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University Research Rankings : From Page Counting to Academic Accountability

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University Research Rankings: From Page Counting to Academic Accountability*

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Abstract

The globalization of the education industry and concern by governments and funding bodies for academic accountability have turned university rankings into an international game with widening participation not only from North America and Europe but from the Asia-Pacific region. This paper provides a literature review that synthesizes current international and national policies and accountability initiatives with the history of research rankings and the use of bibliometrics to produce 21st century university research rankings. It explains key bibliometric measures and how they current ranking systems apply them. It highlights the commonalities and differences in rankings over time. The growth of research from Asian universities is a positive sign for the gradual rise of Asian universities in the top lists at the same time that the best from the past remain the best of today.

Keyword: Higher Education; Universities and Colleges; Bibliometrics; Research; University Rankings

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1. Introduction

The internationalization of the education industry has resulted in a globalization of university rankings. Governments, intergovernmental organizations and funding bodies have shown a growing concern for research accountability which has moved university rankings from a national to a worldwide playing field.

Three different research streams underlie today's university research rankings.

- Concern by governmental and funding agencies over higher education accountability.
- Historical scholarly and commercial rankings.
- Bibliometrics as a methodology and its availability on the internet.

The purpose of this paper is to explore these three research streams and demonstrate their impact on today's university rankings and help readers understand "… how an arguably innocuous consumer concept has been transformed into a policy instrument, with wide ranging, intentional and unintentional, consequences for higher education and society" (Hazelkorn, 2007b).

2. National, Regional and International Policy and Accountability

The increased ability to measure and analyze scholarly output has increased the involvement of governmental and funding agencies in the rankings game. They seek methodologies that will measure universities' accountability to their funding sources and their constituencies. Salmi and Saroyan provide an overview of the of the measures discussed here and the implications of league tables on national policies in developing as well as industrialized countries (Salmi & Saroyan, 2007).

Government concern about the spending and impact of its research monies is not new. In 1965, U.S. President Johnson issued a policy statement to insure that Federal support "of research in colleges and universities contribute more to the long run strengthening of the universities and colleges so that these institutions can best serve the Nation in the years ahead" (Johnson, 1965).

A growing number of countries have initiated research assessment exercises, either directly or through evaluation bodies such as the benchmark United Kingdom Research Assessment Exercise (RAE) initiated in1992 which has used peer review. The new initiative by the Higher Education Funding Council for England incorporates bibliometric measures of research output and considers measurements of research impact(van Raan, 2007; Paul, 2008); (HEFCE, 2009). Geuna and Martin provide an overview and comparison of national evaluation bodies in Europe. (Geuna & Martin, 2001). Other active agencies are the Higher Education Evaluation and Accreditation Council of Taiwan, University Grants Committee of Hong Kong and the Australian Research Quality Framework. Most of these incorporate some form of bibliometrics into their evaluation methodology (HEEACT, 2007-; University Grants Committee, 2009; The Excellence in Research for Australia (ERA) Initiative, 2008).

While this paper is focusing on research rankings, there is also a movement by international organizations to investigate ways to measure teaching and student learning outcomes. In 2006, a group of educators and publishers (International Ranking Expert Group (IREG) met in Berlin and issued the Berlin Principles for ranking colleges and universities. The UNESCO-European Centre for Higher Education in Bucharest, Romania and the Institute for Higher Education Policy, an independent group based in Washington D.C., co-hosted the meeting (IHEP, 2006). The four categories for the 16 Berlin Principles for rankings and league tables include:

- Purposes and Goals of Rankings;
- Designing and Weighting Indicators;
- Collection and Processing of Data;
- Presentation of Ranking Results.

The guidelines aim to insure that "those producing rankings and league tables hold themselves accountable for quality in their own data collection, methodology, and dissemination (Bollag, 2006). As a follow-up, IHEP issued an evaluation of various existing ranking systems (Institute for Higher Education Policy, 2007).

The key findings of the proceedings of three assessment conferences are in the UNESCO-CEPES publication, *Higher Education in Europe*:

- Warsaw in 2002, "Institutional Roundtable on Statistical Indicators for Quality Assessment of Higher/Tertiary Education Institutions -- Ranking and League Tables Methodologies (From the Editors, 2002);
- Washington D. C. in 2004, "Ranking Systems and Methodologies in Higher Education" (Merisotis & Sadlak, 2005) including an article by Usher and Savino comparing national and global rankings (Usher & Savino, 2006); and
- Berlin in 2006, based on the IREG discussions of "Methodology and Quality Standards of Rankings" (Editorial, 2007).

The OECD Feasibility Study for the International Assessment of Higher Education Learning Outcomes (AHELO) gauges "whether an international assessment of higher education learning outcomes that would allow comparisons among HEIs across countries is scientifically and practically feasible. Planning is still ongoing, but the group developed a roadmap that outlines the various types of activities to be undertaken as part of this endeavour" (OECD Directorate for Education, 2008).

Incorporating both the Berlin Principles and the AHELO learning outcomes, the European Commission, Directorate General for Education and Culture, issued a tender to design and test the feasibility of multi-dimensional global university rankings. The envisioned ranking system aims to compare and benchmark similar institutions within and outside the EU, both at the level of the institution as a whole and focusing on different study fields (Tender: Designing and Testing the Feasibility of a Multi-Dimensional Global University Ranking, 2008; European Commission, 2008).

