Enhancing UWA's Research Reputation

A Discussion Paper Based on the Academic Literature

By

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Abstract

This paper is a response to a call from the DVC Research for discussion on how UWA's research reputation may be improved. The paper shows why reputation is important and reviews factors associated with high reputation. Four salient points emerge: (i) Research and teaching are approached and conducted differently across disciplines. However, research drives reputation across all areas. (ii) There are policy decisions UWA can make even with its constrained funding that will positively affect its research outcomes and reputation. (iii) The views of bibliometric experts indicate focusing directly on improving UWA's ARWU ranking derives from an "audit culture" mentality that systematically detracts from generation of high impact research. (iv) The intensity with which UWA can push the policy levers to maximise high impact research is constrained by its mission to excel as well in teaching and civic engagement.

Summary Overview

Motivation

i. The DVC Research W/Prof. Robyn Owens has called for discussion on how UWA's research reputation may be improved. This paper responds to that call by reviewing the academic literature on development of university reputation.

ii. Attending to reputation provides a convenient framework for identifying the trade-offs, commitments required and value-judgments implicit in UWA's goal of becoming a "top fifty" university by 2050.

University reputation: key findings from the literature

iii. Studies show reputation affects recognition of research. This is true at the individual, faculty and university level. There is a "halo effect", e.g., a good university reputation raises the standing of a middling department. A good reputation also attracts higher achieving students, competition for which is intensifying at state, national and international levels.

iv. International reputation is correlated with (a) high impact research, (b) institutional size and (c) student selectivity. The primacy of research is underscored by the widely cited Academic Ranking of World Universities (ARWU) system (formerly known as the Shanghai Jiao Tong rankings) giving zero weight to teaching and learning, notwithstanding its label as an "academic ranking of world universities".

v. Institutional size is associated with reputation because larger institutions have more resources to attract higher quality researchers and are more salient. UWA faces a major challenge to build its resources to achieve a critical mass of high quality researchers. In terms of full-time equivalent (FTE) "Research Only" and "Teaching & Research" staff UWA is about half the size of the Universities of Queensland (UQ), Sydney and Melbourne. UQ, Sydney and Melbourne also rank in the top seven universities in Australia by student enrolments. UWA ranks 25th, having fewer than half the number of students at Melbourne University.

vi. The size statistics are pertinent because research shows "… the university's reputation and resource commitment set the broad context for departmental success and account for the bulk of the differences in reputational rankings among departments". This is a relevant point when accounting for the outcomes of research evaluation exercises such as ERA2012.

vii. Opportunities to increase funding streams are limited. A recent study observes "[t]he Australian research funding environment is neither rich nor diverse and does not provide significant alternative funding sources for universities. A major problem is the structure of the Australian economy, especially the weakness of science-based industries; accordingly contributions by industry to the funding of research are low …".

viii. Nevertheless, a comparison of UWA and UQ subsequent to their adoption of different hiring policies and performance measures shows institutional practices do affect production of high impact research and, consequently, reputation. This comparison and other investigations indicate fostering high impact research entails (a) rewarding research quality rather than quantity, (b) developing and recruiting top researchers, (c) giving them considerable autonomy and (d) being cognizant and tolerant that high impact research entails high risk so the incidence of "failed" research increases along with increase in incidence of "break through" research.

ix. Research and teaching are approached and conducted differently across disciplines. However, research drives reputation across all areas, notwithstanding widespread criticism of "irrelevant" research in the disciplines associated with the professions and the humanities.

x. Justifying research is a perennial challenge for academics with seemingly esoteric interests but is particularly problematic for the arts, humanities and social sciences because bibliometric measures used as a proxy for quality work less effectively in these fields. These disciplines risk being marginalized within "enterprising universities" that aim to improve their status by aligning their internal incentives with performance on ostensibly "reliable, transparent" bibliometric measures such as those used by the ARWU.

Issues in developing a high performance research culture at UWA

xi. A dilemma for UWA (and other research intensive universities) is that an environment productive of high impact research competes with teaching and institutional values such as equity of access and community engagement:

a. Research and teaching are not complementary; a robust finding is that universities with strong research orientation do poorly in teaching.
b. Top research universities have student populations extraordinarily skewed to the upper-middle class.
c. Applied research that fosters community and industry engagement detracts from "high impact" research that builds reputation.

xii. One rationale for UWA's "top 50" aspiration is that it is an attempt to square this circle: the premise being a "top fifty" research university yields reputational benefits that make it easier to attract resources to provide, inter alia, scholarships for deserving students, a better teaching environment and community engagement from high impact research that is seen to make a difference in people's lives.

xiii. As UWA addresses the challenges posed by its relatively small size, its constrained funding environment and intensified global competition to achieve "top 50 status – cf. "Wannabe U" by Gaye Tuchmann – the views of leading bibliometric experts indicate it would be a mistake for UWA to incorporate as part of its strategy a close alignment of internal incentives with the ARWU's measures of reputation.

xiv. The evidence (canvassed in this discussion paper) shows bibliometric measures are just not sophisticated enough – evidence indicates UWA's Socratic Index falls short of by a considerable margin – to use as an effective tool to manage high performance research. Use of bibliometric measures does affect behaviour and choice of research questions but leads systematically to low risk/low impact research. UWA has been down this path before, as a comparison of its performance with UQ since the early 1990s shows.

xv. A separate threat associated with the ARWU is that a determined focus on achieving "top fifty" ranking will further squeeze resources from teaching and those disciplines not counted by the ARWU. This squeeze will occur at a time when UWA likely needs to devote substantial new investment and attention to respond effectively to technological-driven changes in teaching that threaten the viability of traditional funding and operating models that link student numbers to research funding. There is a high probability that research reputation will not be closely linked to student demand in future.

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Enhancing UWA's research reputation

Motivation

1. A decline in UWA's reputation relative to its research achievements has prompted a call for discussion on how it may be improved[1]. This paper responds to that call by reviewing the research on university reputation and discussing the implications.

Differentiating reputation and performance

2. Rankings based on reputation measures (e.g., surveys) can differ substantially from rankings on bibliometric measures (e.g., citations per capita). UWA is not alone in having its research reputation mismatch its performance. Williams and van Dyke (2008) observe:

    2.1. "among the Go8 universities, … the University of Queensland [UQ] is rated more highly using … [research] performance measures than using … [reputation-based] survey scores. Combined with the finding that Australian academics rate Queensland higher than do their overseas colleagues, this suggests that Queensland's reputation lags its performance".

3. The strong research performance of UQ is evident in its Academic Ranking of World Universities (AWRU) ranking. In 2011, UQ moved up at least 14 places to number 86. UQ was previously ranked in the 101-150 band. In 2012, UQ slipped four places to number 90 whilst for the first time UWA clambered into the top 100 at number 96. The ARWU rankings are based only on bibliometric measures of research quality, i.e., survey findings play no part in the ranking exercise. Further, quality of teaching and learning does not figure at all.

4. In their US-based comparison of university rankings based on reputation survey and bibliometric measures, Diamond and Graham (2000) report:

    4.1. "in all of the comparisons … the patterns of research performance that emerge are consistent with our research findings that reputational rankings tend to mask the

[1] At a meeting of Academic Board on 16th November 2011, W/Professor Robyn Owens, Deputy Vice-Chancellor Research, tabled a paper (Appendix D of Meeting Agenda) with the aim of providing a "starting point for a discussion on ways in which the University can facilitate an improvement of UWA's research reputation at both the national and international level" (page D1). Professor Owens observes, in the paper: "recently, we have noticed that The University of Western Australia's reputation, when compared with other Australian universities, appears to be declining. This decline is most likely the result of our recently reduced share of national competitive research funds and because those rankings that rely upon reputational surveys see UWA relatively poorly placed within the Australian sector, even though Australia as a whole does well internationally."

demonstrable research achievements of challenging institutions" (p.5).

