

## By What Criteria Might Research and Innovation in the Public and Private Post-Secondary Sector be Measured?

### Overview

The objective of this question scan was to locate research of potential relevance to the assessment of research and innovation in post-secondary institutions. The topic was divided into two related questions:

- a) What criteria might be used to effectively measure research and innovation in post-secondary environments?
- b) What are the strengths and limitations of the various methods?

An initial search employing a broad range of search terms in four appropriate databases yielded 303 articles potentially relevant to the stated questions. Subsequent examination of article abstracts reduced the number to 146. In many of the reviewed articles the measurement of research and innovation productivity was incorporated into examinations of methods used for larger, institutional assessments, for example, Banta (1994), and Brennan and Shaw (2000). While the majority of articles came from the United States there is ample evidence that the European community has recently invested a great deal of time and effort in evaluating research, for example, Westerheijden (1997), Boffo, Kaukonen, and Opdal (1999) and Morgan (2001).

### Question 'a'

The literature indicates that universities and colleges increasingly find external influences like social and economic values carrying greater weight in academic life, for example Brennan and Shah's (2000) *Quality assessment and institutional change: experiences from 14 countries*. In general, most journal articles address the notion of evaluation by focusing on a particular assessment model. While there are an ample number of articles reporting on the various models being applied to institutional assessment, there is little quantitative research directly addressing the validity of criteria being employed by individual assessment models.

### Question 'b'

References to assessment criteria are most often found in articles examining a particular evaluative model. In most articles relating to Question 2, a model is defined and then examined for effectiveness within a given academic setting. The particular criterion used in the various models is generally not described in the article abstract. It is therefore difficult to determine the strengths or limitations of these criteria simply by surveying abstracts.

### Observations

**Quantitative: 39 Articles** - Included under this heading is any scholarly literature that gathers statistical evidence to make its case. These articles include experimental, quasi-experimental, and large-scale descriptive studies (e.g. surveys and questionnaires). While a number of articles focus on evaluative models used for assessment (e.g. benchmarking, best practices, performance indicators, reputation ratings) the criteria most often used in these models appears to be peer review, for example Print and Hattie (1997) *Measuring*

*Quality in Universities: An Approach to Weighting Research Productivity.* Other criteria deemed necessary in assessing research and innovation are the prevalence of cited journal articles and the attainment of research grants. As the line between educational institutions and profit-driven industries blurs, economic criteria appears to be playing a larger role in the evaluation of research. The number of patents stemming from research and the increasing use of performance-based funding are examples of corporate models of efficiency being incorporated by post-secondary institutions (e.g. Jaffe, 1989, *Real Effects of Academic Research*).

One of the issues involved in assessing research is the paucity of actual reporting of research projects. In their article *Faculty Productivity Reporting Systems in Research Universities*, Cooper and Hensley (1993) discover that many institutions do not have a formal, periodic method of reporting faculty productivity. Overall many articles indicate that institutions struggle with the evaluation of academic productivity because of difficulties in determining all the factors involved. Johnes (1992) *Performance Indicators in Higher Education: A Survey of Recent Work* points out that “the absence of market prices for teaching and research outputs severely hinders the construction of comprehensive measures of assessment” since in their absence no objective weights can be assigned to the various roles of professors and the institutions that employ them. One measurement approach that may be successfully employed is bibliometrics, which utilizes quantitative analysis and statistics to describe patterns of publication within a given field or body of literature. Spruyt *et al.*'s (1996) *Are Bibliometric Indicators Appropriate Policy Tools in a Young University?* suggests this quantitative method is reliable and provides useful comparative data.

Other relevant observations:

- there is a positive relationship between research productivity and other elements of career measurement like student evaluations and faculty status, for example, Mein (2002) *Research Productivity and Career Status*.
- research productivity is positively influenced through such means as setting specific research activity goals; recruiting and retaining outstanding research faculty; and providing assistance in writing proposals, for example, Snyder (1990) *Factors Contributing to Research Excellence*.

**Qualitative: 30 Articles** - Included under this heading are descriptive case studies, narratives and interviews published in academic journals. The majority of the qualitative literature articles are case studies which focus on the use of various assessment models. Where assessment criteria could be determined, peer review, bibliometric analysis and the awarding of grants appear the most often cited methods of assessment. Huetnner and Clark's (1997) *Comparative Research Productivity Measures for Economics Departments*, illustrates difficulties in using publication rates as an effective cross-discipline assessment tool; journal acceptance rates and the availability of grant funds are not equivalent throughout the various academic disciplines. Another article illustrates challenges with implementing evaluation measures for research. Newton's (2000) *Feeding the Beast or Improving Quality? Academics' Perceptions of Quality Assurance*

and *Quality Monitoring* argues that institutions and external quality bodies need to consider the conditions and context of academics' work in order to understand how it can best be evaluated.

**Editorials: 8 articles** - These are position or opinion papers advocating for certain principles or practices regarding research, innovation and productivity. Many of the articles take pains to point out that the measurement of research performance is multidimensional, and no single type of measure can assess the full range of professional role performance, for example Braxton and Brayer (1986) *Assessing Faculty Scholarly Performance*. In a series of editorials on research in social work the question of ranking schools on their journal publication rates is debated. Krueger (1993) *Should there be a moratorium on articles that rank schools of social work based on faculty publications? Yes!*, points out problems with inferring quality in a specific discipline based solely on the appearance of a few faculty members in field related publications; evidence exists of bias in the journal review process while citation numbers are increasingly artificially inflated as this measurement tool is increasingly a part of faculty performance reviews and promotion.

**Review: 2 articles** – Both of the review articles trace the development of their respective assessment models and provide an explanation of why these models are currently being utilized and their effectiveness within an academic environment. Kostoff's (1992) *Federal Research Impact Assessment Methods* examines three areas of research project assessment as well as variety of evaluation methods and concludes that peer-evaluation is the most flawed.

**Reports: 61 articles** - These are relevant reports and documents found in trade or academic journals. Most articles found by this question scan are reports, an indication of the dearth of quantitative research on useful research and innovation assessment criteria. General themes include the impact of assessment methods within postsecondary institutions (e.g. Patrick and Stanley, 1996 *Assessment of Research Quality*) problems with peer-review (e.g. Charbonneau and Leo 2002 *Without Peer? Peer Review Put to the Challenge*), and the problems in defining what constitutes productive research (e.g. Henkel, 1986, *Excellence versus Relevance: The Evaluation of Research*). A good example of different approaches toward assessing quality internationally is Smith's (2000) *"How Will I Know If There Is Quality?" Report on Quality Indicators and Quality Enhancement in Universities: Issues and Experiences*, which examines differences between examples of performance-based funding in the United States and research-assessment exercises in Great Britain.

**Grey Literature: 6 articles** - Grey literature may subsume any of the above four genres. Documents include reports made available on the internet in PDF, such as an article prepared for the Council of Ministers of Education of Canada, David Wolfe's (1998) *Quality and Accountability in PSE Research: The Measurement Challenge*. This report asserts "efforts to measure the quality and effectiveness of research activity in PSE institutions must start with developing a framework that can be used to evaluate the quality." Wolfe also discusses the difficulty associated with measuring knowledge flows which he sees as the dynamic interaction between the three distinct categories of data, information and

knowledge. He claims that “we cannot adequately answer important questions about the nature of knowledge flows in the Canadian innovation system with the existing basis of statistical information.” (Wolfe, 1998)

## Summary

- Assessment of academic institutions appears to be of paramount concern for institutions throughout the world. Approaches to research assessment vary according to national context; in the United States evaluation is increasingly linked to market forces while in Europe and Canada focus is on overall system efficiency, for example, Murphy (1994) *Research Quality, Peer Review and Performance Indicators*.
- No single model or set of criteria is suitable for the evaluation of research and innovation; however, clustering various approaches has proven to be of value, for example, Tan (1992) *A Multivariate Approach to the Assessment of Quality*.
- Of the various models currently utilized, benchmarking appears to be the most often cited, for example, Shafer and Coate (1992) *Benchmarking in Higher Education: A Tool for Improving Quality and Reducing Cost*.
- The use of assessment tools is beneficial in that they provide insight into ways in which institutional costs and structure increase or restrict productivity. However the evaluation of productivity is still proving to be difficult to determine, for example, Gilmore and To (1992) *Evaluating Academic Productivity and Quality*.
- Increasingly, the ability to create and sustain partnerships with corporate entities is being considered criteria for promotion and funding, for example, Hall, Link, and Scott (2003) *Universities as Research Partners*.

Academic institutions employ resources and a number of evaluative strategies in order to assess the research and innovation productivity of their faculty. For this mission, models of assessment have been appropriated from the corporate world (benchmarking, best practices, Total Quality Management) and incorporated into the academic environment. While it was not difficult to locate a number of models useful for evaluating research and innovation productivity, understanding the validity and reliability of the criteria used in each model requires more in depth analysis.

## Feasibility

Because of the difficulty in using a scan of the research to establish a full understanding of the criteria used for assessing research and innovation, particularly in regards to their strengths and weaknesses, there is sufficient reason for this question to undergo a systematic review. We estimate that this review can be completed in three person months at a cost of approximately \$25000.

## Appendix A: Included References

### References - Canada

- Ontario Universities: Academic Assessment, Assessment of Research, Technology Transfer. (1997).  
This document provides an overview of the 17 universities in the Province of Ontario, describing undergraduate and graduate program offerings, sources of operating income and research funding, and linkages between the universities and the private sector. The first section includes a discussion of the appraisal process used to assess both graduate and undergraduate academic programs. The second section, on research assessment, explains the self-regulated monitoring process that governs the accountability relationship between the universities and the provincial government. Sub-sections consider: assessment of individual researchers, assessment of research through the three federal granting councils, performance indicators for research, a research funding infrastructure envelope, the Ontario Centres of Excellent Program, the Ontario Research and Development Challenge Fund, and the Canada Foundation for Innovation. The final section discusses technology transfers in sub-sections on: industry pull, technology push, resources required for effective technology transfer, and institutional research performance indicators.
- Association of Universities and Colleges of Canada. (2004). *Building on Our Strengths: Higher Education and Research for Canada's Future*. Retrieved Nov./16, 2005 from [http://www.aucc.ca/publications/index\\_e.html](http://www.aucc.ca/publications/index_e.html)
- CAUT Educational Review. (2000). *The Canada Research Chairs*. Retrieved November/16, 2005 from <http://www.caut.ca/en/publications/index.asp>
- Godwin, Benoit & Gingras, Yves. (1999). *The Impact of Collaborative Research on Scientific Production*. Retrieved Nov./16, 2005 from [http://www.aucc.ca/publications/index\\_e.html](http://www.aucc.ca/publications/index_e.html)
- Langford, C. H. (1999). *The Evaluation of Research Done in Post Secondary Institutions*. Retrieved Nov./17, 2005 from <http://www.cmec.ca/postsec/publications.en.htm>
- Martin, F & Trudeau, M. (1998). *The Economic Impact of University Research* (Research No. Vol. 2, No. 3). Ottawa, ON: Association of Universities and Colleges of Canada. (Economic impact of research) November 16, 2005, from the [http://www.aucc.ca/publications/index\\_e.html](http://www.aucc.ca/publications/index_e.html) .  
Within business and economic circles, awareness is growing of the role of knowledge in stimulating economic growth. Accordingly, economists are adapting traditional growth models to account for the essential contribution of knowledge, and science and technology, in particular. Interest is likewise growing in how university research, which is society's largest source of knowledge, affects economic performance. This new study provides quantitative evidence of the contribution of university research to wealth creation. The study confirms that Canadian university

research is a powerful stimulus for economic development, producing measurable increases in GDP and employment.

Martin, F., & Trudeau, M. (1998). *The Economic Impact of University Research.*

*Research File, 2(3)*

This report summarizes the findings of a study which used traditional input-output economic models merged with recent understandings of new growth theory to measure and assess both the static and dynamic economic impact of university research, especially in Canada. The study highlights were: (1) university research is a powerful stimulus for economic development, leading to measurable increases both in gross domestic product (GDP) and employment; (2) university research in Canada sustains \$5 billion of GDP and results in more than 81,000 jobs, almost 1 percent of Canada's 1994-95 GDP and more than 0.5 percent of all the nation's jobs; (3) university research has a profound effect on the underlying productivity of the economy; (4) university research has the potential to produce breakthrough advances that can fundamentally alter economic growth and quality of life; (5) university research also has an economic impact by equipping students with the ability to generate new ideas and research skills; and (6) the total dynamic impact of university research in Canada amounts to around \$15.5 billion each year, which corresponds to approximately 150,000 to 200,000 jobs.

Smith, D. C. (2000). "How Will I Know If There Is Quality?" Report on Quality Indicators and Quality Enhancement in Universities: Issues and Experiences.