These approaches to university rankings are designed for countries with well developed university and research infrastructures. However, Professor Morshidi Sirat, director of the National Higher Education Research Institute at Universiti Sains Malaysia, warns countries such as Laos, Vietnam, Cambodia and Malaysia from trying to reach the ranks of the world's top universities, as measured by the current league tables. He has set up a new system, in collaboration with Southeast Asian Ministers of Higher Education, to provide alternative measures, based on the needs of the individual countries (Gooch, 2008).

3. Historical Literature Review

The appearance of *U.S. News and World Report* rankings in 1983, followed by *Business Week's* MBA rankings in 1987/8, marks the beginning of the modern era in rankings, with a shift in emphasis from faculty research output and peer review to input factors and student/faculty characteristics with a concurrent change in audience from scholars to the general public (Byrne, 1988). Governments and scholars had been publishing quality or research rankings for over 100 years. Salmi and Saroyan identify statistical annual reports published by the Commission of the US Bureau of Education from 1870-1890 that classified institutions (Salmi & Saroyan, 2007).

Pagell and Lusk's paper on business school rankings cites a series of early scholarly rankings (Pagell & Lusk, 2002). The earliest cited work, Raymond Hughes' "A Study of Graduate School of America", published on behalf of the America Council of Education. Hughes rated 19 graduate departments in the U.S., primarily Ivy League private universities and the major mid-western state universities. All but three of his initial 19 appear in one of three top 30 lists of worldwide universities today (See Table 7 below) (Hughes, 1925). Two other studies measure the quality of graduate education using Hughes' methodology (Keniston, 1959; Cartter, 1966). Magnoun compares the three studies and analyzes the consistencies and changes during the 40 year interval (Magoun, 1966). He emphasizes the importance of the rankings to university administration and the importance of quality graduate programs to the country as a whole. Dolan provides a critical analysis of the Cartter study, highlighting the importance of knowing the agenda of the authors or funding body (Dolan, 1976).

Business is an active rankings field, with today's high profile international MBA rankings following a long history of scholarly rankings, covering periods starting in 1939 and moving from peer review to tools now considered basic bibliometrics: counting publications and pages (Henry & Burch, 1974; Moore & Taylor, 1980; Niemi, 1988). Trieschmann et al, using weighted page counts from 20 journals, found a significant difference between research rankings and *U.S. News* MBA ranking ($p<.05$) (Trieschmann, Dennis, Northcraft, & Niemi, 2000).

Non-U.S. universities appear in rankings that focus on specific publications in narrow disciplines that count all articles. Klemkosky and Tuttle published two articles on finance departments, one ranking journal article pages by institution and the doctoral programs (Klemkosky & Tuttle, 1977a, 1977b). Petry examined finance by counting the percent of papers presented at major conferences (Glenn H. Petry, 1981). The *Journal of Finance* published rankings by author, doctoral program and publishing institutions to mark its 40th anniversary. Canada and Israel are represented (Heck, Cooley, & Hubbard, 1986). Petry and Settle followed up on Henry's article, including international and non-university contributors. They found that over 12% of the articles were from non-U.S. universities, but only 7% were from outside North America (Glenn H Petry & Settle, 1988).

The American Educational Research Association sponsored research rankings in the 1970s (Blau & Margulies, 1974; Schubert, 1979). Kroc introduces citation analysis for schools of education and analyzes early challenges using Social Science Citation Index (SSCI), many of which persist today(Kroc, 1984). Robinson and Adler also measure citations for universities marketing faculty and doctoral graduates(Robinson & Adler, 1981).

Kirkpatrick and Locke re-introduce peer review to productivity-based rankings to include influence and reputation as two other elements of scholarship. They track 15 management journals, citations from SSCI and Science Citation Index (SCI) for one year and peer ratings. (Kirkpatrick & Locke, 1992).

Scholarly rankings in today's higher education environment are global. Baltagi's "Worldwide Econometric Rankings" uses Econlit to rank individuals and universities, incorporating multiple journal impact factors (Baltagi, 2007). He builds on similar studies by Hall (1987, 1990). Jin has published two studies on economic rankings in East Asia relying on Econlit and page count (Jin & Yau, 1999; Jin & Hong, 2008). Two additional ranking sources use the power of the internet. University of Texas, Dallas produces "The UTD Top 100 Worldwide Business School Rankings Based on Research Contributions Between 2004-2008". It counts papers in 24 business journals. Users can create their own rankings of schools for different journals and time periods (UT Dallas School of Management, 2008). The economics open access repository RePEc

contains numerous rankings, based on authors' deposits in the repository and it allows users to create their own rankings (IDEAS Rankings, 2009).

No one ranking is "correct". However, there is a consistency across top rankings. In the scholarly surveys this paper cites, spanning 1924 to 2008, employing peer review and a variety of counting methodologies across different subject categories, a limited number of schools are number one with Harvard leading the way for the first forty years.

The rankings are only as good as one's understanding of the underlying measurements described below. In 1976, Dolan introduced the concept of rankings as a game, and this concept continues today (Dolan, 1976; Corley & Gioia, 2000; Henshaw, 2006; Meredith, 2004; Farrell & Van Der Werf, 2007). University administrators play the game by making educational decisions based on what will improve their standings in those rankings that are important to them. 63% of leaders/university administrators from 41 countries who responded to a 2006 survey under the auspices of OECD reported taking strategic, organizational academic or managerial actions in response to their rankings. The results of this survey are available in a variety publications (Hazelkorn, 2007a, 2007b; Hazelkorn, 2007; Hazelkorn, 2008; Walshe, 2007).