Why reputation matters

5. Multiple studies support the contention that reputation affects recognition of research. The effects operate at the individual, faculty and university level.

6. Merton (1968,1988) describes the Matthew Effect[2] whereby scientists with an established reputation earn disproportionately greater recognition than scientists who undertake research equally as good[3].

7. Consistent with the Matthew Effect, Cole (1970) documents that when two physicists publish papers of equal quality the physicist with a higher reputation receives recognition sooner. He also finds that it is a distinct advantage for less well-known physicists to be in highly rated departments; their work diffuses more rapidly than otherwise.

8. Adams, Clemmons and Stephan (2005) find that

   8.1. "citation probabilities from lower to higher ranked institutions[4] exceed the reverse citations, though the latter are significant. Higher ranked institutions are more often cited by peers than lower ranked institutions. This suggests that knowledge flows from peers increase with rank of institution" (p. 61).

9. Even when research quality rating exercises are based principally on bibliometric measures, they typically incorporate a reputation component, as Butler and McAllister (2009) find in their study "*Metrics or peer review? Evaluating the 2001 UK research assessment exercise in political science*"[5]. Butler and McAllister (2009) report,

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[2] "For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath" Matthew Ch. 25, verse 26, *King James Bible.*

[3] Barber (1961) writes "perhaps the classical instance of low professional standing helping to create resistance to a scientist's discoveries is that of Mendel. The notion that Mendel was "obscure," in the sense that his work did not come to the attention of competent and noted professionals in his field, can no longer be accepted" (p. 600). Barber notes that Carl von Naigeli, one of the most distinguished botanists in Mendel's time "looked down, from his position of authority, upon the unimportant monk from Brunn …Nor was Naigeli unique. Others, such as W. O. Focke, Hermann Hoffman, and Kerner von Marilaun, also dismissed Mendel's work because he seemed *an insignificant provincial* to them" (p. 600).

[4] Adams et al's rankings are based on peer rankings of graduate programs.

[5] It's worth noting that Butler and McAllister interpret their results as "suggesting unequivocally, that a metrics-based model, using objective, transparent indicators drawn from a range of readily available measures, will yield results which are very close to those of a peer-

9.1. "the results show that citations are the most important predictor of the RAE outcome, followed by whether or not a department had a representative on the RAE panel. …. [A] department that was awarded a 4 ranking in the RAE but did not have a staff member on the panel could have expected to receive close to a 5 ranking if one of its members had been on the panel – net of a wide variety of other factors. This is a substantial effect … **It is also an indication that, for general acceptance within the sector, panel membership needs to be drawn from the elite echelon of researchers who are normally associated with highly rated departments**" (pp. 9/10, emphasis added).

10. A university with a good reputation raises the standing of an otherwise middling department, i.e., the "halo effect". Anderson, Narin and McAllister (1978) document that "university ranks and scores within different fields are much more correlated when based on peer assessment than when based on bibliometric measures" .

11. In a direct test of the halo effect, Katz and Eagles (1996) find that a mediocre political science department within a good university is likely to rate more highly than bibliometric measures would place it. Katz and Eagles conclude that

    11.1. "it is the universities as a whole that are responsible for most of the variance in rankings of political science departments … variance between universities in their overall reputations and commitment to research can account for about 73% of the variance in reputations between political science departments. Variance in political science department characteristics increases the variance in their reputations that is accounted for by another 18%. …".

12. The halo effect implies all academics have a stake in enhancing UWA's research reputation, not just their own or their Faculty's or Discipline's[6]. Two examples illustrate

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based evaluation model" (p. 14). This is despite their earlier comment that "unexpectedly, whether the department had a member on the RAE panel was the second most important predictor of the RAE outcome" (p.14).

[6] Bibliometric experts Henk F. Moed, W.J.M Burger, J.G. Frankfort and Anthony Van Raan (1985) make a reasonable case that the capacity for making relevant research heard is an aspect of scientific quality. They state "for research to have impact, first of all it is necessary that colleague researchers do have the opportunity to form an opinion on the basic quality of that research. Then it becomes possible that this research, when it indeed has a certain basic quality, does make an impact. This means that basic quality is a necessary, but not a sufficient condition to make an impact. According to this view, one aspect of successful research performance is that researchers are active in presenting their research findings to colleague researchers. In fact, we consider this activity as an aspect of scientific quality in a more broader sense. Scientific quality thus defined includes basic quality as well as the extent to which

this point. In the ARC Discovery Projects 2012 round, applicants' "research environment" accounted for 20% of scores awarded, a significant change from earlier rounds. It is reasonable to assume that assessors' view of the reputation of the applicants' institution would substantially influence their appraisals of "research environment"[7].

13. Institutional reputation also affects academics' mobility. Chan, Chen and Steiner (2002) find amongst finance academics

    13.1. "… an individual who is able to relocate to a higher-ranked institution must exhibit a research record that is approximately two times stronger than that of an average faculty member at the destination institution. … On the other hand, we find that the length of an individual's teaching experience does not increase the probability of moving up to a higher ranked institution."

14. Finally, a good reputation helps the university attract higher achieving students. The competition for such students is intensifying. In December 2011, the *Sydney Morning Herald* reported

    14.1. "many leading schools report a growing trend among their best and brightest to aim immediately to begin their tertiary study overseas. 'It's definitely increasing and it's confirmation that we measure ourselves on global standards, not on regional or even national ones,' said Tom Alegounarias, the president of the NSW Board of Studies[8]".

15. A strong reputation also helps a university withstand vicissitudes in its fortunes. In their 2007 report, "*University league tables and the impact on student recruitment*", UK education consultants David Roberts and Lisa Thompson note "[s]everal studies, ours included, show that wider or embedded reputation is a stronger factor in influencing student choices than a specific league table position. Reputation is an elusive concept but it is likely

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researchers successfully perform "public relations" aclivities. We think that our impact indicators are indicators of scientific quality in this sense. (p. 134/5). The distinction between impact and quality is further discussed in the following section on determinants of reputation.

[7] ARC Discovery grant applicants were asked whether their institutions had an existing or developing, supportive and high quality research environment, whether their institution had the necessary facilities to complete the proposed project and whether there were adequate strategies to encourage the dissemination, commercialisation (if appropriate); and promotion of research outcomes.

[8] "A world of offers for brightest students" by Andrew Stevenson and Jen Rosenberg *Sydney Morning Herald* 19 December 2011. As discussed further on, the "global standards" referred to by Mr Alegounarias are not based on quality of teaching but on institutional reputation derived largely from research.

that league table positions contribute to a reputation if they can be sustained over a period of time."

Determinants of reputation

16. Studies reveal three factors contribute towards research reputation: research standing, institutional size and student selectivity. Each factor is next discussed in turn.

Research standing

17. The overwhelming importance of research to a university's overall standing may be inferred from the developers and promoters of the ARWU rankings calling their system an "academic ranking" despite the rankings giving zero weight to quality of teaching and learning[9].

18. In their study, "*Measuring the international standing of universities with an application to Australian universities"* Williams and Van Dyke (2007) observe "by definition, international academic standing is gained through activities that command respect internationally".

19. It is research that underpins a university's reputation beyond its local area, perhaps because high impact research has wider ramifications than good teaching. In line with this conjecture, Derek Bok, a former president of Harvard University has said,

    19.1. " … teaching cannot be readily evaluated by colleagues in one's own institution, let alone by peers in other universities. As a result, published research emerges as the common currency of academic achievement, a currency that can be weighed and evaluated across institutional and even national boundaries" (1986, p.77).