In this paper presented by the Council on Ontario Universities, quality indicators are considered in light of their relationship to the challenges Ontario's universities expect to face in the next decade. These challenges include a surge in enrollment; the need for new, first-rate faculty; and Ontario's potential role in leading innovation and research. The report makes five recommendations in the following five areas to policymakers and planners in Ontario's higher education arena regarding quality indicators and quality enhancement. First, Ontario's universities are at a critical juncture in the quality of their work, and in striving to enhance quality, they face major challenges. Second, quality refers to excellence in the work of universities. It is considered in terms of the institution, academic program or department, and the university sector. Third, quality indicators refer to evidence of characteristics associated with quality and overlap with performance indicators. Fourth, the paper looks at Ontario's specific experience with indicators at three levels. Lastly, international perspectives on quality are considered. One appendix is included.

Wolfe, D. A. (1998). *Quality and Accountability in PSE Research: The Measurement Challenge.* Retrieved Nov.16, 2005 from <http://www.cmec.ca/stats/indexe.stm>

## References -USA

Relevant research. (2002). *University Affairs*, 43(3), 20.

Abdullah, F. G. (1990). Peer Review--The Only Answer to High-Quality Research?

*Journal of Professional Nursing*, 6(2), 70-70.

A discussion of the National Institutes of Health grants peer review system suggests that, while the system is the most effective for assuring support for high-quality medical and nursing research, serious erosion in confidence in the system has occurred and must be resolved within the biomedical research community.

Acs, Z. J., Audretsch, D. B., & Feldman, M. P. (1992). Real Effects of Academic Research: Comment. *American Economic Review*, 82(1), 363-67.

Adams, J. D., & Griliches, Z. (1998). Research Productivity in a System of Universities.

*Annales d'Economie Et De Statistique*, 0(49-50), 127-62.

This paper considers research performance of US universities for eight science fields. At the aggregate level we find that research output follows a constant return to scale process. However, for individual universities we find evidence of diminishing returns. We offer two explanations for these differing results. First, data errors are more important at the individual level. Second, research spillovers exist between universities and fields that are captured only at the aggregate level.

Association of Universities and Colleges of Canada, Ottawa (Ontario). (1995). A Primer on Performance Indicators. *Research File*, 1(2)

This report discusses the use of performance indicators (PIs) in higher education, focusing on definitions, frameworks, examples, and implications for universities. It notes that demands for accountability have led to intense interest in university performance measures and that early indicators simply described the university or the system and hence had limited impact on policy or management decisions. True PIs are: (1) goal or result oriented; (2) have a reference point; (3) provide strategic information about the condition or functioning of an institution; (4) are evaluative; (5) are strategic, specific, policy-orientated, and issue-driven; (6) connect outcomes to structure and process, taking inputs into account; and (7) are used for improvement, enhancement, and positive reform. The report asserts that PIs can best be used for internal university purposes to enhance the quality of education, research, community service, and other functions. It argues that PIs are not absolute facts, and that they are best interpreted as indicative, suggestive, or diagnostic.

Banta, T. W., & Borden, V. M. H. (1994). Performance Indicators for Accountability and Improvement. *New Directions for Institutional Research*, (82), 95-106.

Five criteria for judging college or university performance indicators (PIs) used to guide strategic decision making are outlined. The criteria address: purpose; alignment of PIs throughout the organization or system; alignment of PIs across inputs, processes, and outcomes; capacity to accommodate a variety of evaluation methods; and utility in decision-making.

Baughman, J. C., & Goldman, R. N. (1999). College rankings and faculty publications: are they related? *Change*, 31(2), 44-50.

Two current examples clearly illustrate the importance of publications to universities. Brown University, which ranks in the top category in Barron's "College Admissions Selector, had 1,797 publications in 1997, according to the Institute for Scientific Information. On the other hand, New Jersey Upsala College, which closed in 1995, was ranked competitive in Barron's but had less than 35 publications in the last decade or so. The writers report on an exploratory study on the relationship between scholarship and institutional ranking, which found a strong and positive connection, with a few notable and intriguing exceptions.

Bentley, R., & Blackburn, R. (1990). Changes in Academic Research Performance over Time: A Study of Institutional Accumulative Advantage. *Research in Higher Education*, 31(4), 327-353.

A study analyzed data from four national surveys of the American professoriate conducted between 1969 and 1988. To assess whether groups of institutions might be accumulating advantage relative to others, research activities were compared across five Carnegie institution types. An overall strengthening of research emphasis and other changes emerged.

Blake, V. L. P., & Tjoumas, R. (1990). Research as a Factor in Faculty Evaluation: The Rules Are A-Changin'. *Journal of Education for Library and Information Science*, 31(1), 3-24.

Discusses research as a criterion for library and information science faculty assessment and reviews the literature pertaining to faculty work patterns, evaluation criteria, assessing the quality of research, and publication productivity. Guidelines for evaluating the quality of research publications are presented, and alternatives to current faculty assessment procedures are suggested.

Blustain, H. (1998). Navigating the Process Labyrinth: A Process Model for Higher Education. *Business Officer*, 31(8), 39-48.

Examines administrative processes in higher education institutions, focusing on the different core processes within an institution and the creation of structures to make them more efficient and productive. Proposes a framework of four process-related activities benchmarking, identifying best practices, redesign, and organization alignment to reexamine the work of colleges and universities and create value for institutions and their customers.

Boyce, B. R., & Hendren, C. (1996). Authorship as a Measure of the Productivity of Schools of Library and Information Science. *Journal of Education for Library and Information Science*, 37(3), 250-271.

Discussion of the evaluation and ranking of degree programs of library and information science at ALA (American Library Association) accredited schools focuses on a study of faculty authorship in "Library Literature" as a measure of productivity. Doctoral programs, Association of Research Libraries affiliation, and Carnegie I research universities are considered.

- Braxton, J. M., & Bayer, A. E. (1986). Assessing Faculty Scholarly Performance. *New Directions for Institutional Research*, 13(2), 25-42.  
Measurement of faculty research performance is multidimensional, and no single type of measure can assess the full range of professional role performance. A variety of subjective and quantitative measures and weighting systems should be used together to minimize bias.
- Brown, K. W., & Fischer, M. L. (1994). Assessment Measures: Management's Yardstick. *Assessment & Evaluation in Higher Education*, 19(3), 163-174.  
Performance measures are discussed for assessing organizational effectiveness in nonprofit organizations including institutions of higher education. With hundreds of possible measures, ratios, and data available, the nonprofit manager must select measures that portray the institution's condition and performance. A process and rationale for determining the measures are presented, and one set of measures is highlighted.
- Cassuto, L. (2005). Evaluation and the Culture of Secrecy. *The Chronicle of Higher Education*, B16.  
The culture of secrecy surrounding evaluation in higher education invites unfairness and bad decisions. The unexamined practice of confidentiality can invite manipulation and deceit and can lead to suspicion of academics' professional work. Moreover, this culture threatens the very workings of peer review and is especially egregious with regard to tenure. In contrast, a culture based around open access offers protection against possible character assassins, improves the quality of information, and can help people to become better teachers and scholars.
- Charbonneau, Leo. (2002). Without Peer? Peer Review put to the Challenge. *University Affairs*, 43(3), 18.
- Clarke, M. (2004). Weighing Things Up: A Closer Look at "U.S. News & World Report's" Ranking Formulas. *College and University*, 79(3), 3-9.  
Since their first appearance in 1983, the U.S. News & World Report rankings of colleges and graduate schools have generated much debate. This article examines two common criticisms of the methodology used to produce the rankings, finds supporting evidence, and makes recommendations for both their producers and their consumers. Reprinted by permission of the publisher.
- Cooper, P. A., & Hensley, O. D. (1993). Faculty Productivity Reporting Systems in Research Universities. AIR 1993 Annual Forum Paper.  
This study identified the existence, types, related procedures, and use of faculty productivity reporting systems currently used by institutions of higher education involved in externally-funded research. Institutional research officers at 200 institutions of higher education were surveyed in an effort to characterize the existing productivity reporting systems of these institutions. These were institutions with the highest levels of total, separately budgeted, science/engineering research and development expenditures. A total of 83 administrators responded. The survey

instrument requested information concerning institutional procedures for the methods, frequency, and use of information obtained through faculty productivity reports. Copies of the related institutional policies, procedures, and reports also were requested. Results indicated that the use of faculty productivity reporting systems occurs much less frequently than the federally-mandated systems. Only 68.7 percent of the responding institutions indicated that a formal, periodic method of reporting faculty productivity exists, and of these institutions, 83.6 percent require the reports to be submitted by all faculties. The productivity reports are typically used for internal activities such as tenure evaluation, promotion and merit evaluations and raises, and less frequently for budgeting and planning purposes. There is generally little attempt to correlate faculty productivity measures with financial data.

Creswell, J. W. (1986). Concluding Thoughts: Observing, Promoting, Evaluating, and Reviewing Research Performance. *New Directions for Institutional Research*, 13(2), 87-102.

When institutional personnel assess faculty research performance, they should consider the extent to which the institution rewards research, ways to encourage faculty to be productive, criteria for evaluating research performance, and the specific steps useful in reviewing research performance within academic units.

De Greve, J. P., & Frijdal, A. (1989). Evaluation of Scientific Research Profile Analysis, a Mixed Method. *Higher Education Management*, 1(1), 83-90.

A method for evaluating research using both quantitative and qualitative analysis is presented. It is proposed as useful for a variety of evaluation needs including large-scale projects, acquisition of expensive equipment, and nomination of scientists to important positions. It is seen as especially useful for evaluation in small entities.

Dey, E. L., Milem, J. F., & Berger, J. B. (1997). Changing Patterns of Publication Productivity: Accumulative Advantage or Institutional Isomorphism? *Sociology of Education*, 70(4), 308-323.

Investigates two competing perspectives, accumulated advantage and institutional isomorphism, on the relationship between publication productivity and institutional hierarchy. Accumulated advantage refers to the continuing attraction of students, faculty, and research dollars to prestige universities. Institutional isomorphism denotes the tendency of institutions to model themselves after the leaders.

Diamond, N., & Graham, H. D. (2000). How Should We Rate Research Universities? *Change*, 32(4), 20-33.

Discusses, in the context of the National Research Council's next study of research-doctorate programs, arguments over continuing use of reputational surveys as the primary measure of program quality, as opposed to more objective measures of research performance. Eleven tables rank institutions for specific fields by reputation, citation density, and award density.

Dill, D. D. (1986). Research as a Scholarly Activity: Context and Culture. *New Directions for Institutional Research*, 13(2), 7-23.

A wide variety of individual and contextual factors, within and outside institutional control, can affect faculty research performance. These collective factors, the research culture, include policies and practices affecting recruitment, workload, evaluation, collegial communication, leadership, and structure.

Doerfel, M. L., & Ruben, B. D. (2002). Developing More Adaptive, Innovative, and Interactive Organizations. *New Directions for Higher Education*, (118), 5-27. Presents a comprehensive view of benchmarking, including best-practice approaches to organizational assessment and improvement in higher education (the Malcolm Baldrige and "balanced scorecard" frameworks) and lessons that can be gleaned from the benchmarking process.

Dundar, H., & Lewis, D. R. (1998). Determinants of Research Productivity in Higher Education. *Research in Higher Education*, 39(6), 607-631. A study extends recent research on college-faculty research productivity by examining the relationship between research productivity and institutional factors, drawing on recent National Research Council data on research universities and their programs in four broad fields: biological sciences, engineering, physical sciences and mathematics, and social/behavioral sciences. Recommendations are made for institutional policymakers.

Ellwein, L. B., & Others. (1989). Assessing Research Productivity: Evaluating Journal Publication across Academic Departments. *Academic Medicine*, 64(6), 319-325. Medical faculty publications over a three-year period were used to analyze relative research productivity of one medical school's basic and clinical science departments. Journal citation ratings, number of authors, and faculty member's byline position were used as criteria. Departments varied greatly in research productivity, correlated with citation ratings.

Feldman, K. A. (1987). Research Productivity and Scholarly Accomplishment of College Teachers as Related to Their Instructional Effectiveness: A Review and Exploration. *Research in Higher Education*, 26(3), 227-298. Extant research was explored for factors that might mediate either positive or inverse associations between research productivity and teaching effectiveness and those that possibly could be common causes of them. Pedagogical practices and dispositions of faculty members, as well as certain course or class characteristics were examined.

Feller, I., Ailes, C. P., & Roessner, J. D. (2002). Impacts of Research Universities on Technological Innovation in Industry: Evidence from Engineering Research Centers. *Research Policy*, 31(3), 457-74. NSF engineering research centers (ERCs) constitute the most upstream performer of R&D among university-industry-government research centers. Findings from surveys and interviews with 355 firms participating in the 18 ERCs established between 1985 and 1990 indicate that firms participate primarily to gain access to

upstream modes of knowledge rather than specific products and processes. Findings also point to problematic continuation of industrial support for ERCs following termination of NSF funding after reaching the maximum number of years (11) permitted under the program, and related pressures on ERCs to direct their research portfolios towards shorter-term, more applied research.