4. Using Bibliometric Methodology

Consumers of rankings need to check the documentation and methodology. Some articles cited above use peer review. Many use quantifiable output such as journal articles in a group of "top" journals, proceedings, number of actual pages, number of normalized pages based on characters per page or doctoral degrees by school (Cleary & Edwards, 1960). Some give full credit to each author, some distribute a percent per school by author; a few just use first author. Peer review may cover one to three years; rankings using output measures cover one year to decades. Article counts may include book reviews, editorials and comments. All of these methods have their strengths and weaknesses. In order to select the international research university ranking that reflects an organization's needs today, it is necessary to understand the bibliometrics that are used.

Peer review was the standard method for the early comparisons of university programs and departments and is still in use today. Even after Eugene

Garfield launched Science Citation Index, rankings relied primarily on counting articles and pages. Garfield originally positioned citation indexes as a subject approach to literature and a way to check the validity of an article through its cited references and he later saw broader applications for citations as evaluation tools (Garfield & Sher, 1963). Prichard coined the term "bibliometrics" to mean the quantitative analysis and statistics to scholarly outputs, such as journal articles, citation counts, and journal impact (Pritchard, 1969). Bibliometrics has become a tool for organizations, such as universities and government bodies, to measure research performance (Miyairi, 2008). Widespread use of bibliometrics is possible with easy access to articles, citations and analytical tools in both Thomson Reuters Scientific Web of Science (WOS) and its newer rival Scopus. Many individuals turn to Google Scholar.

Measurement in today's academic environment is evidence-based and as noted by Leung "There is now mounting pressure all over the world for academics to publish in the most-cited journals and rake in as many citations to their work as possible" (Leung, 2007).

Individuals, researchers, departments, universities and outside bodies are all counting output. Departments employ bibliometrics to evaluate faculty for hire, tenure and promotion decisions, using number of publications and citation counts, journal quality and additional tools such as an H-Index. Yet Moore, in the introduction to his 1981 article studying journal publications notes that "numerical quantity of research and publication is not an indicator of academic quality but simply one of many indicators of the research and writing productivity of university faculty" (Moore & Taylor, 1980).

Academic output such as articles and citations provide the data for internal and external benchmarking. Universities are using more bibliometrics for government and stakeholder reporting of output. Country level benchmarking and comparisons use bibliometrics as well.

International data in any field poses problems involving standardization and cross country comparisons. University research rankings using both quality measures such as peer review and quantity metrics compound these issues. Usher notes that "international indicators have a restricted range of possible indicators due to the lack of available cross-national comparative data" (Usher &

Savino, 2006). Federkeil adds that "The only field typified by valid international indicators is research in the natural and life sciences…." He also notes that there is no "valid concept for a global ranking of teaching quality…" (Federkeil, 2009).

Even if rankers agree to use a standard source for tracking articles or citations, there is no consensus on how to count multiple authors, authors who have changed universities and whether to take a total figure, which favors large institutions or a per faculty count favoring smaller institutions. However, a per-faculty definition has issues of its own in whom to count as a faculty and how to calculate FTE.

It is necessary to understand the strengths and weaknesses of each of the bibliometric tools when analyzing and applying them to real world situations. It is important to check the methodology, including definitions and weightings, when comparing rankings or doing time series comparisons with the same tool. Table 1 organizes the most commonly used bibliometrics for research assessment by what they measure and which sources use them.

Table 1. The Metrics

Metric	Measurements	Sources
Publications	Number of articles Number of pages Quality of journals	Web of Science Scopus Google Scholar Individual databases Individual publications
Citations	Number per article Number per faculty Number per university Quality of journal	Web of Science Scopus Google Scholar (Harzing, 2009) Individual databases (Science Direct, EBSCO, JStor, Proquest) Scholarly websites (Repec, ACM Portal)
H-Index	The number of papers with citation numbers higher or equal to the number of citations(Hirsch, 2005)	Web of Science Scopus Harzing Individual calculations
Journal Quality	Journal Impact Factor	Journal Citation Reports Journal H-Index

Source: Pagell (2008).

Other approaches use weighted averages or scores, output per capita and output by subject or country norms. They may also adjust for multiple authors from different organizations. Metrics should be stable and consistent in order to measure changes over time and be replicable for user input.

Robinson and Adler, in their early study using citations, list the advantages and costs of citation analysis which have not changed: objective; using bibliographies picks up books and other publications; shows timely impact; measures impact of one scholar's work on other scholars. Even with citation tools, it is time consuming; there are rules about what is acceptable; handling joint authors and self citations (Robinson & Adler, 1981).