20. Likewise, Simon Marginson (2005, p8) states

    20.1. "[a]ll over the world, research is the driver of university mission and status, and for good reason. All else equal, strong research universities attract more resources and better academics; have a more advanced capacity in teaching; and offer more to

[9] Marginson (2007) says that the AWRU did not incorporate data on teaching and learning because of the difficulties of obtaining reliable, comparable data. However, he notes "an additional rationale for using research performance data is that arguably research is the most important single determinant of university reputation and widely accepted as merit-based (p. 133). The focus on measured research is also remarked on by Gavin Moodie (2005, p.8) who notes "[i]t will be seen from the foregoing quick review that most national and international rankings of universities are based mostly on research, and mostly only on investigator-initiated and discipline-based or mode 1 research … in the empirical sciences."

governments, professions, industry, foreign universities and the brighter students from home and abroad".

21. Consistent with the above, Ross Williams and Nina Van Dyke report in their (2008) study "*Reputation and reality: ranking major disciplines in Australian universities*":

    21.1. "Our empirical results show that high international academic standing among peers is achieved through research performance, which in turn translates into high demand for places by students who are then not always pleased with what they get, at least immediately after graduation. Under any system of education, high academic standing in research is the main driver for postgraduate students and scholars seeking positions. A weakness of the current Australian system is that good teaching is not a major driver of student preferences at the undergraduate level" (p. 13).

Distinguishing high quality and high impact research

22. Paul Ramsden (1994) in his paper "*Describing and explaining research productivity*" notes:

    22.1. "Harris (1990) makes a useful distinction between four related but distinct ways of evaluating research performance: impact, quality, importance, and quantity. Impact is a measure of the influence of a piece of research, and is evaluated by means of the number of citations made to it by other scholars. This bibliometric measure is most typically used at aggregate (academic unit or group) level …. Importance and quality are evaluated through expert value judgements, typically using peer review; importance may not become clear until time has passed. Neither quality nor importance can be captured through bibliometric indicators alone (Harris 1990, Martin and Irvine 1981, 1983 [Ramsden's references]). Quantity is the simplest of the measures. It concerns the number of publications or pages produced. There is a strong correlation between impact and quantity" (p. 208)[10].

23. Claire Donovan and Linda Butler (2007) similarly distinguish between impact and quality in their study of novel measures of research quality, esteem, user engagement of five Australian economic groups and departments. They state:

    23.1. "While we maintain that bibliometric indicators measure the *impact* of research rather than its actual *quality*, in this paper we use the term 'quality' to mirror the policy

[10] Notwithstanding the correlation, it is a mistake to reward quantity in the hope of achieving impact. This issue is discussed in the section "Fostering high impact research.

discourse of ‘quality metrics’ and the definition of ‘impact’ as the ‘social, economic, environmental and/or cultural benefit of research to end users’ …” (p. 242, endnote no. 4).

24. The distinction between quality and impact is important for managing research. High quality may not always be recognized – which is why working within an institution with an established reputation is helpful – but having institutional policies that reward impact rather than the cultivation of expert judgment within a scientific or scholarly group is likely to be counterproductive. The point here is that policies aimed at maximizing proxies for research quality systematically miss the true objective. A pertinent example relates to Ramsden’s assertion of a strong correlation between impact and quantity of research. There may indeed be a correlation but a comparison of the policies and outcomes of UWA and the University of Queensland since the late 1980s shows it is a mistake to reward quantity in the hope of achieving impact; what such a policy achieves is more research output but less impact than earlier research produced by the same institution. This issue is discussed in the section “Fostering high impact research”.

Institutional size

25. Diamond and Graham (2000) point out

    25.1. “reputation ratings are biased in favour of large programs. Raters who recognise three published scholars in a department of forty faculty tend to rate it higher than a department of twenty where only two are recognised”.

26. In an empirical study, Katz and Eagles (1996) “confirm that the number of faculty members in a political science department and their average citations are important variables for predicting the department's reputation.”

27. Similarly, Williams and Van Dyke (2007) document “evidence that it is the totality of research output which matters most for international prominence”. Williams and Van Dyke’s analysis is based on Australian universities and their conclusion is particularly relevant to UWA since they find that

    27.1. “the Australian National University ranks first on research performance if adjustment is made for size but ranks second if a measure of total research

performance is used; the University of Western Australia is ranked seventh on levels but second if adjustment is made for size"[11].

28. Size matters even for institutions that focus on teaching. Volkwein and Sweitzer (2006) investigate the drivers of reputation amongst 242 US "national doctoral granting" universities and 205 liberal arts colleges. They highlight

    28.1. "[t]he importance of size for both types of institutions, despite their dramatic differences. Studies of research universities have long suggested that bigger is better, but our findings suggest that the larger liberal arts colleges also enjoy more robust reputations than their smaller counterparts. Also … institutional size is an important determinant of reputation regardless of the measure of size. Whether measured by enrollment, by the number of faculty, or by the number of degrees awarded, the size variable appeared in the same order of significance in all three models in both populations" (p.143).

29. Pertinently, Volkwein and Sweitzer posit that the association of reputation with size is related to a university's ability to gather resources. They observe that highly regarded institutions

    29.1. "compete in the market place for talented students and talented faculty by investing in faculty and student recruitment, as well as in the services and activities that make the institution more attractive. The budgets of public and private institutions alike are substantially enrollment driven, thus providing incentives to raise enrollment, rather than lower it. As every [US-based university and college] admissions director knows, success in the competition for students depends on institutional attractiveness, admissions selectivity, and high SAT scores. As every president and provost knows, success in the competition for faculty depends on high salaries and favorable working conditions. Our analysis suggests that older, larger, and wealthier institutions have an edge in the competition for faculty, students, and prestige."

<u>Australian data on university size and reputation</u>

[11] This strong per capita performance offers cold comfort for UWA. In a subsequent work titled "Reputation and reality: ranking major disciplines in Australian universities" Williams and Van Dyke (2008) state "because we are interested in evaluating the international academic standing of disciplines, we focus on *total research performance* rather than performance per academic staff member" (emphasis in italics added).

30. Australian data support Volkwein and Sweitzer's conjecture that the association between institutional size and resource generating ability is why size is positively associated with reputation.

31. As Table One shows, universities in the Group of Eight (Go8) occupy places one to seven when the 42 universities[12] in Australia are ranked by size of full-time equivalent employees (FTEs); Adelaide, the smallest institution in the Go8, is ranked number 11[13]. There are a total of around 86,500 FTE persons in the sector and the Go8 account for 44% of them, although the Go8 comprise less than 20% of the total number of institutions.

32. Even when student enrolment is used as a measure of size, Monash, Sydney University, UNSW, Melbourne University and the University of Queensland rank in the top seven institutions. However, Adelaide plunges to 22nd, UWA to 25th position and ANU to 29th place. To the extent a significant part of research funding comes from student enrolment (either via government funding or student fees) then Adelaide, UWA and ANU operate with a very substantial disadvantage.

33. The competitive edge in research afforded by the greater resources the Go8 are able to command shows up clearly in ARC Discovery Project outcomes. Of the 778 ARC grants awarded in 2011 for projects commencing in 2012, the Go8 won 551 (71%).

34. The association between institutional size and success in winning ARC DP grants is less obvious within the Go8 principally because of the conspicuous relative success of ANU, which won 90 grants, just two less than Queensland University which won the most. ANU is the third-smallest university by FTE staff among the Go8, trailing some distance behind UNSW, the fourth-smallest Go8 university. However, ANU's experience does not contradict the resource-based conjecture about research success since, as a matter of policy, it receives considerably better research support from the Federal Government.

