brings.

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