4.1 Bibliometric Resources

The two major commercial bibliometrics sources are Web of Science (WOS) and Scopus. WOS is the current iteration of ISI's Science Citation Index, first printed in 1961. It includes Science Citation Index (SCI-e from 1900), Social Science Citation Index (SSCI from 1956) and Arts & Humanities Citation Index (A&HCI from 1975). It recently added Conference Proceedings in Sciences and Social Sciences and about 1,200 non-US/UK journals (Master Journal List, 2009). An institution can subscribe to any or all of the databases, for as many years as they can afford. WOS has two search interfaces: General Search and Cited Reference Search. General Search is the database of journal articles that WOS indexes. For each article, it provides both the citations in the article and the times cited. Users can create their own rankings using WOS analysis tools for authors, institutions or journals and rank output by number of articles by subject area, document type, leading authors, source titles, institutions and countries as shown in Example 1. Each individual author's information (institution, country) receives one count. Not all articles include addresses. An H-Index is also calculated.

Example 1. Ranking of Institutions Publishing Articles on Bibliometrics from 2000-2009 (Web of Science General Search, searched 1 February 2009)

Institutions Ranked by Articles	Number of Articles	Number of Citations	Countries Ranked by Articles	Number of Articles	Number of Citations
Leiden Univ.	45	525	USA	263	1658
Katholieke Univ. Leuven	36	247	Spain	183	193
Univ. Granada	33	144	England	120	753
Office Naval Research	22	249	Germany	81	376

Cited Reference Search picks up additional citations for articles or books not in a general search journal but cited in a general search record.

SCOPUS started in 2004 with citations back to 1996. It has journals and proceedings and includes its own Elsevier pre-publication articles. It has four databases for all dates included in a subscription: Health Sciences, Physical Sciences, Life Sciences and Social Sciences. Added features are author and affiliation searches (Scopus in Detail: What does it Cover?, 2009). Authors can check their name authority and affiliation to link all their articles together. SCOPUS includes analysis of citing journals, authors and institutions and an H-Index. Both Scopus and WOS are refining ways to identify authors with similar names.

Google Scholar is the third and most controversial source of citations. Younger authors favor Google Scholar for personal counting. They get more hits since it includes books, working papers and even course syllabi. Advanced search has a feature to search by author. It picks up variations of an author's name but cannot differentiate authors with the same names. It lacks analytical tools, authority control and quality control. Australian researcher Anne-Wil Harzing created her own software, Publish or Perish, to conduct citation searches in Google Scholar (Harzing, 2009). She recommends using Google Scholar for social sciences, arts and humanities and engineering which are not as well covered (Harzing & van der Wall, 2008). Other authors, such as Peter Jacsó, warn against using Google Scholar for citations (Jacsó, 2006, 2005, 2008). Meho

discusses the impact of data sources on citation counts and provides a balanced review, while pointing out the thousands of hours required for data cleansing using Google Scholar (Meho & Yang, 2007).

WOS and SCOPUS understate the number articles or citations, especially for universities that are not strong in the sciences but Google Scholar is not a viable alternative for quality university rankings. Table 2 compares features in WOS, SCOPUS and Google Scholar.

Table 2. Comparison of Key Sources

	WOS	SCOPUS	GOOGLE SCHOLAR
Publisher/ Cost	Subscription from Thomson Reuters Scientific	Subscription from Elsevier	Free
Coverage	>16000 selected scholarly journals; proceedings added in 2008	>16000 selected scholarly journals, conference proceedings	Articles, books, papers. ??
Time	Varies by subscription (1900-)	1996 for citations (started in 2004)	Not stated
Strengths	History of quality and scholarly applications Date range Scientific coverage Cited Reference Search Analytical tools	Conference proceedings Ease of use Flexible software Scientific coverage Prepub articles	Widest coverage of materials not found in peer reviewed sources
Weaknesses	Western focus/ Scientific bias Cost	Date Range Scientific bias	No quality control Cannot recognize dates Numerous errors Time consuming (Meho & Yang, 2007)
Users	Top tier institutions' Funding agencies	Scientific institutions; usage growing	Individuals
Rankings Applications	Governments Research Institutions Shanghai Jiao Tong HEEACT HEFCE	Times Higher Education and U.S. News World's Best Colleges	
Quality Control	Peer reviewed articles and proceedings	Peer reviewed articles and proceedings	None

Table 2. Comparison of Key Sources (Coritinued)

	WOS	SCOPUS	GOOGLE SCHOLAR
Citations	Citations included from non- WOS journals in cited references; cumulated counts	Only citations from SCOPUS articles Cumulated counts	Not stated; web harvesting; Manual counting
Name Identity	Building Name Authority Self Registration	Building Name Authority Automatically; needs clean-up but good start	No authority; no way to deal with common names
Add-ons	Analysis tools; ESI, JCR	Analysis tools	Harzing's Publish or Perish
Notes	EXCLUDES in General Search: Books and chapters, theses, working papers, reports ADDED: Conference papers; non-western journals	EXCLUDES cites from publications not covered within SCOPUS content ADDING :Arts & Humanities	INCLUDES: Guides, Notes, Syllabi, non-reviewed articles; best for; individual use with extensive data cleansing

Source: Pagell (2008).

WOS or SCOPUS offer quality and standardization. However, they do not reflect changes in scientific communication. Research output today appears in open access journals, repositories and on websites. The body of literature around "webometrics" is outside the scope of this article. Björneborn and Ingwersen, in a special webometrics issue of *Journal of the American Society for Information Society and Technology,* warn against taking the analogy between citation analyses and link analyses too far (Björneborn & Ingwersen, 2004).