35. Note ANU's "Research Only FTE" staff amount to 160% of the number of its "Teaching and Research FTE" staff; the corresponding percentage for the University of Queensland is around 140% and for the University of Melbourne it is just over 100%. All the other universities have more Teaching and Research FTEs than Research Only FTEs. UWA's

[12] The Australian Bureau of Statistics figures include the Batchelor Institute of Indigenous Tertiary Education, Avondale College and Melbourne College of Divinity.

[13] Queensland University of Technology, Griffith University and Curtin University of Technology rank above Adelaide University, in that order, by number of FTEs.

Research Only FTEs are around 93% of its Teaching and Research FTEs and on a much smaller number.

Size threshold effects

36. Clearly large size helps institutions garner the resources to hire top-level academics but absolute numbers of staff and students is also important *per se* in developing reputation[14]. A topical example neatly illustrates this point: for a discipline (i.e., "unit of evaluation") to be included in the ERA 2012 ranking exercise it must have at least fifty units of defined research "output" over the period 2005 to 2010[15]. UWA, being smaller than all of the other Go8 universities other than the University of Adelaide - UWA has 48% of the number of academic staff at the University of Melbourne - will find it correspondingly more difficult to field enough "units of evaluation" to match the numbers of the the larger universities.

37. The threshold size issue as well as the halo effect discussed earlier may account for the observations noted in the DVC (Research)'s report that

    37.1. "[d]espite achieving the highest possible score of 5 (Well Above World Average) for Psychology in the ERA rankings, in the recent QS ranking for Psychology, while we were ranked 45th in the world, among Australian universities we were ranked 7th, with only the University of Adelaide ranked below us within the Go8. In contrast, when we look at the ERA results, UWA and UNSW were the only universities to achieve a 5, with ANU, Melbourne, UQ and Sydney achieving a 4, and Adelaide and Monash scoring only 3. UWA's poor result among Australian universities within the QS ranking is due to our low score in the survey of academics, which accounts for 50% of the total score, as well as the very poor rating provided by employers who are surveyed as to the quality of our graduates (30% of the score)" (p. D5).

[14] The dominance of ANU has been slipping of late. In a Canberra Times news report, "Melbourne Uni challenging ANU's dominance" (6 September 2011), Emma Macdonald reports a senior executive of one of the world ranking systems as saying, "In whichever evaluations you refer to in recent times, the QS World University Rankings by Subject, The Excellence In Research for Australia (ERA) initiative, or the Shanghai rankings, the University of Melbourne keeps getting stronger". Tellingly, Ms Macdonald finds fit to report "the University of Melbourne is, however, almost twice the size of the ANU, with about 36,000 full-time equivalent students and 3500 academic staff compared with the ANU's 13,000 full-time equivalent students and 1500 academic staff."

[15] See section 3.6 Low Volume—Non-Assessable Units of Evaluation in the ARC's ERA 2012 Submission Guidelines accessible at: http://www.arc.gov.au/pdf/era12/ERA2012_SubmissionGuidelines.pdf

38. Western Australia has just 10.4% of Australia's population (source ABS publication: 3101.0 - Australian Demographic Statistics, June 2011) and is very distant from major population centres (the distance between Perth and Adelaide is just 372 kilometres shorter than the distance between London and Moscow[16]) so it is unlikely that many employers on the East Coast will be familiar with our graduates, who in any event are much fewer in number than those of other institutions (recall that UWA ranks 25th in Australia in number of enrolled students) An arguably better measure of the quality of our graduates would be employment after graduation but that's not the measure used in the QS ranking.

Size of world-leading universities

39. The prominence in popular culture of a handful of US universities that have very small student bodies may lead some to conclude that size is less critical than the discussion to now indicates. A comparison of MIT with UWA is useful in clarifying the relevant dimensions of size. UWA has more academics than MIT but also considerably more students to teach and they are spread over more disciplines (MIT doesn't have a law school or a medical school). The statistics that follow reveal the stark contrast.

    39.1. In 2010 MIT had 4,299 undergraduates and 6,267 students enrolled; In 2011 it had 1,017 academics of all ranks, including nine Nobel Prize winners[17]. MIT's endowment at the end of 2011 stood at US$9.9 billion[18]. MIT's ARWU 2011 ranking is number three[19].

    39.2. UWA's "History of the University" website states "[w]e now have more than 21,000 students enrolled at UWA for undergraduate and postgraduate courses as well as cross-institutional and enabling courses. Of our total number of students, about 4,500 are international students. Our number of academic staff now stands at over 1370, of which one third has gained overseas qualifications". UWA's endowment was $326 million around 2005, based on its 2005 Annual Report. UWA's ARWU 2011 ranking is between 102 and 150[20].

[16] The distance between Perth and Adelaide is 2,136 kms. That between London and Moscow is 2,508 kms. By way of further comparisons, the distance between Perth and Sydney (Melbourne) is 3,298 kms (2,727 ams) Distance is defined as the theoretical air distance (great circle distance). Source: http://www.timeanddate.com/worldclock/distance.html
[17] Source: www.mit.edu/facts/ accessed December 2011
[18] Source: http://web.mit.edu/newsoffice/2011/endowment-0926.html accessed December 2011
[19] Source: http://www.shanghairanking.com/ARWU2011.html accessed December 2011
[20] Source: http://www.shanghairanking.com/ARWU2011.html accessed December 2011

40. MIT is on some figures, including student enrolment, a small university. However, the above statistics show that on the measures of capacity that count for developing a research reputation it is substantially larger than UWA. It is also pertinent to note that the most highly regarded US universities and colleges go to considerable lengths to ensure their students are drawn from all over the US and, increasingly, other countries. Among other things, this helps develop and promote their reputation widely even though they have a small student body. In contrast, Australian students typically do not venture far from their home state (or even suburb).

Increasing UWA's resource funding – size of challenge

41. An indication of the size of the challenge is provided by comparing UWA with the University of Queensland (UQ). In 2012, UWA made its debut, at number 96, into the ranks of the top 100 ARWU universities. It joined UQ that first entered the top 100 at number 86 in 2011 but slipped to number 90 in 2012. University of Sydney (no 93), ANU (no 64) and University of Melbourne (no 57) were the other Australian universities in the top 100 by the ARWU system in 2012. Maintaining UWA's place in the top 100 is likely to prove more of a struggle for UWA than the other institutions. UQ has almost exactly double the number of FTE staff as UWA in Research Only and Teaching & Research positions. The University of Sydney, the second lowest ranked Australian university in the top 100, also has close to double the number of FTE staff as UWA in Research Only and Teaching & Research positions.

42. Widening UWA's range of funding sources may be thought to be one strategy to enlarge our resource base, particularly in view that government funding is unlikely to increase in real terms[21]. A description by Glaser and Laudel (2008) of the Australian research funding environment highlights a significant structural obstacle to this solution. Glaser and Laudel observe:

    42.1. "[t]he Australian research funding environment is neither rich nor diverse and does not provide significant alternative funding sources for universities. A major problem is the structure of the Australian economy, especially the weakness of science-based industries; accordingly contributions by industry to the funding of research are low … Many researchers cannot find industry partners in Australia in fields where this would be possible in most industrialised countries. Furthermore,

[21] See Teece (2012) for an analysis of Australian government funding of universities from 1996 to 2010.

support from the states is limited to ad-hoc funding in designated fields" (p. 137)

Factoring in size when evaluating Schools and Disciplines on ERA2012 outcomes

43. One implication of the association of size and resources with capacity to produce high impact research is that this association should be taken into account when Disciplines and Schools (i.e., "units of evaluation") are being assessed on their performance following release of the outcomes of ERA 2012.