Fransson, R. (1985). Resource Allocation Based on Evaluation of Research. *International Journal of Institutional Management in Higher Education*, 9(1), 67-71.

At Sweden's Karolinska Institute, a resource allocation model for medical research in use since 1970 allows the research activity of the different departments to affect resource allocation directly.

Gavlick, M. (1996). Triangulating the Relationship among Publication Productivity, Teaching Effectiveness, and Student Achievement. *New Directions for Institutional Research*, (90), 49-56.

A model postulating a relationship between faculty research activity, instructor behaviours, and student achievement is advanced, based on two causal models, one linking research activity and instructional effectiveness and another validating student evaluation as good indicators of instructional effectiveness, as measured by student achievement. The importance of distinguishing and isolating specific teaching behaviors is emphasized.

Gibbs, G. (1995). The Relationship between Quality in Research and Quality in Teaching. *Quality in Higher Education*, 1(2), 147-157.

Argues that quality in faculty research does not translate directly into quality in teaching, and industrial modes of quality-assurance involving strong central management control are inappropriate for universities. The link between research and teaching is in mechanisms supporting quality. Academics know how to support quality in research; the university must adopt parallel supports for good teaching, especially rewards.

Golden, J., & Carstensen, F. V. (1992). Academic Research Productivity, Department Size and Organization: Further Results, Comment. *Economics of Education Review*, 11(2), 153-160.

In response to earlier article (Jordan et al. 1989) showing per capita publication increases, up to a point, with department size and is higher at private institutions than elsewhere, this article demonstrates impact of both private vs. public affiliation as well as department size on per capita publication plunges after controlling for both research support and department's faculty rating.

Gray, P. J., & Others. (1994). Assigning and Assessing Faculty Work. *New Directions for Institutional Research*, (84), 79-91.

The current practice of assigning and assessing college faculty workloads is analyzed briefly, and issues involved in developing a new process consistent with a broadened definition of faculty work are discussed. The professional portfolio is

suggested as a structure for assigning and assessing faculty responsibilities in a collaborative and equitable way.

Gray, P. J., & Diamond, R. M. (1994). Defining Faculty Work. *New Directions for Institutional Research*, (84), 65-78.

A process of planned change is proposed for redefining college faculty work. Legitimate faculty work is defined in broad terms, and information sources and methods for collecting information to support redefinition are identified. The final step in the redefinition process is the development of new mission statements for the institution and its academic units.

Groth, R. H., & Others. (1992). Research Activity in Major Research Universities: An Alternative Ranking System. *SRA Journal of the Society of Research Administrators*, 23(4), 23-33.

Application of a multidimensional measure of university research activity, the Research Activity Index (RAI), is described and compared to the more common use of research and development expenditures as a criterion of activity. The RAI incorporates seven expenditure variables, three graduate-student-related variables, and a research library ranking index.

Hall, B. H., Link, A. N., & Scott, J. T. (2003). Universities as Research Partners. *Review of Economics and Statistics*, 85(2), 485-91.

Universities are a key institution in the U.S. innovation system, and an important aspect of their involvement is the role they play in public-private partnerships. This note offers insights into the performance of industry-university research partnerships, using a survey of precommercial research projects funded by the Advanced Technology Program. Although results must be interpreted cautiously because of the small size of the sample, the study finds that projects with university involvement tend to be in areas involving new science and therefore experience more difficulty and delay, yet are more likely not to be aborted prematurely. Our interpretation is that universities are contributing to basic research awareness and insight among the partners in ATP-funded projects.

Hare, P. G., & Wyatt, G. (1992). Economics of Academic Research and Its Implications for Higher Education. *Oxford Review of Economic Policy*, 8(2), 48-66.

Hekelman, F. P., & Others. (1995). Successful and Less-Successful Research Performance of Junior Faculty. *Research in Higher Education*, 36(2), 235-255.

A survey of 404 full-time, tenure-track assistant professors at Case Western Reserve University (Ohio) found that successful researchers exhibit specific research activities and scholarly habits to an extent that less-successful researchers do not. Implications are drawn for faculty development and related research. The survey instrument is appended.

Hekelman, F. P., & Others. (1992). Evaluation of an Instrument to Predict Successful Medical Researchers.

An instrument to measure the 13 personal characteristics of productive researchers described by C. J. Bland and others (1986, 1990) was developed and evaluated. The total eligible sample was 404 full-time assistant professor faculty members in the tenure track at Case Western Reserve University in Cleveland (Ohio). A random sample of 100 respondents received a follow-up telephone call urging response to the survey developed for the study. A final sample was selected, consisting of 49 successful and 27 less successful researchers. Univariate analysis of the survey responses indicated that 62% of items significantly discriminated successful and less successful researchers. On the average, successful researchers exhibited more of the identified characteristics than did the less successful ones. Factor analysis identified four stable factors; only two were needed to achieve maximum discrimination--scholarly habits and research activities/environment. The two-factor approach identified 92% of the successful researchers and 93% of the less successful researchers. Eight characteristics measured by the two factors were: (1) research skills; (2) motivation; (3) adequate research time; (4) multiple projects; (5) vital networks; (6) external/internal orientation; (7) supportive departments; and (8) in-depth content knowledge. Implications for encouraging researchers are discussed. A 15-item list of references and two tables are included.

Henderson, R., Jaffe, A. B., & Trajtenberg, M. (1998). Universities as a Source of Commercial Technology: A Detailed Analysis of University Patenting, 1965-1988. *Review of Economics and Statistics*, 80(1), 119-27.

This paper explores the recent explosion in university patenting as a source of insight into the changing relationship between the university and the private sector. Before the mid-1980s, university patents were more highly cited, and were cited by more diverse patents, than a random sample of all patents. More recently several significant shifts in university patenting behavior have led to the disappearance of this difference. Thus the authors' results suggest that between 1965 and 1988 the rate of increase of important patents from universities was much less than their overall rate of increase of patenting.

Henry, G. T., & McMillan, J. H. (1993). Performance Data: Three Comparison Methods. *Evaluation Review*, 17(6), 643-652.

The following methods for selecting similar units in performance monitoring are compared: (1) cluster groupings; (2) index groups; and (3) benchmark groups. Advantages and drawbacks of each method are presented, with a discussion that demonstrates the statistical superiority of the benchmark grouping method.

Hercules, D. M. (1995). Research Activity and Productivity in U.S. Chemistry Departments 1985-1988. *Journal of Chemical Education*, 72, 782-792.

Research activity and productivity in 187 U.S. chemistry departments in the years 1985-88 is reviewed. The use of peer evaluations was avoided in an effort to separate the performance of the chemistry department from the reputation of its institution. Research activity was based on the level of research funding, number of

publications, number of graduate students enrolled, and number of postdoctoral researchers. Research productivity was defined as research activity divided by the number of full-time faculty members in the department. Among the conclusions drawn from the study were that a broad range of research activity exists in the U.S. and that chemistry departments vary widely in their effectiveness. A correlation also exists between research activity, productivity, and the size of the department.

Hollingsworth, P. M., & Reutzel, D. R. (1994). Institutional Productivity Ratings Based on Publications in Eight Reading Journals: 1983-1991. *Reading Improvement, 31*, 2-8.

Huettner, D. A., & Clark, W. (1997). Comparative Research Productivity Measures for Economics Departments. *The Journal of Economic Education, 28*, 272-278.  
A comparative study of research productivity measures for economics departments is presented. Data on the number of subscribers, article acceptance rates, and National Science Foundation grants were used in relation to economics, finance, geology, psychology, physics, oceanography, chemistry, and geophysics. The findings suggest that university administrators should recognize that interdisciplinary variances in publication rates partly depend on journal acceptance rates and the availability of grant funds. Furthermore, resource misallocations among departments could result from direct comparison of performance indicators on articles per faculty or research dollars per faculty.

Jacobson, R. L. (1992). Colleges Face New Pressure to Increase Faculty Productivity. *Chronicle of Higher Education, 38*(32)  
Agencies in at least a dozen states are seeking information about college faculty workload, including number of student contact hours, reflecting concern about faculty productivity and quality of undergraduate teaching. The issue is considered delicate, but both internal and external pressure to account for faculty time and salaries are mounting.

Jaffe, A. B. (1989). Real Effects of Academic Research. *American Economic Review, 79*(5), 957-70.  
The existence of geographically mediated "spillovers" from university research to commercial innovation is explored using state-level time-series data on corporate patents, corporate R&D, and university research. A significant effect of university research on corporate patents is found, particularly in the areas of drugs and medical technology, and electronics, optics, and nuclear technology. In addition, university research appears to have an indirect effect on local innovation by inducing industrial R&D spending.

Kostoff, R. N. (1992). Federal Research Impact Assessment Methods. *Research Management Review, 6*(2), 22-48.  
The practice and methods of federal research impact assessment are described. Three areas of evaluation (selection of research project, research review, and post research assessment) are examined, and different evaluation methods (qualitative,

retrospective, and quantitative) are compared. Peer evaluation, the most common assessment method, is seen as flawed.

Layzell, D. T. (1998). Linking Performance to Funding Outcomes for Public Institutions of Higher Education: The US Experience. *European Journal of Education, 33*(1), 103-111.

Discussion of funding for public colleges and universities in the United States looks at different mechanisms for measuring institutional performance, recent experiences with performance indicators for purposes of funding and the pitfalls and limitations of their use, the current status of performance-based funding in public colleges, and implications for its continued use.

Levin, H. M. (1991). Raising Productivity in Higher Education. *Journal of Higher Education, 62*(3), 241-262.

A system for raising productivity in higher education institutions is proposed, based on two theories used to explain the tendency of unit costs to rise. Emphasis is on combining clear goals, accountability, and incentives with an experimental approach. An institutional research strategy for implementation is outlined.

Lombardi, J. V., Craig, D. D., Capaldi, E. D., & Gater, D. S. (2000). The Top American Research Universities. An Occasional Paper from the Lombardi Program on Measuring University Performance. *U.S.; Florida: University of Florida*.

This paper offers an alternative ranking of top American research universities, criticizing the methodology used by US News & World Report and its commercialization. It begins by questioning two "givens"--the American pursuit of the "best" and the rankings "game" of trying to define the best colleges and universities. Following a brief discussion on university characteristics and what is the definition of a research university, the paper presents a list of the nine indicators of performance used to rank the institutions in this report: total research expenditures; federal research expenditures; endowment assets; annual giving; faculty members in the National Academies; faculty awards; doctoral degrees; postdoctoral appointees; and entering freshmen SAT scores. The next section examines the competitive context in which top universities operate and offers measures of comparative performance. This is followed by several tables ranking the top private and top public research universities. A final section offers a discussion of additional measures, not captured in the nine indicators noted above, that provide a fuller examination of institutional characteristics, including institutional size and composition, funding sources, institutional reputation, average faculty productivity, and National Merit and Achievement scholars. Appended are source notes for the nine measures and data notes and adjustments.

Magner, D. K. (1997). Report Says Standards Used to Evaluate Research Should Also Be Used for Teaching and Service. *Chronicle of Higher Education, 44*(2)

A recent Carnegie Foundation for the Advancement of Teaching report counters the conventional wisdom in academe that faculty research must be evaluated by standards different from those of teaching and service, maintaining that the different

types of faculty work have much in common and must be judged similarly if teaching and service are to gain respect in promotion decisions.

Mansfield, E. (2000). Academic Research and Industrial Innovation. *The Economics of Science and Innovation. Volume 2*, 248-59.

Mansfield, E. (2000). Academic Research Underlying Industrial Innovations: Sources, Characteristics, and Financing. *The Economics of Science and Innovation. Volume 2*, 151-61.

Mansfield, E. (1998). Academic Research and Industrial Innovation: An Update of Empirical Findings. *Research Policy*, 26(7-8), 773-76.

Mansfield, E. (1995). Academic Research Underlying Industrial Innovations: Sources, Characteristics, and Financing. *Review of Economics and Statistics*, 77(1), 55-65. There has been no systematic study of the characteristics of the universities and academic researchers that seem to have contributed most to industrial innovation. Nor do we know how such academic research has been funded. This paper, based on data obtained from sixty-six firms in seven major manufacturing industries and from over two hundred academic researchers, sheds new light on the sources, characteristics, and financing of academic research underlying industrial innovation. The findings should be of interest to economists concerned with technological change and to policymakers attempting to increase the economic payoff from the nation's academic research.

Massey, W. F., & Wilger, A. K. (1992). Productivity in postsecondary education: a new approach. *Educational Evaluation & Policy Analysis*, 14, 361-376.