4.2 Factors Limiting Number of Articles and Citations: Subject, Location and Language

Scientific disciplines are the strength of WOS and SCOPUS. Subject matter, language, country of origin and format understate the scholarly output in social science and humanities and put pressure on authors to publish in high impact journals at the expense of local research. Local journals or books publish scholarly output in these fields in the local language. Table 3 shows that the average citation rates in Essential Science Indicators, of the most highly cited

papers, differ by over 20 citations per article between a highly cited field such as Molecular Biology/Genetics and social sciences.

Table 3. Average Citation Rates for Papers Published by Field, 1998-2008
From Essential Science Indicators, October, 2008

Fields	1998	2001	2004	2007	All Years
All Fields	17.27	14.43	8.94	1.60	9.56
Computer Science	6.97	5.75	2.44	.53	3.00
Social Science, general	7.37	5.98	3.89	.58	3.99
Econ & business	9.98	7.21	4.33	.55	4.91
Psychiatry/Psychology	17.75	14.80	8.73	1.22	9.52
Clinical Medicine	20.10	17.16	11.15	1.97	11.61
Molecular Biology/Genetics	45.63	37.09	21.95	3.90	24.54

Table 4 illustrates the small number of Chinese articles published abroad based on data from the Network of Humanities and Social Sciences in Chinese Universities (Information Network of Humanities and Social Sciences in Chinese Universities, 2007).

Table 4. Chinese Social Science and Humanities Articles Published Abroad
Information Network of Humanities & Social Sciences in Chinese Universities -- 2001

University	B Number of Articles	C Articles Published Abroad	D Percent Published Abroad
Renmin U	2726	56	2.14
Wuhan U	2411	63	2.61
Fudan U	1982	26	1.31
Zhejiang U	1754	27	1.54
Nanjing Normal	1696	34	2.00
Peking U	1605	13	.81
Zhongshan U of Econ & Law	1575	7	.44
Jiangxi U of Econ & Finance	1488	9	.60
Xiamen U	1471	86	5.85

Sources: http://www.sinoss.net/en-us/stat/stat02.htm

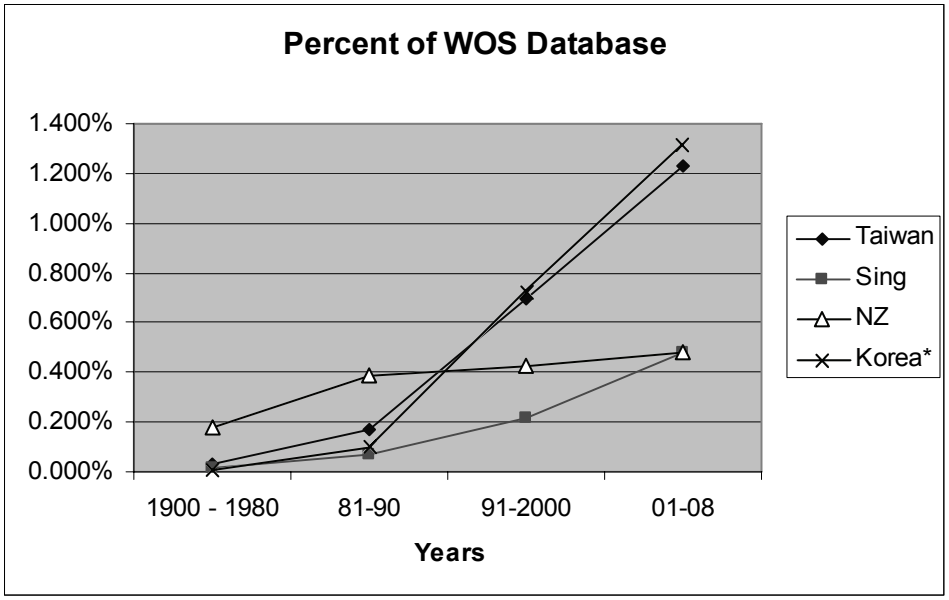
The situation is more positive in the sciences. The U.S. National Science Board tracks the growth of non-U.S. science and engineering (including social science) output in *Science and Engineering Indicators* using Thomson Scientific data.

- From 1995 to 2005, academic articles co-authored by non-U.S. authors grew by 54% and were over 25% of all S&E articles.
- Medical and biological sciences had the highest number of co-authored articles.
- The U.S. "Share top 1% cited articles" fell against all categories.
- Over 20% of all highly cited articles in engineering are from Asia 10's (inc. China, Taiwan, Korea, Singapore).
- Scientific fields such as chemistry, physics and geosciences showed over 100% growth from 1995-2005 (Academic Research and Development, 2008).

Jin and Hong, in their article ranking economics departments in East Asian universities, note that "when journal quality and sample periods were adjusted favorably to East Asian schools, the current research productivity of top-tier East Asian universities was found to be close to that of major state universities in the United States a decade ago" (Jin & Hong, 2008).

Figure 1 shows the rapid growth from less then 0.2% of WOS content in the 1900-1980 time period to over 1.2% for Taiwan and Korea with slower growth for English language Singapore and New Zealand. The number and percent of Chinese articles in WOS is growing annually and is up to 1.7% but the percent of non-science articles is less then 0.5% of all non-science articles. Growth of peer reviewed articles from Asia-Pacific as indicated in data from WOS and Science and Engineering Indicators will have a positive impact on the number of Asian-Pacific universities appearing in the research rankings.