44. Katz and Eagles (1996), cited earlier, address this issue. They are members of a department that rated 72nd out of 98 political science programs in the US. They note their "less-than-stellar performance reflects a variety of considerations, only some of which are our 'fault'" (p.149).

45. Katz and Eagles point out their results

    45.1. "show that the most statistically robust and important predictor of ratings success - department size - reflects a characteristic of departments that is beyond their control, and has no direct bearing on the quality of the members of the departments concerned, while a second important indicator - the proportion of full professors - is at least in part similarly beyond departmental control" (p. 149).

46. In their closely related article "A rising tide lifts all boats: political science department reputation and the reputation of the university" Lowry and Silver (1996) caution that he influence of resources in facilitating high quality research that gets recognised does not imply reputation is entirely out of the control of each discipline. They note their findings imply that:

    46.1. "departments of political science still have room to maneuver. They can affect their own reputations both positively and negatively despite the strong influence of the university's reputation and resources. Although the reputations of political science departments usually rise and fall with the tide of their university's reputation, if their own faculty perform well but are in a sea of mediocre departments, they can enjoy a better reputation than the rest of the university. And if they perform poorly, their reputation can suffer even if they find themselves in a university whose faculty have a high overall scholarly reputation. *But our analysis suggests that the university's reputation and resource commitment set the broad context for departmental success and account for the bulk of the differences in reputational rankings among*

departments" (p. 167, emphasis in italics added).

47. The need for UWA's to increase its resources to achieve its ambitions is not news. For instance, UWA's OPP for 2009 to 2013 includes a note that an internal paper written by the then Vice Chancellor, Alan Robson, underscored the need for "a substantial increase in the resources available to the University" (p. 8). The point here is that the Faculties, Schools and Disciplines within UWA have few levers at their disposal to increase their resource base. Increasing UWA's resource capacity is a challenge that rests within the Vice-Chancellery.

Student selectivity

48. Measures of reputation based on surveys (as opposed to bibliometric measures) are highly correlated with student selectivity. This effect is independent of size since Astin and Solomon (1981) find that "large size enhances prestige if an institution is highly selective, but that it has little or no positive effect on the prestige of non-selective institutions."

49. The Go8 universities are generally regarded as being more selective. Even within the Go8, UWA does relatively well on selectivity. On the website headed *UWA – The State's Top University*[22] it is stated that "the entry (Australian Tertiary Admission Rank) scores for UWA mean that the University's undergraduate cohort is the most academically talented of any WA university and generally recognised as being of the highest quality in Australia."

50. Another UWA-affiliated website[23] includes the claim that "UWA's pass rates are amongst the highest nationally and the University consistently attracts over 83% of the top 5% school-leavers in Western Australia." Further, "UWA has been ranked first or second in Australia for the quality of undergraduate programs, based on staff-student ratio, progression rates, continuation to higher studies and student evaluations. (Source: Melbourne Institute of Applied Economic and Social Research, International Standing of Australian Universities, 2006.)"

51. In UWA's 2009 Performance Portfolio it is noted UWA admissions have a predicted equivalent SAT (Scholastic Aptitude Test) score of about 1370 (out of 1600). In a table of universities ranked on mean SAT scores, this would place UWA amongst many leading

[22] (http://www.uwa.edu.au/top-university ; accessed 10 December 2011)
[23] Source: http://www.taylorscollege.edu.au/courses/university_westernaustralia.aspx (accessed 10 December 2011)

universities. UWA students' predicted mean SAT score is, for instance, above Princeton University's mean SAT score of 1339 for its admissions[24].

52. Attracting academically high achieving students is helpful in increasing UWA's standing in the ranking systems that use "quality of students" as an input. For instance, Dill and Soo (2005) report that one of the measures the Good Universities Guide (GUG) – an Australian universities' "league table" – looks at is "students ranked in top decile nationally". Further, as Astin (1999, p.93) observes, "the fact that the typical student … is well prepared academically may make it easier to employ practices such as independent research and involvement in faculty research projects". There is a important caveat to this conjecture. Astin (1999) goes on to note that the average socio-economic status of the student peer group, a variable highly correlated with academic performance, is "associated with more positive outcomes than virtually any other environmental attribute of the institution, its program, or its faculty."

53. Notwithstanding the above, we should bear in mind that student selectivity is largely an outcome rather than driver of international reputation. As Marginson (2007) contends,

    53.1. "in local competition between universities the key factors are historical tradition; student demand and student selectivity within the city, district, state/province or nation; research performance; and the reputation of the university with local employers. In global competition most of this does not count. Unless the university is a genuine worldwide name like Harvard or Oxford, local tradition and student selectivity are irrelevant, though the level of demand from good-quality foreign doctoral students can be important. The keys to global competition are research performance and reputation, which is partly fed by research performance" (p. 132).

<u>Research reputation as driver of institutional reputation amongst students</u>

54. Given increasing competition for top students, one potential concern is that focusing on research at the likely expense of teaching may be counterproductive. A disproportionate resource allocation to research may not matter if, as Dill and Soo (2005) speculate, "perhaps universities with strong research orientation have the best learning environment and give the best education?" (p. 507)

[24] The University of Western Australia's 2009 AUQA Performance Portfolio, Sec 2, The Student Experience, p. 8 (available at http://www.qualityassurance.uwa.edu.au/__data/page/21802/UWA_Portfolio_2009.pdf accessed Dec 2011)

55. Regrettably, it seems not, as the subsequent passages from Dill and Soo (2005) indicate:

55.1. "empirical research … suggests that the correlation between research productivity and undergraduate instruction is very small and teaching and research appear to be more or less independent activities ... Astin's (1996) studies specifically explore the nature of the relationship between research and teaching in the US. A department that has a strong research orientation (i.e., a department that publishes many books and articles, spends a substantial amount of time on research, and attaches high personal priority to engaging in research) has a negative correlation with factors having to do with teaching: hours spent teaching and advising, commitment to student development, use of active learning techniques in the classroom, and the percentage of faculty engaged in teaching general education courses. In addition, research orientation has a negative effect on student satisfaction with faculty as well as on student's leadership, public-speaking, and interpersonal skills".

56. Ramsden and Moses (1992) report findings consistent with Astin (1996). Their investigation of the relationship between research and undergraduate teaching in Australia "revealed typically no relation or a negative relation between teaching and research at the level of the individual and at the level of the department, across all subject areas"[25].

57. Reflecting on their analysis, Ramsden and Moses observe:

57.1. "our findings suggest that undergraduate students who select their programmes of study in the belief that high status, highly selective, highly productive research departments will provide the best teaching may be making a mistake. The most committed teachers are sometimes to be found in the less distinguished departments which paradoxically often have lower entry requirements. Although we have seen that good teaching and good research sometimes coexist, it is equally clear that scholarly prestige and extremely competitive entry requirements do not necessarily indicate excellence in teaching" (p. 294)[26].

[25] The notion that teaching and research are incompatible is unfashionable (not to say politically inconvenient) now but this wasn't always the case. Until the German reform of higher education in the 19th century, universities focused principally on teaching rather than research, much to the scorn of many scientists. Cardinal (John Henry) Newman in the preface to *The Idea Of A University* (1852) contended that "to discover and to teach are distinct functions; they are also distinct gifts, and are not commonly found united in the same person" (*Preface p. xxi).* Ironically, Newman made his point in the course of arguing that teaching is the principal purpose of universities and research detracts from this function.