Massy, W. F., & Wilger, A. K. (1995). Improving Productivity: What Faculty Think about It--and Its Effect on Quality. *Change*, 27(4), 10-20. A discussion of college faculty productivity defines the term and looks at related issues, including ways of improving productivity; costs of academic work; "deadwood"; and productive behavior as it relates to research, grantsmanship, instructional quality, enrollment and class size, and teaching load. Incentives and persuasive arguments are seen as critical to improving productivity.

McCarthy, T. (1986). Performance Appraisal of University Academics: Issues and Implications. *Australian Universities' Review*, 29(1), 8-13. Issues in the introduction of performance appraisal of individual academic staff members are examined from the viewpoint of general management theory and practice. Benefits to the faculty and institution and the potential for abuse of the procedures and results are discussed.

McDaniel, O. C. (1996). The Theoretical and Practical Use of Performance Indicators. *Higher Education Management*, 8(3), 125-139. A study of the use of performance indicators in assessing the quality of higher

education investigated the potential contribution to quality control of 17 indicators. It is concluded that of the 17, only 7 have high or medium impact, while 10 have low to marginal impact. Concerns regarding government use of performance indicators intended for institutional purposes are discussed.

McGuire, J. W., & Others. (1988). The Efficient Production of "Reputation" by Prestige Research Universities in the United States. *Journal of Higher Education*, 59(4), 365-389.

The productivity of 40 major research universities in combining faculty and governmental grants to obtain reputational rankings in the 1980s is examined empirically. These productivities are measured relative to the most efficient members of the group and for their proximities to minimal costs.

Meador, M., Walters, S. J. K., & Jordan, J. M. (1992). Academic Research Productivity: Reply, Still Further Results. *Economics of Education Review*, 11(2), 161-67. In this reply to J. Golden and F. Carstensen (1992) the authors extend their earlier research on faculty research productivity by (1) employing a superior proxy measure of long-term research performance and (2) considering two additional inputs in the production of research. They find that research performance is enhanced by department size (at a diminishing rate), private organization, grant support, a larger pool of graduate students and a quality research library.

Morton, L., & Beard, F. K. (2005). Faculty Productivity and Carnegie Institutional Characteristics within AEJMC Programs. *Journalism and Mass Communication Educator*, 60(2), 176-189.

Muffo, J. A., & Others. (1987). Using Faculty Publication Rates for Comparing "Peer" Institutions. *Research in Higher Education*, 27(2), 163-175. Data on publication rates were gathered for two years from the Corporate Indexes published by the Institute for Scientific Information, and numbers of faculty by academic discipline were computed using standard reports generated annually by the participating universities. These rates can provide one measure of relative university research productivity.

Noble, J. H., Jr, & Others. (1992). Faculty Productivity and Costs: A Multivariate Analysis. *Evaluation Review*, 16(3), 288-314. Results of combining various measures of faculty productivity in a public research university with budgetary cost data using input-output analyses are reported. Application of this method provides mixed support for the notion that university administrators can use annual budget decisions to influence faculty productivity and costs.

Orr, D. (2004). Research Assessment as an Instrument for Steering Higher Education--A Comparative Study. *Journal of Higher Education Policy and Management*, 26(3), 345-362.

This paper argues that research assessment is of increasing importance as an

instrument of New Public Management and within the context of efforts to establish a European Research Area. Specifically, it compares the procedures of research assessment in the Netherlands, the United Kingdom, Ireland and Germany in an attempt to distil basic design options for such procedures. It is suggested that this general model may be utilised to assist reviews of currently practised procedures and for the development of new ones.

Page, S. (1995). Rankings of Canadian Universities: Pitfalls in Interpretation. *Canadian Journal of Higher Education*, 25(2), 17-28.

A critique of rankings of Canadian universities focuses on one popular 1993 ranking and comparative data for the previous year. Several problems in the ranking procedures and results of some correlational analyses of the ranking data are discussed. Implications, particularly in the wider context of public institution accountability and the practical context of student choice of college are examined.

Patrick, W. J., & Stanley, E. C. (1996). Assessment of Research Quality. *Research in Higher Education*, 37(1), 23-42.

The British experience with nationwide research quality assessment exercises and newly-introduced measures to improve research program accountability is described. Consequences for institutions of higher education and for the system as a whole are examined, using the University of Glasgow (Scotland) as an example. Utility of performance indicators is discussed. Relevance for American researchers is explored.

Payne, A. A., & Siow, A. (2003). Does Federal Research Funding Increase University Research Output? *Advances in Economic Analysis and Policy*, 3(1)

This paper estimates the effects of federal research funding on research outcomes at 68 research universities. We provide a new interpretation of the instrumental variable estimate of the coefficient in a regression of the output of an institution on an input. Absent parameter heterogeneity, it captures the total change in output when an institution obtains an additional unit of the input that may be correlated with the other inputs that affect the output measure. Our instrument for research funding is alumni representation on U.S. Congressional appropriations committees. Our results suggest an increase of \$1 million in federal research funding (1996\$) to a university results in 10 more articles and 0.2 more patents. The change in citations per article is negative but very small and imprecisely measured. As a first approximation, increasing federal research funding on the margin results in more, but not necessarily higher quality, research output.

Presley, J. B., & Engelbride, E. (1998). Accounting for Faculty Productivity in the Research University. *Review of Higher Education*, 22(1), 17-37.

Economic, political pressures have focused state legislative interest on faculty productivity. In Maryland, a negotiated approach resulted in a mission-sensitive policy, including a reporting mechanism to measure instructional and noninstructional productivity. Legislative reporting requirements are being reduced

as trust develops about reporting integrity and faculty time management. However, two nonmedical research institutions continue to receive special scrutiny.

- Robinson, M. D., Hartley, J. E., & Dunn, S. R. (2001). Geoscience research at liberal arts colleges: school rankings. *Journal of Geoscience Education*, 49(3), 267-273.  
A study examined geoscience research at liberal arts colleges in order to develop college rankings. Data were obtained from publications in GeoRef listed journals for the period 1970-1996. Results revealed that geoscience research is highly concentrated in a relatively few colleges, that this research has increased considerably over time, and that the emphasis on research has spread to more colleges. Results also revealed that geoscience faculty members are deeply interested in teaching and that faculty research seems to contribute to successful teaching. A table showing the ranking of national liberal arts colleges based on publications is presented.
- Roever, J. E. (1990). Faculty Development, Faculty Evaluation, and Faculty Productivity: An Administrator's Perspective. *ACA Bulletin*, (74), 69-73.  
Maintains that teaching and faculty development (research as well as a broad range of other possible activities) are mutually beneficial and inseparable activities.
- Rogers, P. S., & Sherblom, J. C. (1995). What Are Characteristics of Significant Research? (Doing Research). *Business Communication Quarterly*, 58(2), 56-61.  
Describes a list of characteristics of significant research compiled by the Association for Business Communication think-tank participants. Presents a preliminary analysis of the list. Discusses frequently occurring words and their contextual interpretation.
- Schultz, J. B., & Chung, Y. L. (1988). Research Productivity and Job Satisfaction of University Faculty. *Journal of Vocational Education Research*, 13, 33-48.
- Seymour, D. (1993). The IBM - TQM Partnership with Colleges and Universities. A Report.  
In 1991, International Business Machines (IBM) Corporation announced its commitment to work with higher education to accelerate the teaching, research, and use of quality management practices in college and university operations. Besides cash and equipment awards being offered, IBM proposed partnerships with IBM facilities to include loaned executives, IBM speakers, and faculty and student internships with IBM. This report, in five sections, examines the initial activities and future plans of nine Partnership institutions: (1) Clark Atlanta University (Georgia); (2) Southern College of Technology (Georgia); (3) Georgia Institute of Technology; (4) Oregon State University; (5) Pennsylvania State University; (6) Rochester Institute of Technology (New York); (7) University of Houston at Clear Lake (Texas); (8) University of Maryland at College Park; and (9) the University of Wisconsin at Madison. The first section establishes the context for pursuing a quality management agenda on college campuses. Remaining sections synthesize the quality efforts and plans of the institutions across the four major criteria used to evaluate proposals: embedding quality management principles into core business and

engineering courses; conducting research on issues related to quality management; using quality management to improve university operations; and sharing the knowledge gained through the Partnership with others. In addition, the report contains profiles of each institution highlighting a distinctive characteristic of its proposal. An appendix details the competition guidelines and selection process.

Shafer, B. S., & Coate, L. E. (1992). Benchmarking in Higher Education: A Tool for Improving Quality and Reducing Cost. *Business Officer*, 26(5), 28-35.

Benchmarking is an ongoing, systematic process for measuring and comparing work processes of one organization to those of another to identify best practices. Higher education can gain much from this technique, as industry has. The method is objective, reduces resistance to change and can lead to dramatic innovation and rapid development.

Snyder, J. K. (1990). Factors Contributing to Research Excellence.

The paper considers the management process within central research offices of universities, or the research divisions of universities, to determine how funded research is encouraged at research institutions. It also looks at the characteristics of those research institutions which had strong growth in the last 10 years. A telephone survey of 37 leading research universities concerning aspects of managing research activity within a changing environment. Usable responses numbered 33; an 89% response rate. Results were analyzed in terms of faculty participation (e.g., an average of 46% of faculty participate in research activities as either principle or co-investigator); research visibility (e.g., the typical institution had \$97 million in research expenditures); influential environmental factors (e.g., 63% saw an increased administrative emphasis on research); and key success factors (e.g., 39% used total number of proposals or awards as a measure of success). Institutions are encouraged to increase research productivity through such means as setting specific research activity goals; recruiting and retaining outstanding research faculty; and providing assistance in writing proposals.

Stack, S. (2003). Research Productivity and Student Evaluation of Teaching in Social Science Classes: A Research Note. *Research in Higher Education*, 44(5), 539-556.

Analyzed data for 167 social sciences classes and 65 faculty members to study the relationship between faculty research productivity and student evaluations of teaching (SETs). A significant positive relationship between research productivity and SETs emerges when the distribution of citations is corrected for skewness.

Stralser, S. (1995). Benchmarking: The New Tool. *Planning for Higher Education*, 23(4), 15-19.

This article suggests that benchmarking, the process of comparing one's own operation with the very best, can be used to make improvements in colleges and universities. Six steps are outlined: determining what to benchmark, forming a team, discovering who to benchmark, collecting and analyzing data, using the data to redesign one's own operation, and assessing improvements.

- Swaffar, J. (1996). Institutional Mission and Academic Disciplines: Rethinking Accountability. *Journal of General Education*, 45(1), 18-38.  
Examines issues involved in assessing faculty work, applying a model developed by the American Sociological Association that proposes criterion-based review of professorial performance informed by the institution's mission. Focuses on difficulties related to assessing interdisciplinary work, new directions in scholarship, and distinctions between teaching and research.
- Tack, M. W., & Heberlein, G. T. (1987). Planning for the Enhancement of Research Productivity in a College or University. *Educational Planning*, 6(2), 3-17.  
The advancement of academic research productivity should be accomplished systematically using the following five steps: (1) determine the research fit within the institutional mission; (2) identify the extent of research involvement; (3) identify necessary staff and associated costs; (4) allocate institutional funds; and (5) monitor and evaluate research services and output.
- Tan, D. L. (1992). A Multivariate Approach to the Assessment of Quality. *Research in Higher Education*, 33(2), 205-226.  
A study used a multivariate approach to assessing college departmental excellence. Factor analysis identified three potentially useful factor clusters ("faculty research," "input," and "student") and seven indicators based on those clusters. Indicators combining faculty research and input and combining all three clusters were found to be the best predictors of excellence.
- Tien, F. F., & Blackburn, R. T. (1996). Faculty Rank System, Research Motivation, and Faculty Research Productivity: Measure Refinement and Theory Testing. *Journal of Higher Education*, 67(1), 2-22.  
A study explored the relationship between the traditional system of college faculty rank and faculty research productivity from the perspectives of behavioral reinforcement theory and selection function. Six hypotheses were generated and tested, using data from a 1989 national faculty survey. Results failed to support completely either the reinforcement schedule theory or the selection function of academic rank.
- Tognolini, J., & Others. (1994). A Methodology to Choose Performance Indicators of Research Attainment in Universities. *Australian Journal of Education*, 38(2), 105-117.  
Procedures for identifying performance indicators of university research attainment are presented, and definitional issues concerning these indicators are examined. The model, developed at the University of Western Australia, is seen as allowing for both diversity and comparability across the institution. It is stressed that an underlying assumption is the appropriateness of the selected indicators.
- Van Looy, B. (2004). Combining Entrepreneurial and Scientific Performance in Academia: Towards a Compounded and Reciprocal Matthew-Effect? *Research Policy*, 33(3), 425-41.

The increase of entrepreneurial activity within academia has raised concerns that the research orientation of universities might become "contaminated" by the application-oriented needs of industry. Empirical evidence on this concern is scarce and ambiguous. We examine whether entrepreneurial and scientific performance in academia can be reconciled. Our empirical findings (KU Leuven, Belgium) suggest that both activities do not hamper each other; engagement in entrepreneurial activities coincides with increased publication outputs, without affecting the nature of the publications involved. As resources increase, this interaction becomes more significant, pointing towards a Matthew-effect. We finally suggest that balancing both activities further depends on the institutional policies deployed.