Figure 1. Growth of Asian-Pacific Articles in Web of Science from 1900-2008



Source: Web of Science searched November 2008.

5. Contemporary International University Ranking or League Tables

Many countries publish national rankings which are tools for their own students, faculty and funding bodies. As noted in the history section, academic journals continue to publish scholarly rankings focusing on one subject area while commercial publishers create rankings of worldwide MBA programs. With the internationalization of education at an organizational level, institutions and even countries compete for students and researchers and not surprisingly, this has led to international ranking systems. Commercial sources, universities and evaluation authorities compile today's university rankings that include research components.

- THE-QS "World University Rankings" (2004-);
- Shanghai Jiao Tong University "Academic Ranking of World Universities" -- ARWU- (2003);
- HEEACT's "Performance Rankings of Scientific Papers of World Universities" (2007-);

- U.S. News and World Report republished THE-QS as "World's Best Colleges and Universities" (2008);
- Leiden Rankings 2008.

The methodology for THE (Times Higher Education) rankings belongs to QS, Quacquarelli Symonds, a UK educational consultancy and the weightings are provided by THE. Consumers and university administrators are the target markets. It specifically states that it is ranking first degree programs. Research rankings based on publications and citations differ from the THE-QS comprehensive ranking; 21 of the top 50 universities are from Commonwealth or former Commonwealth countries, compared to 8 in ARWU and 7 in HEEACT (THE-QS, 2005-).

Shanghai Jiao Tong's Center for World-Class Universities designed ARWU for Chinese Universities to highlight the need for them to improve their international research visibility. It includes Nobel Prize winners in two indicators, uses Thomson Reuters bibliometric data and counts articles from *Nature* and *Science* for all but those schools strongest in social sciences (ARWU, 2003-; Liu & Cheng, 2005).

Higher Education Evaluation and Accreditation Council of Taiwan designed their ranking as a "benchmarking tool for research universities in transitional and newly developed countries in assessing the achievement of science research" (HEEACT, 2007-). HEEACT is also working on a College Navigator System, incorporating the Berlin Principles, for use by college-bound students (HEEACT, 2009).

Recognizing the need to internationalize the market for North American college -- bound students, *U.S. News and World Report* republished the Top 200 from THE-QS in 2008. According to Robert Morse, *U.S News* is working together with QS (World's Best Colleges and Universities, 2008; Morse, 2009).

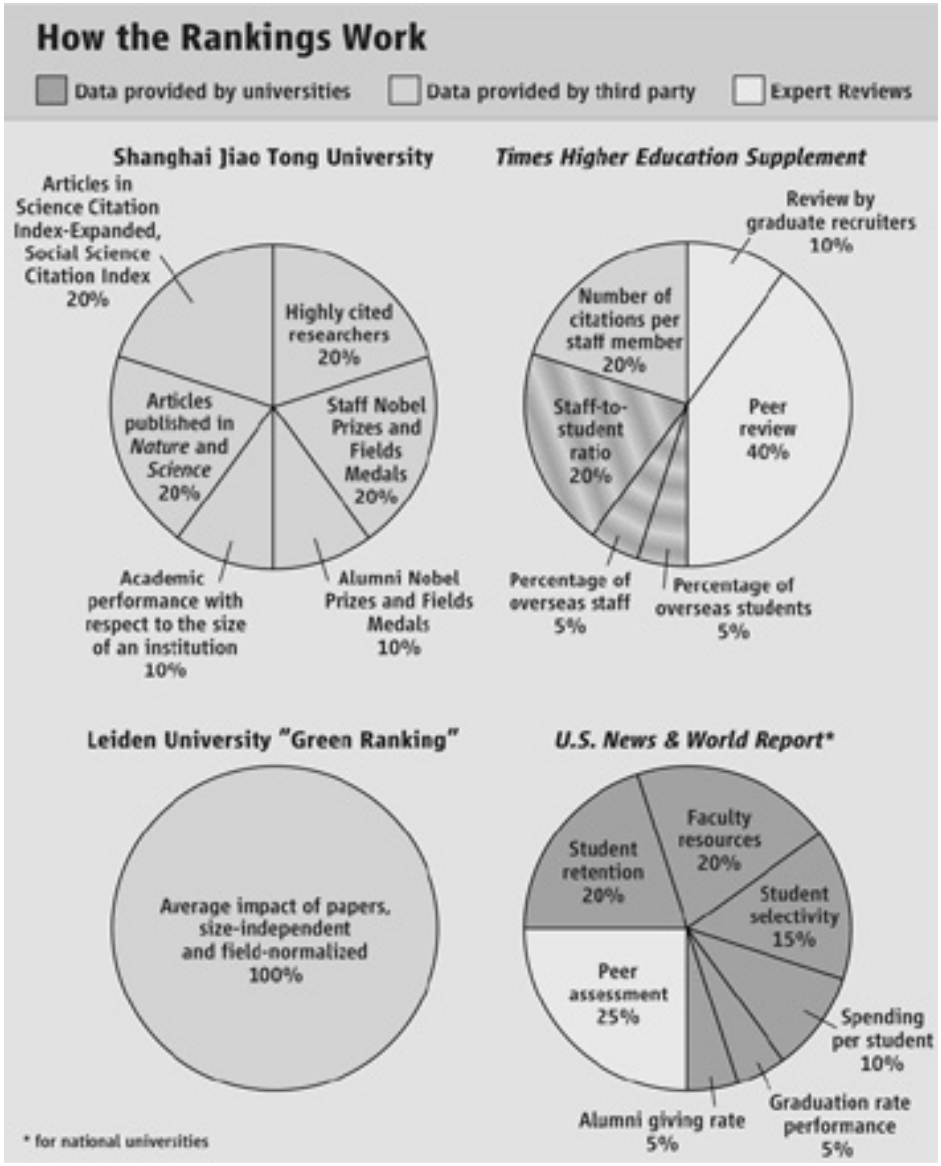
Researchers at Leiden University's Center for Science and Technology Studies (CWTS) developed their own ranking system using bibliometrics indicators. It includes all 1,000 universities worldwide which have more then 700 Web of Science indexed publications per year. CWTS has four rankings categories for the top 100 and 250 for Europe (2000-2007) and the World (2003-2007). The Green ranking factors in size of the institution, differences in subject