[26] In similar vein, Volkwein and Sweitzer (2006) caution that "readers should not assume that

58. Ramsden and Moses presume students are misled by reputation rankings derived largely on research. The reality is more nuanced because students are heterogeneous in their attributes and in what they seek from universities. Soutar and Turner (2001) review the factors that influence choice of university amongst a sample of Western Australian school-leavers. They find course suitability and academic reputation are the two highest ranked factors influencing choice of university. These factors are followed by job prospects and teaching quality.

59. A key point to note because it relates to issues of access and diversity is that reputation is important principally to high academic achieving students (who, as noted earlier, tend to have more socio-economic advantages) and international students. Clarke (2007) summarises the findings from research on the use of rankings by students:

    59.1. "[r]esearch on the specific impact of rankings on these choice decisions has focused on two main areas: the types of students most likely to use rankings, and the effect that changes in a school's rank has on overall applications to, and enrollment in, that school. In relation to the first area, the evidence suggests that rankings do not play an important role in most students' application and enrollment decisions. For example, McDonough et al. (1998) report that only 11 percent of the 221,897 undergraduate students who responded to their survey saw commercial rankings as a very important factor in their choice of school; 60 percent found them not at all important (Lipman Hearne 2006). Students who found rankings to be a very important factor in their choice of school were more likely to be high-achieving, from high-income families, and from families with college educated parents. They also were more likely to be Asian-American (or non-U.S. citizens), and to have intentions of getting doctoral, medical, or law degrees. Low-income and first-generation (i.e., children of parents with no higher education experience) college students were least likely to view the rankings as important" (p. 39).

60. Anecdotal evidence from Australia bears out the US findings that higher achieving students are influenced by institutional reputation derived from research. The *Sydney Morning Herald* news report (19th December 2011) "*A world of offers for brightest students*" included a statement by the Principal of Queenwood School for Girls in Sydney who said

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[university] prestige equals educational quality" (p. 144). Likewise, Dill and Soo (2005) comment, "from the measures utilized in the [commercially published] tables [used to rate universities] we would infer that prominent research institutions give the best education, although it is more accurate to conclude that the listed performance indicators do a much better job in assessing the research quality of a university than its teaching quality." (p. 506).

the choice of top Australian students to study overseas was motivated by ambition rather than a belief there was "anything inherently wrong with Sydney universities" … Peter Taylor, the executive director of the Australian Mathematics Trust, said an increasing number of Maths Olympiad students were heading overseas, particularly to Cambridge University, but they were not necessarily getting a better education. "It's a perception they've got, but I can't see why, for instance Sydney University runs an outstanding course for high flyers. They're absolutely in as good quality company as anywhere else""[27].

61. Given the many campaigns that seek to improve learning, it may strike many as incongruous that high achieving students are relatively unconcerned by quality of teaching.[28] Michael Spence (who delivered the 2011 Warren-Marshall Lecture at UWA) won the Nobel Prize in Economics for his theory that, *inter alia*, explains this puzzle.

62. In his seminal (1973) paper, "*Job market signaling*", Spence posits students use attendance at schools as a means of sending employers a credible signal of their quality. Selective, reputable universities are attractive to high achieving students not because of what they can learn there but because going through the filtering process of admission and graduation allows prospective employers to readily gauge the students' quality.

63. One may not find Spence's theory convincing[29] but it is not in serious dispute that high achieving students select universities on the basis of reputation rather than teaching quality.

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[27] As hinted earlier, it is likely that Mr Taylor is missing the point; the students aren't heading to the higher ranked institutions because they think the teaching is better. On May 10, 2007 *The New York Times* carried an article "Harvard task force calls for new focus on teaching and not just research" in which a star student was quoted as saying he did not come to Harvard for the teaching. Joshua Billing, 22 years, said "You'd be stupid if you came to Harvard for the teaching. You go to a liberal arts college for the teaching. You come to Harvard to be around some of the greatest minds on earth."

[28] This **is not** to say that students don't care about quality of teaching when they are sitting in class (although as the preceding footnote suggests, at least some aren't so fussed by quality of teaching). It **is** to say that they rate quality of teaching below other attributes when choosing which university to attend.

[29] The evidence that investment in education is primarily due to signalling rather than to developing one's capacity or competencies (i.e., the human capital perspective) is remarkably strong (see Weiss 1995). Signalling theory is relevant to explaining more than just investment in education. Spence (1973) used education principally to illustrate the broadly applicable point that when person X has information that they wish to convey in a credible way to person Y, person X will be willing to incur significant costs if the benefits of sending a credible signal are high enough. See Connelly, Certo, Ireland and Reutzel (2011) for an accessible review of the research on signaling theory. Notwithstanding this point, Dale and Krueger (2002) find that students who attended more selective universities "earned about the same as students of seemingly comparable ability who attended less selective schools. Children from low-income families, however, earned more if they attended selective colleges" (p. 1491).

64. It may be argued that students – even high achieving students – pick research-intensive institutions because information on teaching is unavailable. Siegfried and Getz (2006) overcome the information problem by investigating where the children of academics and those of non-academic parents attend university. Academics are assumed to be informed about universities and to guide their children's choices accordingly. Siegfried and Getz find information does make a difference: The children of academics are much more likely to attend research universities and selective liberal arts colleges.

65. Astin (1999) points out selective liberal arts colleges in the US "[come] closer than any other type of institution in the American higher-education system to achieving a balance between research and teaching. This view is consistent with Volkwein and Sweitzer's (2006) finding that "faculty [i.e.., academics] at the higher ranked liberal arts colleges publish many more journal articles than those at their lower ranked peers, despite the emphasis on the teaching mission at liberal arts institutions".

66. It is tempting to regard the selective liberal arts college as the model to follow. The "fly in the ointment" is that Astin and Chang (1995) analysed 212 leading US universities and found "[v]irtually no institutions with very strong Research Orientations (top ten percent) are even above average in Student Orientation" (p. 46).

67. We may also note the qualities that make the selective liberal arts colleges attractive to high achieving students – many of whom go on to pursue postgraduate degrees at elite research-intensive universities – are demanding of resources. Astin (1999, p. 9) includes frequent student-academic contact, frequent student-faculty interaction, frequent student-student interaction, generous expenditures on student services, frequent use of courses that emphasize writing, frequent use of narrative evaluations as the key characteristics of the top selective liberal arts colleges. Courses such as those at UWA that include tutorials with up to 25 students don't meet the standard.

68. Ranking systems may be justifiably criticised on many grounds but they are not responsible for teaching being subordinated to research within research-intensive universities. The tension between teaching and research manifested long before the US News & World Report pioneered the ranking of colleges and universities in 1983 (Sanoff, 2007). In his (2012) book College: What It Was, Is, And Should Be Andrew Delblanco, Professor in the Humanities at Columbia University, points out:

    68.1. "[b]y the end of the nineteenth [sic] century the American college found itself in an utterly transformed environment, of which the most conspicuous institutionalised

feature was the new university. In its orientation toward specialised scholarship and research, the university was both a rival to the colleges and … the source of future faculty even for those colleges that remained apart from the new universities. This was both a boon and a problem … [i]t created a context in which ambitious academics regarded teaching undergraduates as a distraction and a burden" (p. 80/81).

69. The focus on research and specialised scholarship as the path to prestige led several universities to consider a strategy more than faintly reminiscent of the approach being proposed today at UWA in relation to research "underperformers". Delbanco notes

69.1. "[a]t [US] universities that had taken form around an established college, proposals were floated to relegate undergraduate teaching to what amounted to a second-class faculty of failed or former researchers, while at some urban institutions there were even plans to ship undergraduates out from the main campus to some affiliated college in the country" (p 81).