Vinsonhaler, J. F., & Others. (1995). Using a Knowledge System to Document and Evaluate Faculty Productivity in a College of Business. *Journal of Education for Business*, 70(6), 337-343.

Describes a computer-based knowledge system that assists faculty and administrators in defining, documenting, and evaluating faculty productivity. Suggests that these systems may be valuable in improving faculty productivity documentation, evaluating productivity more objectively, and linking institutional policy to teaching, research, and service activities.

Volkwein, J. F., & Others. (1988). Research in Higher Education: Fifteen Years of Scholarship. *Research in Higher Education*, 28(3), 271-280.

A descriptive analysis is given of the authors and articles appearing in "Research in Higher Education" since the journal was founded in 1973. The analysis compares the 1980s with the 1970s according to subject matter, methodology, authors and institutions.

Volkwein, J. F. (1999). The Four Faces of Institutional Research. *New Directions for Institutional Research*, 26(4), 9-19.

Describes the purposes and roles of institutional researchers: (1) describe the institution, (2) analyze alternatives, (3) present the best case, and (4) supply impartial evidence, noting three dualities internal vs. external demands; academic vs. administrative culture; and institutional vs. professional role that are particularly relevant. Also noted are five competing concerns related to cost, productivity, access, effectiveness, and accountability.

Webster, D. S., & Conrad, C. F. (1986). Using Faculty Research Performance for Academic Quality Rankings. *New Directions for Institutional Research*, 13(2), 43-57.

While department and program quality rankings could be based on such factors as how well the faculty teach, advise students, and perform service roles, in practice most rankings measuring achievement in graduate departments have been based on faculty research performance of various kinds.

Zamarripa, E. (1995). Evaluating Research Productivity. *SRA Journal*, 26(3-4), 17-27.

A survey of 49 university and other research administrators investigated attitudes concerning research productivity and measures to assess it. Results are compared with those of an earlier survey of research scientists, including a rank-order comparison of the relative importance of a number of productivity measures. Implications for demonstrating productivity to both lay and professional audiences are discussed briefly.

Zareh, M., & Beas, A. M. (2004). UCLA Community College Review: Performance Indicators and Performance-Based Funding in Community Colleges. *Community College Review*, 31(4), 62-76.

The writers examine performance indicators and performance-based funding in community colleges. They discuss performance indicators as part of a broader movement toward accountability. They then discuss a recent study that examined community college indicators and performance-based funding by state. They conclude by outlining purposes for and implications of using performance indicators in community colleges.

Zheng, H. Y., & Stewart, A. A. (2000). Assessing the Effectiveness of Public Research Universities: Using NSF/NCES Data and Data Envelopment Analysis Technique. AIR 2000 Annual Forum Paper.

This study explores data envelopment analysis (DEA) as a tool for assessing and benchmarking the performance of public research universities. Using of national databases such as those conducted by the National Science Foundation and the National Center for Education Statistics, DEA analysis was conducted of the research and instructional outcomes of public research I universities. The study also presents an in-depth analysis of Ohio State University. Instructional variables considered included: instructional faculty full-time equivalency (FTE), expenditures/FTE student, faculty/student ratio, graduation efficiency, six-year graduation rate, degree completions, and admissions selectivity. Research variables included: total FTE faculty, expenditures/FTE faculty, number of publications, number of citations, government grants/contracts, total grants/contracts received, and availability of medical research centers and hospitals. Sections of the paper discuss: the use of DEA in performance measurement; data envelopment analysis; the study methodology; using DEA with a minimum number of variables; integrative performance analysis of multiple variables; strategic positioning of universities; and policy implications of the study findings. The paper concludes that DEA analysis allows academic leadership to more clearly articulate the resource and productivity requirements associated with institutional improvement and, additionally, to plan the direction and magnitude of necessary changes.

### References – Other Geographic Areas

- The Evaluative State Revisited.(1998). *European Journal of Education*, 33(3), 261-377.  
A special issue on revisiting the "Evaluative State" in higher education. Articles discuss the Evaluative State, conceptual and epistemological foundations of evaluation in higher education, new public management ideals in higher education, perspectives on university resistance, major international approaches to quality assurance mechanisms and the Australian experience of them since 1993, evaluation in the Italian higher education system, and the implications of the Evaluative State for research in higher education. An editorial is also provided.
- Should There Be a Moratorium on Articles that Rank Schools of Social Work Based on Faculty Publications?(1993). *Journal of Social Work Education*, 29, 240-252.
- Alt, H. (2002). Benchmarking in the Globalised World and Its Impact on South African Higher Education. *South African Journal of Higher Education*, 16(1), 9-14.  
Discusses what benchmarking is and reflects on the importance and development of benchmarking in universities on a national and international level. Offers examples of transnational benchmarking activities, including the International Benchmarking Club, in which South African higher education institutions participate.
- Bannister, B. (1991). Valuing Academic Research: Towards a Policy for Hong Kong's Future Universities. *Assessment and Evaluation in Higher Education*, 16(3), 215-223.  
This article examines strategies to foster and evaluate research and scholarship in Hong Kong's higher education sector. It addresses the definition of performance indicators, the role of governmental policy initiatives, performance indicators in the academic research context, possible research indicators, application of indicators, and other issues.
- Boffo, S., Chave, D., Kaukonen, E., & Opdal, L. R. (1999). The Evaluation of Research in European Universities. *European Journal of Education*, 34(3), 325-334.  
Policies, commissioning bodies, methods, and criteria for both internal and external evaluation of research at universities in eight countries (Finland, Portugal, United Kingdom, Germany, Italy, Norway, Spain, and France) are compared, and the effects of evaluations on the finance, structure, and research problems are examined.
- Brennan, J., & Shah, T. (2000). Quality Assessment and Institutional Change: Experiences from 14 Countries. *Higher Education*, 40(3), 331-349.  
The paper draws on an international study of the effects of national and institutional quality management systems on higher education institutions in 14 countries. The study was undertaken by the authors on behalf of the programme for Institutional Management in Higher Education (IMHE) of the Organisation for Economic Co-operation and Development (OECD). Over the last decade, almost all European countries have established national systems for the assessment of quality in higher education. Similar developments can be found in many other parts of the world. In

most countries, these developments have been largely sponsored by the state even if the national quality agencies so formed generally have a significant degree of operational autonomy and mainly use a form of peer review as their primary assessment method. Drawing on the IMHE study, the paper presents a conceptual model of the relationships between quality management and institutional change in higher education which takes into account variations in the national and institutional contexts in which quality management and assessment takes place as well as differences in the methods used. The impact of quality assessment is considered in terms of rewards/incentives, policies/structures and cultures of institutions. The paper argues that central to the establishment of quality management and assessment systems, whether national or institutional are questions of power and values. One of the central questions which the paper explores is the extent to which quality management represents a challenge to the intrinsic value systems of the academic profession and is a mechanism through which extrinsic values of society and economy are given greater weight in academic institutional life. Changes in the balance of power within academic life between system, institutional, basic unit and individual levels are explored as part of more general processes of institutional change.

- De Jong, O., Schmidt, H., & Zoller, U. (2000). Quality Criteria for Research Papers on Science Education: How Can They Be Used To Improve Manuscripts Submitted for Publication? *Chemistry Education: Research and Practice in Europe*, 1(1), 27-30. Describes a workshop on quality criteria for research papers in science education. The aim of the workshop was to improve the ability of participants in writing papers for research in science education journals. Reports the activities and outcomes of the workshop including its concise evaluation and some suggestions for manuscript improvement.
- Federkeil, G. (2002). Some Aspects of Ranking Methodology--The CHE-Ranking of German Universities. *Higher Education in Europe*, 27(4), 389-397. Describes and discusses the approach of the Center for Higher Education Development (CHE) ranking of German universities.
- Filinov, N. B., & Ruchkina, S. (2002). The Ranking of Higher Education Institutions in Russia: Some Methodological Problems. *Higher Education in Europe*, 27(4), 407-421. The ranking of higher education institutions in Russia is examined from two points of view: as a social phenomenon and as a multi-criteria decision-making problem. The first point of view introduces the idea of interested and involved parties; the second introduces certain principles on which a rational ranking methodology should be based.
- Gibbons, M. (1985). Methods for the Evaluation of Research. *International Journal of Institutional Management in Higher Education*, 9(1), 79-85. Research evaluations should be directed at affecting the implementation of policies

resulting from research, not at monitoring the outcomes of research, particularly in strategic research relating to government and industry.

Goddard, A. (1999). Move to Make broader RAE. *The Times Higher Education Supplement*, (1378), 40.

To encourage academics to submit a broader range of work, rules for Great Britain's research assessment exercise (RAE) are to be rephrased. However, those who submit less than four pieces of research will not necessarily be penalized. The managers of the RAE are encouraging equal treatment for all types of research output.

Harman, G. (1998). Supporting Quality Research in Institutions of Higher Education. *Australian Journal of Education*, 42(3), 285-302.

In recent decades, governments and universities in Organisation for Economic Cooperation and Development (OECD) countries have relied on six major mechanisms to safeguard quality in university research. More recently, many countries have added new quality-assurance mechanisms, particularly reviews of disciplines and academic audits. Two recent Australian developments of importance are described.

Hay, D. (2000). Quality Research in South African Higher Education: Illusions, Imperatives and Ideals. *South African Journal of Higher Education*, 14(1), 53-61. Discusses the complexity facing South African researchers in higher education as they try to overcome the heritage of the old, fragmented higher education system. Necessary paradigm shifts are identified, as are focus areas for improving the quality of South African higher education research at both national and institutional levels.

Henkel, M. (1986). Excellence versus Relevance: The Evaluation of Research. *International Journal of Institutional Management in Higher Education*, 10(2), 175-184.

A British review process for policy-oriented research is described, focusing on the problems of keeping academic criteria and policy relevance distinct in the process. The use of multiple evaluative frameworks for policy-related research is advocated.

Ho, K. K. (1998). Research Output Among the Three Faculties of Business, Education, Humanities & Social Sciences in Six Hong Kong Universities. *Higher Education*, 36(2), 195-208.

Academics in Hong Kong universities are urged to increase their research output. This article investigates the measurement of publication outputs among the three faculties of business, education, humanities & social sciences in the six universities of Hong Kong. Data were collected from the 1990-95 annual reports of research and publication outputs of each university. In order to have a fair comparison of publication outputs of each academic, rank, faculty and university, a framework was developed from practical experience and from literature to investigate the problem. Results indicate that the publication outputs of academics in Hong Kong were about the same as other countries in many aspects. Pressing academics for more research

publications may raise the figure in the start, but would not necessarily increase the output in the long run.

Johnes, G. (1992). Performance Indicators in Higher Education: A Survey of Recent Work. *Oxford Review of Economic Policy*, 8(2), 19-34.

This article surveys recent work on the construction of performance indicators in higher education, focusing particular attention on degree results, student wastage and research output. Performance indicators ought to provide measures of value added by the various institutions under review. As such crude measures of output, which fail to take account of input differences across institutions, are inappropriate. So it is necessary to investigate what factors underlie inter-institution differences in measured output, in order to correct for input variations in assessing overall performance. The absence of market prices for teaching and research outputs severely hinders the construction of composite measures of the performance of higher education institutions, since in their absence no objective weights can be assigned to the different roles of these institutions. The resource implications of performance measurement exercises need to be clarified if rankings exercises are to have the desired incentive effects.

Kreuger, L. W. (1993). Should There be a Moratorium on Articles that Rank Schools of Social Work Based on Faculty Publications? Yes! *Journal of Social Work Education*, 29, 240-5, 251-2.

Kumar, P., Mwamwenda, T. S., & Dye, A. H. (1999). Incentive-Driven Research at the University of Transkei. *Research in Education*, (61), 49-53.

A study examined the extent to which research productivity at the University of Transkei, South Africa, is driven by incentives. Data were obtained by examining the number of research papers published annually between 1990 and 1996 by the university's academics in refereed journals. Results revealed that research productivity was driven by incentives in the form of cash payments. However, results suggested that research productivity is also enhanced by noncash incentives. Among these is the realization by academics that research is an integral part of quality education; that it enhances their promotion prospects, tenure, professional fulfillment, personal status, and teaching and the university's reputation; and that it helps to advance and disseminate knowledge.

Lowe, I. (1987). University Research Funding: The Wheel Still Is Spinnin'. *Australian Universities' Review*, 30(1), 2-12.

The current funding of research in Australia's universities is examined, including the recent forces that have changed the research system and resource allocation, allocations by field, expenditures per researcher by field, and measures of and emphasis on productivity. Prospects for research in the late 1980s are discussed.

Mein, D. G. (2002). Research Productivity and Career Status. *Applied Economics Letters*, 9(12), 809-15.