field and impact measured by citations per article (Leiden Ranking 2008, 2008).

- Yellow: Ranking by size, number of publications (P);
- Green: Ranking "by the size-independent, field normalized average impact" (CPP/CSm) -- the crown ranking;
- Orange: Ranking by the size dependent 'brute force' impact indicator (Yellow times Green) (P * CPP/CSm);
- Blue -- Citations per publication (CPP) -- not normalized by field.

The Berlin Principles emphasize the importance of accountability for the rankers, not only the institutions they are ranking. Quality of rankings has attracted authors from such prestigious journals as *Chronicle of Higher Education*, *Nature* and *Science.* The articles report on the rise of rankings outside the U.S., with a special article on Shanghai Jiao Tong, and also examine the effect of rankings on university behavior (Bollag, 2007; Labi, 2008; Farrell & Van Der Werf, 2007; Hvistendahl, 2008; Declan, 2007; Mishra, 2008). Enserink, in his article in *Science* "Who Ranks the University Rankers", examines the various international rankings. In Figure 2, Enserink compares the national rankings from *U.S. News* and *Time Higher Educational Supplement* and international rankings from Shanghai and Leiden.

Figure 2. How Rankings Work



Source: Enserink (2007).

Table 5 summarizes different aspects of rankings, with emphasis on identifying the target audience for the rankings, the availability of the sources of these rankings and the types of indicators that are used.

Table 5. Rankings Sources and Uses

Ranking Sources	Target Audience	Availability	Summary of Indicators
Scholars by Discipline (see history section)	Used within field for hiring, promotion	Published in scholarly journals; limited readership	Number of articles, pages, PhDs, Editorial Board members
Bibliometricians (Leiden University)	Scholarly research; hired as consultants	Published in special journals; papers on the web	Citations, h-factor; journal impact; weighted averages
Commercial publishers (*Times Higher Education.., U.S. News*…	National and international rankings of universities; MBA programs	Consumer market in popular publications	University level; Demographics of faculty, students
Commercial databases (Thomson Reuters Scientific; SCOPUS)	Universities and government; internal and external evaluations; Authors, Countries	Internet (WOS, ESI; JCR)	Citations; highly cited; Journal impact; H-Index; analysis tools
Universities (Shanghai Jiao Tong)	Scholarly and commercial audience	Internet	Either scholarly or university metrics or a mix
Governmental; Non-Governmental (HEEACT, OECD Project)	Government; funding bodies Accountability; Standardization	Internet	Bibliometrics; learning outcomes

An overview of international university rankings with many more plusses and pitfalls then mentioned in this paper is available in HEEACT's "2008 International Symposium on International Rankings" featuring *U.S. News* data research head Robert Morse, who has been at *U.S. News* since 1976 (Morse, 2008). Other noted speakers were from Germany, Taiwan and Canada (2008 International Symposium Ranking in Higher Education on the Global and National Stages; Federkeil, 2008; Huang, 2008; Usher, 2008).

Table 6 summarizes the methodologies of the key international ranking, as described above. It illustrates the differences in metrics and weights of the various indicators. More information on methodology is available from the websites in the last row of the table.

Table 6. Methodology of Different International Rankings

THE -- QS World University Rankings (and U.S. News)*	**Shanghai Jiao Tong Academic Ranking of World Universities**	**HEEACT Performance Rankings of Scientific Papers**
Academic Peer Review 40% Survey (current response past 3 years) **Employer Review 10%** Survey (current response in past 3 years) **Citations per Faculty 20%** **Student-Faculty Data 30%** Student / Faculty ratio (20%) International Faculty (5%) International Students (5%) * U.S. News uses THE-QS methodology	**Quality of Education 10%** Alumni (with any degree winning Nobel prize or Fields Medals **Quality of Faculty/Staff** winning Nobel Prize or Field Medals **20%** Highly Cited **20%** **Research Output 50%** Articles in *Nature* and *Science* (20%)** Articles in SCI-e and SSCI prior year (20%) Articles per capita (10%) **For institutions social sciences and humanities universities, *Nature* and *Science* points are reallocated	**Research Productivity 20%** Articles (11 yrs) (10%) Articles current yr (10%) **Research Impact 30%** # citations 11 yrs (10%) # citations 2 yrs (10%) Avg cites 11 yrs (10%) **Research excellence 50%** H-Index 2 yrs (20%) Highly cited papers 11 yrs (15%) Current yr articles in high impact journals (15%)
Citations from last 5 yrs of Scopus (2007- Citations from ISI (2004-2006)	W WOS;WOS, excludes A&HIS; ISI Highly cited; Nature and Science from WOS	WOS; ESI, JCR excludes A&HIS
16 October 2008	18 August 2008	28 August 2008
/w.topuniversities.com/	http://www.arwu.org/rank2008/EN2008.htm	http://ranking.heeact.edu.tw/en-us/2008/Page/Methodology