Fostering high impact research

Relevance of policy choice

70. Australian universities face much the same funding environment but there is clear evidence the system allows scope for policy choices that make measurable differences in reputation over the medium term (i.e., five to ten years). Butler (2003a) describes an inadvertent natural experiment involving UWA and the University of Queensland that confirms this point.

71. Butler (2003a) writes, "in the late 1980s, both [UWA and UQ] introduced major, but quite different, changes to their research management policy, *though both sought the same outcome: to strengthen and enhance their research profile* (p. 152, emphasis in italics added)

71.1. "The University of Western Australia introduced a formula for distributing a significant proportion of research funds, one major component of which was a publication count. The formula was much more sophisticated than the government's Research Quantum exercise, with many more publication categories and different weightings for each category in the different fields of research. Nevertheless, the formula was based on quantity, not quality. In direct contrast, the University of Queensland strategy was to instigate a strong recruitment drive targeting the brightest young researchers, including a significant number from overseas, and providing them

with a strong resource base." (p. 152)

71.2. " … productivity rates in both institutions increased markedly. The increase was more marked for the University of Western Australia, which has seen its publications per research staff rate more than double since the introduction of its new system for the internal allocation of research funds. The institution's researchers quickly responded to a system of reward based on productivity, a system reinforced at the sectoral level by the introduction of the Research Quantum collection in the mid-1990s. Productivity at the University of Queensland also increased, though to a lesser degree. The university had sought to enhance its research performance through the recruitment of strongly performing early career researchers. Sociological investigations suggest that such a strategy will increase productivity for two reasons …. Firstly, the studies suggest that the productivity of scientists is strongly influenced by the attitudes and practices of co-workers; and secondly, early career researchers who have already established a strong publication record will continue to actively publish" (p. 153, Butler, 2003a).

72. Butler concludes from her analysis that:

72.1. "[a] focus on productivity at the University of Western Australia has succeeded in lifting its publication output significantly, *but that output has been placed increasingly in journals of lower impact, with a subsequent loss of relative visibility in the research community.*[30] In contrast, the University of Queensland's concentration on staffing strategies has also raised productivity, but this has been achieved in concert with an increase in the impact of its publication output" (p. 154, emphasis in italics added).

73. A 2007 internal UWA report on citations documented findings consistent with Butler's analysis. The report included the following observations:

73.1. "Typically UWA staff publish over a very broad set of journals, however from a citation perspective worldwide, … on average [since 1992] only 2.5% of our publications appear in the Top 300 highest impact factor journals. Thus, our publications are spread thinly and have little impact. …. [T]he two areas in which UQ significantly out-performs UWA [over the three years 2005, 2006 and 2007] are on the

[30] These outcomes were predictable from earlier research. For instance, Cole and Cole (1967) find from their analysis of the reward system in physics departments that "there are indications that the sheer quantity of publications is more likely to be used as a criterion of promotion in the less prestigious departments and that quality research is more often rewarded when it is produced by physicists in higher ranking departments".

Nature and *Science* score and the SCI score. UQ publishes more papers in *Nature* and *Science*, and they publish more papers in journals indexed by Thomsons ISI."

Critical role of hiring policy

74. Butler's analysis shows incentives can make a difference to research output by causing academics to favour quantity over quality. However, the key to fostering high impact research that improves reputation in the long run seems to lie not so much in rewarding quality publications but rather in attracting top researchers.

75. Other studies support the above conclusion. Liefner's (2003) analysis of funding, resource allocation and performance in "six prestigious research universities"[31] incorporates interviews with academics. He finds quality of academics is the most important factor in the long-term. Liefner writes:

    75.1. "… [t]he only factor classified as decisive for long term success by more than 90 percent of the interviewees is the quality of academics. The majority of the interviewees stress that this factor is far more important than all others. The second factor that has a significant impact on the long-term development prospects of universities is the ability (qualification and motivation) of students. The form of resource allocation is less important. … This ranking of factors looks exactly the same at all universities" (2003, p.485)

Importance of high quality research feedback and accommodating risk-taking

76. Liefner (2003) and another study by Azoulay, Zivin, and Manso (2011) reveal crucial nuances in the role incentives play in the production of high impact research. Liefner observes:

    76.1. "the majority of the interviewees [at all six universities] agree that well-qualified people tend to respond less to monetary incentives. Instead they work according to their individual motivation and scientific interests. As they are confident of their scientific capabilities, they need not avoid risks. Faculty that are less motivated

[31] Liefner (2003) claims "the achievements in education and research of these selected institutions are widely recognized, and they serve as role models for other higher education institutions" (p. 471). I provide here the six institutions' respective 2011 Academic Ranking of World Universities in square brackets in the following list: Massachusetts Institute of Technology [3], University of Texas at Austin [35], Swiss Federal Institute of Technology [102-150], University of Basel [89], University of Twente [303-401] (the Netherlands), and University of Bristol [70].

might respond to the pressures created with performance-based budgeting, but as they are not highly qualified, the outcome of rising activity will be small" (p. 486).

77. Given that all six universities are highly regarded for their research yet vary considerably in the extent they incorporate performance-based resource allocation Liefner concludes: "universities with a large number of highly motivated and qualified faculty will be successful regardless of the form of resource allocation" (p. 486). Consistent with this conclusion, academics in all six universities ranked resource allocation (i.e., whether performance-based or not) a distant fourth in importance after academic quality, student ability and university culture. Interestingly, as a group they agreed that performance based funding increases production (measured by publications) of applied research or at least research with lower risk but there was no consensus about its effect on quality.

78. Azoulay, Zivin, and Manso (2011) examine the effect on quality, measured by citations, of incentives that encourage exploration in research. In their paper, "*Incentives and creativity: evidence from the academic life sciences*", Azoulay et al investigate the outcomes from researchers funded by the US's National Institutes of Health (NIH) and the Howard Hughes Medical Institute (HHMI). They note NIH funds projects with clearly defined deliverables and not individual scientists; funding typically last only three years, renewal is not forgiving of failure and feedback on performance is limited in its depth. In contrast, HHMI funding has a five-year cycle and is typically renewed at least once; the review process provides detailed, high-quality feedback to the researcher; and HHMI selects "people not projects" which encourages quick reallocation of resources to new approaches when the initial ones are not fruitful.

79. Azoulay's citation analysis clearly shows that the HHMI approach of identifying top quality scientists and letting them take risks generates higher impact research. In their words,

    79.1. "… we find the effect of selection into the HHMI program increases as we examine higher quantiles of the distribution of citations. Relative to Early Career Prize Winners (ECPWs), our preferred econometric estimates imply that the program increases overall publication output by 39%; the magnitude jumps to 96% when focusing on the number of publications in the top percentile of the citation distribution. Success is also more frequent among HHMI investigators when assessed with respect to scientists' own citation impact prior to appointment, rather than relative to a universal citation benchmark. Symmetrically, we also uncover robust evidence that

HHMI-supported scientists “flop" more often than ECPWs: they publish 35% more articles that fail to clear the (vintage-adjusted) citation bar of their least well cited pre-appointment work. This provides suggestive evidence that HHMI investigators are not simply rising stars anointed by the program. Rather, they appear to place more risky scientific bets after their appointment, as theory would suggest” (p. 4).

Applied research is usually incompatible with “break through” research

80. The freedom to make risky scientific bets as a condition for high impact scientific breakthroughs has another often under-appreciated implication: it doesn’t accommodate “industry-relevant” or “practically useful” applied research which, if used as a goal, typically entails investigating less risky research avenues. This incompatibility has long been recognized. Richard Nelson, a leading research in “national innovation systems” states in his high cited (1959) paper “The simple economics of basic scientific research”:

    80.1. “[a]pplied research is relatively unlikely to result in significant breakthroughs in scientific knowledge save by accident, for, if significant breakthroughs are needed before a particular practical problem can be solved, the expected costs of achieving this breakthrough by a direct research effort are likely to be extremely high; hence applied research on the problem will not be undertaken, and invention will not be attempted. It is basic research, not applied research, from which significant advances have usually resulted.”