Measurement of the productivity of economists, economics departments at

universities and economics institutes has a tradition, which dates back to the 1950s. This study attempts to show that such measurement can be used to explain long-run changes in the overall productivity of university departments and institutes involved in research. The underlying notion in this study is that the productivity of departments and institutes in terms of total output (publications) decreases when the productivity of research staff members and their position (career status) in their departments or institutes do not correlate well. The empirical data used by this study relates to an economics research institute and cover a period of 30 years. The hypothesis that a mismatch between productivity and position leads to a decline in the overall productivity of departments and institutes could not be refuted.

Meinert, R. G. (1993). Should There be a Moratorium on Articles that Rank Schools of Social Work Based on Faculty Publications? No! *Journal of Social Work Education*, 29, 245-251.

Moed, H. F., & Others. (1985). The Use of Bibliometric Data as Tools for University Research Policy. *International Journal of Institutional Management in Higher Education*, 9(2), 185-194.

A University of Leiden study on the potential use of quantitative, literature-based indicators as tools for monitoring research productivity and establishing research policy, based on the bibliographic productivity of two major faculties, is reported and discussed.

Morgan, K. J. (2004). The Research Assessment Exercise in English Universities, 2001. *Higher Education*, 48(4), 461-482.

At intervals of 3-4 years, research quality in English universities has been externally reviewed 5 times over the past 16 years. Assessment is based on peer-review of material submitted by universities to 70 separate subject panels. The principal component is information on research output, usually publications, from all academic staff identified as "research active." Research quality is rated on a numerical (1-5\*), criteria-based scale. Ratings in all subject areas and across all universities have increased to give an average rating in 2001 corresponding to a level of "attainable national excellence." Between universities there are significant variations. In the prestigious Loxbridge group, where almost all academic staff are research-active, 90[percent] of subject areas achieved ratings at level 5 in 2001; in contrast, in the New universities, where only 40[percent] of academic staff is research-active, level 5 was achieved in 7[percent] of subject areas. A combination of high research quality and high cost research (medicine, science, engineering) concentrated in the Old universities is similarly evident in the distribution of research funding. Income from both research subsidy and research grants and contracts is divided: Old universities, 94[percent] (Loxbridge, 35[percent]), New universities, 6[percent]. High institutional costs of the assessment process, particularly for areas of low-cost research, and increasing concern about the inadequacies of the rating system and failure of its direct link to funding suggest that substantial revision will be needed for future assessment exercises.

- Murphy, P. S. (1995). Benchmarking Academic Research Output in Australia. *Assessment & Evaluation in Higher Education*, 20(1), 45-57.  
A study of faculty published research output in Australia's university system in 1991 resulted in national benchmarks of faculty publications productivity (number of publications per 10 equivalent academic staff members), for each of 13 publication types, for the highest performing institution, and the highest performing units within any institution.
- Murphy, P. S. (1994). Research Quality, Peer Review and Performance Indicators. *Australian Universities' Review*, 37(1), 14-18.  
It is suggested that approaches to research assessment vary according to national context. In the United States, higher education is dominated by market forces; in Britain and Australia, emphasis is on interinstitutional competitiveness; in northern Europe, focus is overall system efficiency. Performance indicators and peer review of research are compared.
- Newton, J. (2000). Feeding the Beast or Improving Quality? Academics' Perceptions of Quality Assurance and Quality Monitoring. *Quality in Higher Education*, 6(2), 153-163.  
Discussion of quality assurance in Australian higher education focuses on a case study of a university sector college. Identifies an "implementation gap" between the intentions underpinning "quality policy" and actual outcomes. Argues that institutions and external quality bodies need to consider the conditions and context of academics' work in order to involve academics in efforts to improve teaching quality.
- Ng, Y. C., & Li, S. K. (2000). Measuring the Research Performance of Chinese Higher Education Institutions: An Application of Data Envelopment Analysis. *Education Economics*, 8(2), 139-156.  
Using data from 84 key Chinese higher education institutions, examines the effectiveness of a mid-1980s educational reform. Computes the efficiency of individual institutions' research performance, using data envelopment analysis. Research performance across regions has improved, but the institutions themselves remained inefficient between 1993 to 1995.
- Patrick, W. J., & Stanley, E. C. (1998). Teaching and Research Quality Indicators and the Shaping of Higher Education. *Research in Higher Education*, 39(1), 19-41.  
Research and teaching quality ratings have become established in the United Kingdom, influencing the level of government funding provided to higher education institutions. The correlation between the two indicators, and possible consequences of policies that reshape the higher education sector by concentrating research resources in a limited number of institutions, are considered. Comparisons are made with the United States.
- Print, M., & Hattie, J. (1997). Measuring Quality in Universities: An Approach to Weighting Research Productivity. *Higher Education*, 33(4), 453-469.

A study tested a procedure to identify and weigh various indicators of college faculty research productivity, as one measure of program quality. Eighty-six faculty in 34 Australian schools of education were surveyed. Highly valued indicators of research productivity included refereed journal articles, peer reviewed books, and major competitive research grants. Refereeing was critical in determination of research quality.

Ramsden, P. (1999). Predicting Institutional Research Performance from Published Indicators: a Test of a Classification of Australian University Types. *Higher Education*, 37(4), 341-358.

In 1998, the Australian federal government published comprehensive performance indicator data on universities. This article makes use of several indicators to examine correlates of research productivity in Australian universities, and to test the explanatory power of Marginson's (1997) typology of universities. Research productivity is measured using the quantity known as the 'research quantum' (RQ), which is a performance-related component of operating grant funding. Results of the analysis reveal that a large proportion of the variability in research performance can be attributed to two latent constructs. One relates together favourable student-staff ratios, a high proportion of graduating students continuing into further study, and a high proportion of research qualified staff. The other connects graduates' experiences of low quality courses, good student progress rates and low attrition with high graduate employability. These factors also predict membership of the four Marginson types. The results confirm that Australian universities can be separated into four main reputational groups based chiefly on research performance. Some implications for the use of performance indicators in a more market-driven system are discussed.

Ramsden, P. (1994). Describing and Explaining Research Productivity. *Higher Education*, 28(2), 207-226.

A study of research productivity among 890 Australian faculty members in 18 universities during 1985-89 found the overall average to be low but with a wide range of variation. Additional variables examined include level of research activity, subject area, institution type, gender, age, early research interest, and satisfaction with the promotion system.

Rasmussen, P. (1985). A Case Study on the Evaluation of Research at the Technical University of Denmark. *International Journal of Institutional Management in Higher Education*, 9(1), 58-66.

The chemistry and chemical engineering department's experiences with an institution-wide research evaluation process is discussed, focusing on the departmental input into the process, the estimation of research activity and productivity, and the evaluation of the research's relevance to teaching, international research, and society.

Richards, H., & Tysome, T. (1996). Towers of Strength. *The Times Higher Education Supplement*, (1259), 1.

The results from the 1996 Research Assessment Exercise reveal that the quality and volume of research throughout British higher education have risen over the past four years. Former polytechnics and the best research universities improved their standing, with overall average ratings increasing by almost half a point and top grades being awarded to 497 departments.

- Rouban, A. M. T. (1985). The Evaluation of Research: An Economic Process. *International Journal of Institutional Management in Higher Education*, 9(1), 44-51. The relationship between evaluation of research and resource allocation in universities is examined. Some areas of concern include the institution's capability to evaluate research, its objectives, problems of peer evaluation, and the search for new methodologies.
- Roulet, E. (1994). A Swiss Example: The Evaluation of Teaching and Research Units at the University of Geneva. *Higher Education Management*, 6(2), 127-136. Main features of the cyclical procedure used by the University of Geneva (Switzerland) to evaluate 75 teaching and research units (TRUs) over a 6-year cycle are that it covers teaching, research, and services simultaneously and combines self-evaluation, peer assessment, and use of a database on TRU resources and achievements.
- Sizer, J., Spee, A., & Bormans, R. (1992). The Role of Performance Indicators in Higher Education. *Higher Education*, 24, 133-155.
- Spruyt, E. H. J., & Others. (1996). Are Bibliometric Indicators Appropriate Policy Tools in a Young University? *Higher Education Management*, 8(3), 141-154. A study at the University of Antwerp (Belgium) investigated the ethics, sensitivity, and reliability of bibliographic methods to assess faculty research productivity. Such methods measure the impact of a university research group by counting the times the group's publications are cited by other authors. Results suggest that this quantitative method is reliable and provides useful comparative data.
- Stanley, E. C., & Patrick, W. J. (1998). Quality Assurance in American and British Higher Education: A Comparison. *New Directions for Institutional Research*, 25(3), 39-56. Compares quality improvement and accountability processes in the United States and United Kingdom. For the United Kingdom, looks at quality audits, institutional assessment, standards-based quality assurance, and research assessment; in the United States, looks at regional and specialized accreditation, performance indicator systems, academic program reviews, student outcomes assessment, rankings of research/doctorate programs, and published institutional rankings
- Tapper, T., & Salter, B. (2004). Governance of Higher Education in Britain: The Significance of the Research Assessment Exercises for the Funding Council Model. *Higher Education Quarterly*, 58(1), 4-30. This article uses the political struggles that have enveloped the research assessment

exercises (RAEs) to interpret the UK's current funding council model of governance. Ironically, the apparently widespread improvement in the research performance of British universities, as demonstrated by RAE 2001, has made it more difficult to distribute research income selectively, which was supposedly the central objective of the whole evaluative process. Whilst enhanced research ratings may be seen as a cause for celebration in the universities, the failure to anticipate this outcome and, more significantly, to plan for its financial implications is seen in political circles as a failure of higher education management. The article explores the alternative models of governance that are likely to emerge as a consequence of this crisis and, in particular, whether the funding councils can have much freedom of action, given the tighter political control of policy goals and their critical dependence upon the academic profession for the conduct of the evaluative process.

Thomas, H. G. (2001). Funding Mechanism or Quality Assessment: Responses to the Research Assessment Exercise in English Institutions. *Journal of Higher Education Policy and Management*, 23(2), 171-79.

During the last two decades, higher education in the UK has been dominated by two themes: financial constraint and quality assessment. Both these themes find expression within the Research Assessment Exercise. Findings from interviews held with staff in a number of institutions ranging from established research-orientated universities to institutions with aspirations of university status indicate a range of institutional and individual behaviour patterns in response to the Research Assessment Exercise. This article explores those responses and considers the perceived tension between using the Research Assessment Exercise as an assessment of the quality of research (an accountability function) and as a means of selectively allocating research funding (a resource allocation function).

Turner, D. (2005). Benchmarking in Universities: League Tables Revisited. *Oxford Review of Education*, 31(3), 353-371.

This paper examines the practice of benchmarking universities using a "league table" approach. Taking the example of the "Sunday Times University League Table", the author reanalyses the descriptive data on UK universities. Using a linear programming technique, data envelope analysis (DEA), the author uses the re-analysis to demonstrate the major shortcomings of current league tables. Those shortcomings include the arbitrary allocation of weightings to performance indicators, the failure to differentiate between inputs and outputs, and the comparison of institutions with dissimilar comparators. DEA is used to exemplify how these three shortcomings could be overcome, and how a better approach to benchmarking could be developed. In particular, it is argued that a DEA approach to benchmarking allows for the recognition of diverse missions, which is more appropriate to universities.

Waworuntu, B., & Holsinger, D. B. (1989). The Research Productivity of Indonesian professors of higher education. *Higher Education*, 18(2), 167-187.

Westerheijden, D. F. (1997). A Solid Base for Decisions. Use of the VSNU research evaluations in Dutch universities. *Higher Education*, 33, 397-413.

To gain insight into the use of the VSNU research quality evaluations (since 1993) in the practice of research and of institutional management in Dutch universities, interviews were held in eight cases evaluated in the first year of this procedure. The main conclusions are that use of these research evaluations is universal, both 'instrumentally' (in decisions directly based on the judgements) and 'incrementally' (in decision-making processes not directly linked to the evaluation). Underlying this is 'conceptual use:' an important change in deans' and rectors' views of their role in managing research, which they now can realise, because the VSNU research evaluations give them, for the first time, solidly legitimate arguments on which to base strategic decisions. Next to use, other effects can be discerned within universities, pointing to a growing dependency of researchers on managers, necessitating amongst others ever more consciously strategic publication behaviour. Whether quality of research improves in this way, cannot be answered here, but certainly it is more difficult for academics not to engage in research.

Wood, F., & Meek, L. (2002). Over-Reviewed and Underfunded? The Evolving Policy Context of Australian Higher Education Research and Development. *Journal of Higher Education Policy and Management*, 24(1), 7-25.