Using 2008 Shanghai Jiao Tong (ARWU) as the basis, and bringing in the top ten from the 2008 rankings from HEEACT, THE-QS and Leiden Green, 19 universities make up the top 10 for all four lists; 9 are on Hughes original top 19 from 85 years ago; four are on all lists; and only Harvard is top 10 on all list. It is interesting to note the similarities among the four schemes and between the international lists and Hughes original 1,925 rankings. Internationalization brings UK universities into the top 20 and time has shifted the U.S. balance for public institutions from the mid-west to California. Two top technology universities are in the top tier.

Table 7. Comparative World University Rankings Based on Top 10 from ARWU

	ARWU (50% Bibliometric (Thomson Reuters)	HEEACT (100% Bibliometric (Thomson Reuters)	THE-QS (20% Bibliometric; 40% Peer review; SCOPUS)	HUGHES Grad Programs 1925 (Peer review)	Leiden Green (WOS)
Harvard	1	1	1	2	4
Stanford	2	3	17	14	3
U C Berkeley	3	6	36	9	2
Cambridge	4	16	3		27
MIT	5	8	9		1
Cal Inst Technology	6	31	5		5
Columbia	7	13	10	3	13
Princeton	8	42	12	6	
University of Chicago	9	24	8	1	6
Oxford	10	19	4		30
Yale	11	15	2	5	10
UCLA	13	5	30		12
UC San Diego	14	10	58		9
Univ Washington	16	4	59		8
UC San Francisco	18	9	Not listed		7
Johns Hopkins	20	2	13	7	11
Univ Michigan	21	7	18	8	15
Univ Col London	22	20	7		44
Imperial Col London	27	27	6		37

Source: From websites listed in Table 6 (Leiden Ranking 2008, 2008; Hughes, 1925).

The evaluating bodies list universities by their rank, based on an underlying scoring system. Table 8 shows the importance of checking underlying scores to get a better understanding of what it means to be one or 100. It shows the scores for universities 1, 2 and 100 and the percent of separation from 1st to 100th. For example, in THE-QS/U.S. News rankings the first and 100th university show a 31.4 difference in scores while in the HEEACT rankings the first and 100th universities are over 79% apart.

Table 8. Scoring Differences among Ranking Schemes for Universities 1, 2 and 100

RANK /Score	1	2	100	% from 1 - 2	% from 1-100
THE-QS /U.S. News	100	99.8	66.6	0.2	31.4
ARWU	100	73.7	24.1	26.3	75.9
HEEACT	96.27	50.93	19.96	55.4	79.3
LEIDEN	2.44	2.28	1.33	23	45.5

Source:

Only U.S. and U.K. universities are in the top ten lists. Several Asian universities are in the top 100, with the strongest showing from Japan. Table 8 lists Asia's top 10 from the same four rankings.

Table 9. Top 10 Asian Universities (ex. Israel) in 2008

Rank	ARWU (1-6 in top 100)	HEEACT (1-6 in top 100)	THE-QS (13 in top 100)	Leiden Gteen (0 in top 100)
1	Tokyo	Tokyo	Tokyo	U Hong Kong
2	Kyoto	Kyoto	Kyoto	Tokyo
3	Osaka	Osaka	U Hong Kong	Ntl U Singapore
4	Tohoku	Tohoku	Ntl U Singapore	Osaka
5	Kyushu	Seoul Ntl U	HKUST	Kyoto
6	Nagoya	Ntl U Singapore	Chinese U (HK)	KAIST
7	Ntl U Singapore	Nagoka	Osaka	Tokyo Inst Tech
8	Tokyo Inst Tech	Kyuahu	Peking	Yonsei
9	Hokaido	Ntl U Taiwan	Seoul Ntl U	Tohoku
10	Ntl U Taiwan	Tokyo Inst Tech	Tsinghua	Seoul Ntl U

Source: Extracted from sources in Table 7.

Many other organizations provide national evaluation and rankings. A list is available at http://ranking.heeact.edu.tw/en-us/2008/Page/Link.

6. Conclusion

Today's university rankings combine a variety of methodologies, including faculty or student input data, research output data and peer review. The research rankings are as narrow as a few journal titles in a discipline or as broad as all publications in Web of Science or Scopus. Countries have their own national commercial rankings. International organizations are seeking a new approach to measure learning outcomes and research impact.

Government organizations and funding bodies require measures that evaluate quality of scholarly output as well as quantity. Commercial and academic publishers and faculty researchers are creating new and more complex measuring tools to meet these needs. A higher level of accountability is expected from the research producers. A higher level of accountability is also needed by the consumers of the metrics used to evaluate the outputs.

Despite the different methodologies, the external pressures and internal maneuvering, there are two somewhat conflicting conclusions: Many of the historical best continue to dominate the top of the rankings; and many new faces, including a growing presence from Asia are joining the elite.

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