Major restructuring to the Australian higher education sector was initiated in 1988 with the dismantling of the previous binary system and the introduction of the unified national system. Since this time the sector has been the subject of continuous review by government and the policy and funding framework for higher education research in particular has undergone a number of changes. After providing contextual information regarding Australia and its R&D effort, this paper examines a number of major reviews that have impacted on the higher education sector. Particular attention is directed to identifying changes in both policy and funding environment. It is argued that the crisis facing Australian universities is the result of not only inadequate funding but also an over-reliance by government on the market steering of the sector.

Yonezawa, A., Nakatsui, I., & Kobayashi, T. (2002). University Rankings in Japan. *Higher Education in Europe*, 27(4), 373-382.

Traces the development of university rankings in Japan and explains the link between rankings and the mature, but drastically changing, Japanese higher education market.

Yorke, D. M. (1987). Indicators of Institutional Achievement: Some Theoretical and Empirical Considerations. *Higher Education*, 16(1), 3-20.

Several general approaches to organizational effectiveness are outlined, and three specifically relevant to higher education institutions are examined. Literature on the causal relationship of various areas of institutional achievement as a basis for a discussion of empirical findings and issues in assessment of institutional achievement.

Yorke, M. (1991). Performance Indicators: Towards a Synoptic Framework. *Higher Education, 21*, 235-248.

**Appendix B: Excluded References**

- Academic ranking of world universities, 2004*(2004). Shanghai Jiao Tong University.from <http://ed.sjtu.edu.cn/rank/2004/2004Main.htm>][cited20October2004
- Best in Show: Rethinking the Rankings Game.(2003). *Change*, 35(5), 55-58.
- Experts Call for New Higher Education Research Agenda.(2003). *Black Issues in Higher Education*, 19(26), 18.
- Austin Community College Benchmarking Update.(2002).
- A Need Answered: An Executive Summary of Recommended Accountability Reporting Formats.(1996).
- Research remedy (Grant application strategies for academics).(1995). *University Affairs*, 36(10), 44.
- University Funding: Information on the Role of Peer Review at NSF and NIH. Fact Sheet for the Ranking Minority Member, Committee on Appropriations, United States Senate.(1987).
- Alexander, F. K. (2000). The Changing Face of Accountability: Monitoring and Assessing Institutional Performance in Higher Education. *Journal of Higher Education*, 71(4), 411-431.
- Allen, M. (1996). Research Productivity and Positive Teaching Evaluations: Examining the Relationship Using Meta-Analysis. *Journal of the Association for Communication Administration (JACA)*, (2), 77-96.
- Anderson, R. C. (1986). A Proposed System for Classifying Research Universities.
- Asbury, C. A. (1988). Perspectives on the implications of research productivity for the black college professor. *The Journal of Negro Education*, 57, 1-2.
- Astramovich, L. R., Okech, E. J., & Hoskins, J. W. (2004). Counsellor Educators' Perceptions of Their Doctoral Coursework in Research Methods. *Guidance & Counselling*, 19(3), 124.
- Baird, L. L. (1986). What Characterizes a Productive Research Department? *Research in Higher Education*, 25(3), 211-225.
- Banta, T. W., & Fisher, H. S. (1989). Tennessee's Performance Funding Policy: L'Enfant Terrible of Assessment at Age Eight.

- Barak, R. J., & Kniker, C. R. (2002). Benchmarking by State Higher Education Boards. *New Directions for Higher Education*, (118), 93-102.
- Bauer, K. (1991). Institutional Research in a Changing Society. Proceedings of the Annual Conference of the Northeast Association for Institutional Research (18th, Cambridge, Massachusetts, November 16-19, 1991).
- Bauer, M. (1986). A Commentary on the Northeast Missouri and Tennessee Evaluation Models. *International Journal of Institutional Management in Higher Education*, 10(3), 272-274.
- Bellas, M. L., & Toutkoushian, R. K. (1999). Faculty Time Allocations and Research Productivity: Gender, Race, and Family Effects. *Review of Higher Education*, 22(4), 367-390.
- Bender, B. E. (2002). Benchmarking as an Administrative Tool for Institutional Leaders. *New Directions for Higher Education*, (118), 113-120.
- Benjamin, M. (1996). The Design of Performance Indicator Systems: Theory as a Guide to Relevance. *Journal of College Student Development*, 37, 623-630.
- Bercovitz, J. (2001). Organizational Structure as a Determinant of Academic Patent and Licensing Behavior: An Exploratory Study of Duke, Johns Hopkins, and Pennsylvania State Universities. *Journal of Technology Transfer*, 26(1-2), 21-35.
- Bland, C. J., & Schmitz, C. C. (1986). Characteristics of the Successful Researcher and Implications for Faculty Development. *Journal of Medical Education*, 61(1), 22-31.
- Blumenstyk, G. (1993). Colleges Look to "Benchmarking" to Measure How Efficient and Productive They Are. *Chronicle of Higher Education*, 40(2)
- Borden, V. M. H., & Rooney, P. M. (1998). Evaluating and Assessing Learning Communities. *Metropolitan Universities: An International Forum*, 9(1), 73-88.
- Bowers, L. J., & Elliott, R. W. (1992). Evaluation of Forty-Four University Research Programs That Receive Line-Item Appropriations from the Texas Legislature. *SRA Journal of the Society of Research Administrators*, 24(1), 57-66.
- Boyer, P. (2003). *College rankings exposed TM: the art of getting a quality education in the 21st century* Peterson's.
- Braxton, J. M. (1996). Contrasting Perspectives on the Relationship between Teaching and Research. *New Directions for Institutional Research*, (90), 5-14.
- Bullock, K., & Scott, B. (1992). Evaluating an Innovation. *Assessment and Evaluation in Higher Education*, 17(2), 111-126.

- Caesar, T. B. (1997). Comments on "Slouching toward scholarism". *College English*, 59, 590-591.
- Centra, A. J., & McNinch, J. (1997). Reflective faculty evaluation : enhancing teaching and determining faculty effectiveness. *Journal of Professional Studies*, 4(2), 55.
- Clagett, C. A. (1990). Increasing Institutional Research Productivity, Resources, and Staffing. AIR 1990 Annual Forum Paper.
- Clagett, C. A., & Kerr, H. S. (1995). Institutional Research: What Should We Expect? Defining and Exceeding Campus Expectations. AIR 1995 Annual Forum Paper.
- Clarke, M. (2002). News or Noise? An Analysis of U.S. News and World Report's Ranking Scores. *Educational Measurement*, 21(4), 39-48.
- Clarke, M. (2002). Some Guidelines for Academic Quality Rankings. *Higher Education in Europe*, 27(4), 443-459.
- Cleary, T. S. (2001). Indicators of quality. *Planning for Higher Education*, 29(3), 19-28.
- Cohn, E., Rhine, S. L. W., & Santos, M. C. (1989). Institutions of Higher Education as Multi-product Firms: Economies of Scale and Scope. *Review of Economics and Statistics*, 71(2), 284-90.
- Cole, B. (1989). Conflict of Interest and Research. *Research Management Review*, 3(2), 41-50.
- Corak, K., & Croonquist, J. (1994). From Rubble to Edifice: Research as the Bricks and Mortar of Institutional Change.
- Cowen, R. E. (1996). The Evaluation of Higher Education Systems. World Yearbook of Education. 1996., Report: ISBN-0-7494-1777-3. 214.
- Creamer, E. G. (1998). Assessing faculty publication productivity: issues of equity. *ASHE-ERIC Higher Education Reports*, 26(2), 1-91.
- de Groot, H., McMahon, W. W., & Volkwein, J. F. (1991). The Cost Structure of American Research Universities. *Review of Economics and Statistics*, 73(3), 424-31.
- Dearden, J., Taylor, L., & Thornton, R. (2001). A Benchmark Profile of Economics Departments in 15 Private Universities. *Journal of Economic Education*, 32(4), 387-396.
- Dill, D. D. (1998). Evaluating the Evaluative State': Implications for Research in Higher Education. *European Journal of Education*, 33(3), 361-377.

- Dolan, R. C., & Schmidt, R. M. (1994). Modeling Institutional Production of Higher Education. *Economics of Education Review*, 13(3), 197-213.
- Dooris, M. J., & Fairweather, J. S. (1992). The Organization of Academic Research: Faculty Behavior and Perceptions. ASHE Annual Meeting Paper.
- Dundar, H., & Lewis, D. R. (1995). Departmental Productivity in American Universities: Economies of Scale and Scope. *Economics of Education Review*, 14(2), 119-44.
- Eccles, C. (2002). The Use of University Rankings in the United Kingdom. *Higher Education in Europe*, 27(4), 423-432.
- Edwards, M. R., & Sproull, J. R. (1985). Performance Appraisal for Matrix Management. *Journal of the Society of Research Administrators*, 17(1), 33-47.
- Fairweather, J. S. (2002). The Mythologies of Faculty Productivity: Implications for Institutional Policy and Decision Making. *Journal of Higher Education*, 73(1), 26-48.
- Feller, I. (2004). Virtuous and Vicious Cycles in the Contributions of Public Research Universities to State Economic Development Objectives. *Economic Development Quarterly*, 18(2), 138-50.
- Fetterman, D. M. (1991). Auditing as Institutional Research: A Qualitative Focus. *New Directions for Institutional Research*, 18(4), 23-34.
- Fine, P. (1996). Rankings rated at Maclean's. *The Times Higher Education Supplement*, (1257), 12.
- Fisher, K. (2001). Facility Benchmarking Trends in Tertiary Education - An Australian Case Study. *PEB Exchange*, (43), 20-22.
- Freeman, T. M. (1995). Performance Indicators and Assessment in the State University of New York System. *New Directions for Higher Education*, (91), 25-49.
- Furrow, David, Taylor, & Colin. (1996). Research at two small Canadian universities. *The Canadian Journal of Higher Education*, 26(1), 57.
- Gayeski, D. M. (1995). Benchmarking Multimedia Development in Colleges and Universities. *College & University Media Review*, 1(2), 7-20.
- Geraghty, M. (1997). U.S. news' Alters Methodology of its Controversial College Rankings. *The Chronicle of Higher Education*, 43, A34.
- Geuna, A. (1997). Allocation of Funds and Research Output: The Case of UK Universities. *Revue d'Economie Industrielle*, 0(79), 143-62.

- Gilbert, D. C. (1992). Challenges to the Presumption of Academic and Scientific Integrity. *SRA Journal of the Society of Research Administrators*, 23(4), 47-51.
- Goddard, A. (2003). RAE Reform to Shut out One in Three. *The Times Higher Education Supplement*, (1591), 1-2.
- Goddard, A. (2003). Revamped RAE to Start a Year Early. *The Times Higher Education Supplement*, (1585), 1.
- Goldstein, H. A., & Renault, C. S. (2004). Contributions of Universities to Regional Economic Development: A Quasi-experimental Approach. *Regional Studies*, 38(7), 733-46.
- Goodman, M. J. (1994). The Review of Tenured Faculty at a Research University: Outcomes and Appraisals. *Review of Higher Education*, 18(1), 83-94.
- Graham, H. D., & Diamond, N. (1997). The Rise of American Research Universities. Elites and Challengers in the Postwar Era.
- Green, D. (1994). What Is Quality in Higher Education?
- Guzzetta, D. J. (1995). Teaching/Research: Faculty Roles, Evaluations, and Rewards in Kansas Regents Universities. A Case Study.
- Hanson, E. O. (1995). In Search of the Benchmark Institution. *College and University*, 70(3), 14-19.
- Harrington, C. F., & And Others. (1996). Does Institutional Research Really Contribute to Institutional Effectiveness? Perceptions of Institutional Research Effectiveness As Held by College and University Presidents. *AIR 1996 Annual Forum Paper*. U.S.; Indiana:
- Harvey, L., & Green, D. (1993). Defining Quality. *Assessment and Evaluation in Higher Education*, 18(1), 9-34.
- Hayes, C. R. (1995). Development of Evaluation Indicators: Three Universities of the Texas A&M System. *New Directions for Higher Education*, (91), 91-96.
- Heft, J. L. (1994). Teaching and Research at Comprehensive Universities. *Current Issues in Catholic Higher Education*, 14, 37-41.
- Henkel, M. (1998). Evaluation in Higher Education: Conceptual and Epistemological Foundations. *European Journal of Education*, 33(3), 285-297.

- Heverly, M. A., & Cornesky, R. A. (1992). Total Quality Management: Increasing Productivity and Decreasing Costs. *New Directions for Institutional Research*, 19(75), 103-114.
- Hickson, M., Stacks, D. W., & Amsbary, J. H. (1993). Active Prolific Scholars in Communication Studies: Analysis of Research Productivity, II. *Communication Education*, 42, 224-233.
- Hoare, A. G. (1995). Scale Economies in Academic Excellence: an Exploratory Analysis of the United Kingdom's 1992 Research Selectivity Exercise. *Higher Education*, 29, 241-260.
- Hodges, S. (2002). Authentic Values and Ersatz Standards: Making Sense of College Rankings. *Academe*, 88(6), 33-35.
- Huntington, R. B., & Clagett, C. A. (1991). Increasing Institutional Research Effectiveness and Productivity: Findings from a National Survey.
- Jalongo, M. R. (1985). Faculty Productivity in Higher Education. *The Educational Forum*, 49, 171-182.
- Johnson, F. C. (1991). Application of Tools of Quality to Education. AIR 1991 Annual Forum Paper.
- Johnsrud, L. K., & Heck, R. H. (1998). Faculty Worklife: Establishing Benchmarks Across Groups. *Research in Higher Education*, 39(5), 539-555.
- Jordan, J. M., & Others. (1989). Academic Research Productivity, Department Size and Organization: Further Results. *Economics of Education Review*, 8(4), 345-352.
- Jurow, S. (1993). Tools for Measuring and Improving Performance. *Journal of Library Administration*, 18(1-2), 113-126.
- Kaya, N., & Weber, M. J. (2003). Faculty Research Productivity: Gender and Discipline Differences. *Journal of Family and Consumer Sciences*, 95(4), 46-52.
- Keller, G. (1985). Trees without fruit: the Problem with Research about Higher Education. *Change*, 17, 7-10.
- Kells, H. R. (1999). National Higher Education Evaluation Systems: Methods for Analysis and Some Propositions for the Research and Policy Void. *Higher Education*, 38(2), 209-232.
- Kimmerling, G. (1993). Gathering Best Practices. *Training and Development*, 47(9), 28.

- Kirk, S. A., & Corcoran, K. (1995). School Rankings: Mindless Narcissism or do they tell us Something? *Journal of Social Work Education, 31*, 408-414.
- Kwak, N. K., Choi, T., & Kim, S. (2001). Efficiency Evaluation of Research University Libraries Using Data Envelopment Analysis. *Advances in Mathematical Programming and Financial Planning. Volume 6*, , 3-18.
- Landry, R., & Others. (1996). An Econometric Analysis of the Effect of Collaboration on Academic Research Productivity. *Higher Education, 32*(3), 283-301.
- Lewington, J. (1995). Ranking Canada's universities brings controversy--and profits. *The Chronicle of Higher Education, 42*, A39.
- Ligon, J., Thyer, B. A., & Dixon, D. (1995). Academic Affiliations of those Published in Social Work Journals: a Productivity Analysis, 1989-1993. *Journal of Social Work Education, 31*, 369-376.
- Lowry, P. S., & Walker, C. S. (1992). The Need to Evaluate Research Support Offices in Institutions of Higher Education. *SRA Journal of the Society of Research Administrators, 23*(4), 35-42.
- Lunefeld, M. (1989). Research Outside the "Research" Universities. *Academe, 75*, 60.
- MacFarland, T. W. (1995). Evaluation of Research and Planning. Research and Planning Report.
- Manning, T. E. (1986). Evaluation and Accreditation of Institutions of Postsecondary Education. *North Central Association Quarterly, 61*(2), 261-267.
- Marsh, H. W., & Hattie, J. (2002). The Relation between Research Productivity and Teaching Effectiveness: Complementary, Antagonistic, or Independent Constructs? *Journal of Higher Education, 73*(5), 603-641.
- Maydew, M. J. (1992). Assessing Noninstructional Costs and Productivity. *New Directions for Institutional Research, 19*(75), 49-59.
- McClain, C. J., & Others. (1986). Northeast Missouri State University's Value-Added Assessment Program: A Model for Educational Accountability. *International Journal of Institutional Management in Higher Education, 10*(3), 252-261.
- McCullough, J. (1994). The Role and Influence of the US National Science Foundation's Program Officers in Reviewing and Awarding Grants. *Higher Education, 28*(1), 85-94.
- McEwen, Nelly. (1995). Accountability in Education in Canada. *Canadian Journal of Education, 20*(1), 1.

- Merriam, R. W. (1986). Academic Research vs. the Liberal Arts. *Journal of College Science Teaching*, 16, 105-109.
- Middaugh, M. F., & Hollowell, D. E. (1992). Examining Academic and Administrative Productivity Measures. *New Directions for Institutional Research*, 19(75), 61-75.
- Mittler, M. L., & Bers, T. H. (1994). Qualitative assessment: an institutional reality check. *New Directions for Community Colleges*, (88), 61-67.
- Moloney, D. P., & Grotevant, S. M. (1997). Collegiate and Departmental Performance Indicators: The Measures That Matter! *AIR 1997 Annual Forum Paper*. U.S.; Minnesota:
- Monks, J., & Ehrenberg, R. G. (1999). U.S. News & World Report's College Rankings: Why They Do Matter. *Change*, 31(6), 42-51.
- Monks, J., Ehrenberg, R. G., & Nat. Bur. of Econ. Research. (1999). The impact of U.S. News & World Report college rankings on admissions outcomes and pricing policies at selective private institutions. *National Bureau of Economic Research, Inc.*
- Moore, M. G. (2004). Research Worth Publishing. *American Journal of Distance Education*, 18(3), 127-130.
- Moore, R. (2004). Do Colleges Identify or Develop Intelligence? *Journal of Developmental Education*, 28(1), 28-30, 32, 34.
- Morley, L. (2001). Subjected to Review: Engendering Quality and Power in Higher Education. *Journal of Education Policy*, 16(5), 465-478.
- Musewe, V. O. (1986). A Review of Bases for Evaluating the Performance of Agricultural Research Institutions. *Journal of the Society of Research Administrators*, 18(1), 13-27.
- Narin, F., & Others. (1994). Bibliometrics/Theory, Practice and Problems. *Evaluation Review*, 18(1), 65-76.
- Neave, G. R. (1998). The Evaluative State Reconsidered. *European Journal of Education*, 33(3), 265-284.
- Nedwek, B. P., & Neal, J. E. (1993). Performance Indicators and Rational Management Tools: A Comparative Assessment of Projects in North America and Europe. *AIR 1993 Annual Forum Paper*.
- Noser, T. C., & Others. (1996). Research Productivity and Perceived Teaching Effectiveness: A Survey of Economics Faculty. *Research in Higher Education*, 37(3), 299-321.

- Owen, Michael. (1992). Research at Small Canadian Universities. *The Canadian Journal of Higher Education*, 22(2), 1.
- Page, S. (2000). Ranking of Canadian Universities: A New Marketing Tool. *Journal of Marketing for Higher Education*, 10(2), 59-69.
- Page, S. (1999). Rankings of Canadian Universities and Help to Students. *Guidance and Counselling*, 14(3), 11-13.
- Page, S. (1995). Rankings of Canadian Universities: Pitfalls in Interpretation. *Canadian Journal of Higher Education*, 25(2), 17-28.
- Page, S., & Cramer, K. (2000). Rankings of Canadian Universities, 2000: Buyer Beware. *Canadian Journal of Education*, 25(4), 297-309.
- Page, S., Cramer, K., & Page, L. (2003). Rankings of Canadian Universities, 2002: Implications for Students' Academic Welfare. *Guidance and Counselling*, 18(3), 93-100.
- Page, Stewart. (1998). Rankings of Canadian universities, 1997: Statistical Contrivance versus Help to Students. *Canadian Journal of Education*, 23(4), 452.
- Papa, M. J., & Tracy, K. (1988). Communicative Indices of Employee Performance with New Technology. *Communication Research*, 15(5), 524-544.
- Payne, A. A. (2001). Measuring the Effect of Federal Research Funding on Private Donations at Research Universities: Is Federal Research Funding More Than a Substitute for Private Donations? *International Tax and Public Finance*, 8(5-6), 731-51.
- Pencavel, J. (1991). Higher Education, Productivity, and Earnings: A Review. *Journal of Economic Education*, 22(4), 331-59.
- Rogers, B. H., & Gentemann, K. M. (1989). The Value of Institutional Research in the Assessment of Institutional Effectiveness. *Research in Higher Education*, 30, 345-355.
- Rothkopf, A. J. (1996). College Rankings: Increasing Accuracy, Improving Accountability. *The Chronicle of Higher Education*, 43, B5-6.
- Rothkopf, A. J. (1995). Devising Better Ways to Measure the Quality of Colleges and Universities. *The Chronicle of Higher Education*, 41, B3.
- Ruben, B. D. (1995). Quality in Higher Education.

- Ruscio, K. P. (1987). The Distinctive Scholarship of the Selective Liberal Arts College. *The Journal of Higher Education (Columbus, Ohio)*, 58, 205-222.
- Sanoff, A. P. (1998). Rankings are Here to Stay; Colleges Can Improve Them. *The Chronicle of Higher Education*, 45(2), A96.
- Sapp, M. M., & Temares, M. L. (1992). A Monthly Checkup: Key Success Indices Track Health of the University of Miami. *Business Officer*, 25(9), 24-31.
- Sauer, K. A., & Draugalis, J. R. (2000). Mock Proposals and Other Group Assignments: Bridging Didactic Research Evaluation Skills to Research Applications. *American Journal of Pharmaceutical Education*, 64(3), 307-312.
- Saunier, M. E. (1985). Objective Measures as Predictors of Reputational Ratings. *Research in Higher Education*, 23(3), 227-245.
- Schmitz, C. C. (1993). Assessing the validity of higher education indicators. *The Journal of Higher Education (Columbus, Ohio)*, 64, 503-521.
- Schofield, A. (2000). The Growth of Benchmarking in Higher Education. *Lifelong Learning in Europe*, 5(2), 100-105.
- Schreiber, W. (1994). Answering the Call: How PR Officers Can Communicate Accountability in Four Key Areas: Faculty Productivity, Public Service, Costs, and Research. *Currents*, 20(4), 34-39.
- Seidman, A. (1993). Needed: a Research Methodology to Assess Community College Effectiveness. *Community College Journal*, 63, 36-40.
- Serban, A. M. (1998). Performance Funding Criteria, Levels, and Methods. *New Directions for Institutional Research*, 25(1), 61-67.
- Simone, D., Christina, Ives, Cindy, & McWhaw, Katherine. (2005). Reflections of Researchers Involved in the Evaluation of Pedagogical Technological Innovations in a University Setting. *The Canadian Journal of Higher Education*, 35(1), 61.
- Smart, J. C., & Tierney, W. G. (1999). Higher Education: Handbook of Theory and Research. Volume XIV.
- Strosnider, K. (1997). Study Measures Influence of College Rankings. *The Chronicle of Higher Education*, 43, A34.
- Szeto, W. F. (1994). Perceptions of Faculty Performance Evaluation among Faculty across Academic Disciplines at a Selected University.

- Tan, D. L. (1986). The Assessment of Quality in Higher Education: a Critical Review of the Literature and Research. *Research in Higher Education, 24*(3), 223-265.
- Taylor, J. (1987). Performance Indicators in Higher Education: Recent Developments in UK Universities. *Australian Universities' Review, 30*(2), 28-31.
- Teeter, D. J., & Christal, M. E. (1986). Establishing peer groups: a comparison of methodologies. *Planning for Higher Education, 15*(2), 8-17.
- Valimaa, J., & Westerheijden, D. F. (1995). Two Discourses: Researchers and Policy-Making in Higher Education. *Higher Education, 29*, 385-403.
- van der Westhuizen, L. J. (1998). Assessment of Research in South Africa. *South African Journal of Higher Education, 12*(3), 69-75.
- Vroeijenstijn, A. I. (1995). Government and University: Opponents or Allies in Quality Assurance? *Higher Education Review, 27*(3), 18-36.
- Wedekind, A., & Pollack, R. H. (2002). Measure for Measure: Advancement's Role in Assessments of Institutional Quality. *Currents, 28*(2), 16-21.
- Weeks, P. (2000). Benchmarking in Higher Education: An Australian Case Study. *Innovations in Education and Training International, 37*(1), 59-67.
- Welsh, J. F. (2002). Assessing the Transfer Function: Benchmarking Best Practices from State Higher Education Agencies. *Assessment & Evaluation in Higher Education, 27*(3), 257-268.
- Westerheijden, D. F. (1999). Where are the quantum jumps in quality assurance? Developments of a decade of research on a heavy particle. *Higher Education, 38*(2), 233-254.
- Westney, L. C. H. (2002). Educational rankings annual, 2002: over 4400 rankings and lists on education, compiled from educational and general interest published sources *Gale Group*.
- Wilson, R. (2005). Deep Thought, Quantified. *The Chronicle of Higher Education, 51*(37), A8-A10.
- Woodhouse, D. (1995). Efficient Quality Systems. *Assessment & Evaluation in Higher Education, 20*(1), 15-24.
- Ziolkowski, E. J. (1996). Slouching Toward Scholardom: the Endangered American College. *College English, 58*, 568-588.

Zucker, L. G., Darby, M. R., & Armstrong, J. S. (2001). Commercializing Knowledge: University Science, Knowledge Capture, and Firm Performance in Biotechnology. *National Bureau of Economic Research, Inc, NBER Working Papers: 8499.*