81. At the University of Chicago, one of the world’s great universities (incidentally, not much older than UWA; Chicago’s first classes were admitted in 1892), the tension between basic and applied research is well recognised, with the university mostly favouring basic research. Displaying this bias, one of Chicago’s former presidents, Edward H. Levi has observed

    81.1. “there is an enormous and erroneous temptation to jump from the spectaculars of the applied group work of science to the assumption that this kind of strength is the normal and proper attribute of the teaching research institution which is a university. With some exceptions, most training in the applied fields is better off outside the universities, and most of the applied work of science is better conducted outside the universities. The assumed importance of universities for a particular kind of national strength is disconcerting” (2008, p.167/8).

82. There are signs Chicago’s approach is effective: on its website (as at June 2012), Chicago

lays claim to 87 Nobel Laureates including eight currently on staff.

Stanford and Silicon Valley, an outlier phenomenon

83. Stanford University is often the institution people have in mind when they advocate closer connections between industry and academic researchers. Leslie and Kargon (1996) make the case that Stanford's success in undertaking both outstanding research – as at June 2012, Stanford's website noted its academics have won 27 Nobel Laureates since its founding in 1891 - and spawning revolutionary technologies and companies is the outcome of a set of factors not easily replicable; not least of which was massive postwar defensive spending by the US government on basic R&D.

84. Leslie and Kargon note that when Frederick Terman, the "father of Silicon Valley", attempted to repeat his success in other regions, he largely failed except in Korea where the two institutes, KIST and KAIST, that came closest to marrying industrial innovation with tertiary education were set up "to win markets, not Nobel Prizes". Leslie and Kargon observe that

    84.1. "[a]lthough research was to be a vital part of its [KAIST's] teaching program, especially at the doctoral level, its mission was to satisfy the needs of Korean industry and Korean research establishments for highly trained and innovative specialists, rather than to add to the world's store of basic knowledge" (p. 463)[32].

85. The question for us at UWA is whether our research evaluation system encourages "break through" basic research that is more likely to make an impact or if it promotes safe research with low probability of making an impact. The bureaucratization of research evaluation as opposed to the exercise of academic judgment in assessing research may be one of the most significant barriers to high impact research. We return to this conjecture later. In the interim, it is also worth underscoring that a characteristic of a high performance research environment is one where there is a higher proportion of failures (an inevitable consequence of greater risk-taking).

Research organization and high impact research - a case-study of Rockefeller University

[32] Even if a university chooses to focus on applied research it remains challenging to make an impact. Bresnahan, Gambardella and Saxenian (2001) investigate the factors that generate a "cluster" of high-technology firms. They report " … [s]ome of our other stories reveal that there is a role for universities both as a source of skill labor and of technologies that are exploited for export and growth - e.g., Cambridge, UK and Silicon Valley in the 1960s … Taken as a group, however, these stories are not at all encouraging of the simple 'recipe' view of universities and higher education in starting a cluster" (p. 846).

86. Rockefeller University, based in New York City, is not very well known amongst the public but it can make a strong claim to being the most successful research institution in its chosen field, biomedical science. In his (2002) case-study "*Institutionalizing Excellence in Biomedical Research: The Case of The Rockefeller University*" Roger Hollingsworth points out Rockefeller University has "had more major discoveries in biomedical science throughout the twentieth century than such renowned organizations as Harvard, Yale, the University of California at Berkeley, and Stanford University in the United States; Cambridge and Oxford Universities in Britain; and the Pasteur Institute in Paris". Further, Rockefeller University has also had more major breakthroughs in biomedical science than all the Kaiser Wilhelm and Max Planck Institutes in Germany combined.

87. In his case-study, Hollingsworth, a professor of history and sociology whose work has focused (in part) on how structure and culture of research organizations influence the creation of fundamental new knowledge, describes the management and organisational features of Rockefeller that have contributed to its success. What went on at Rockefeller University over the past 100 years is entirely consistent with the findings from Liefner (2003) and Azoulay, Zivin, and Manso (2011). The key to Rockefeller University's success is that the factors associated with research breakthroughs were implemented more intensely relative to other institutions. Excerpts from Hollingworth's case-study are provided in Appendix 1. It is useful to see how a particular institution has implemented practices and values associated with the generation of high quality, path-breaking research. For instance (a relatively minor but telling example), the dining room at Rockefeller University was carefully set up to promote intellectual and social integration amongst its scientists and it did so much more effectively – in terms of fostering collaboration – than the "high table" tradition at Cambridge and Oxford where there was greater mingling of academics from different disciplines.

Discipline-based variation in determinants of reputation

88. Universities comprise diverse components. Teaching and research are approached and conducted differently across, say, natural science and law. Further, the practices in some disciplines (e.g., medicine, education, law, engineering and business) are likely to be influenced by their links to the professions via accreditation processes and the like. Do these differences affect how each discipline develops its reputation?

89. If we judge priorities by what academics do and how they are rewarded, research is perceived as a driver of reputation across all areas, including the "professional disciplines".

For instance, Volkwein and Sweitzer (2006, p.143) report:

89.1. "[f]aculty at the higher ranked liberal arts colleges publish many more journal articles than those at their lower ranked peers, despite the emphasis on the teaching mission at liberal arts institutions."

90. For law schools, Gomez-Mejia and Balkin (1992) report

90.1. "the primary determinants of faculty pay, in both institutions that grant doctorates and those that do not, are the number of top-tier journal publications a faculty member has authored and changes in institutional affiliation. Teaching performance and numbers of citations, second-tier publications, and books published affect pay allocations only for faculty members who have exceptional research records."

91. Armstrong and Sperry (1994) examine

91.1. "the relationships between the research originating at business schools, students' satisfaction with the schools, and the published ratings of the school's prestige. Research was positively correlated to prestige (where prestige was based on the perceptions of academics, firms, and student candidates) … [We conclude] that schools should emphasize research instead of teaching if they desire high prestige" (p.14).

92. There's a lively literature decrying the emphasis on publications in the professional disciplines, the principal criticism being a charge of irrelevance[33]. Nevertheless, it's clear

[33] For example, Ruscio (1987) states "[i]n the field of English literature, the pressure of mandatory publication has led to work that "seems increasingly trivial or increasingly making use of a very technical and sophisticated apparatus that somehow does not end up enhancing the work or some aspect of the work or anything else." Another literature professor expressed puzzlement about why someone would "want to succeed in knowing more about the Elizabethan use of the comma than anybody needs to know"" (p. 213).
Similarly, in business, Bennis and O'Toole (2005) claim, "[d]uring the past several decades, man leading B [Business] schools have quietly adopted an inappropriate – and ultimately self-defeating – model of academic excellence. Instead of measuring themselves in terms of the competence of their graduates, or by how their faculties understand important drivers of business performance, they measure themselves almost solely by the rigor of their scientific research. They have adopted a model of science that uses abstract financial and economic analysis, statistical multiple regressions, and laboratory psychology. Some of the research produced is excellent, but because so little of it is grounded in actual business practices, the focus of graduate business education has become increasingly circumscribed – and less and less relevant to practitioners" (2005, p. 97).

that across all disciplines, linked to the professions or otherwise, research is identified as the building block of reputation. Alexander Astin, the eminent American scholar of higher education, notes it is institutional values that underpin the focus on research. Astin writes

92.1. "[f]or several years now I have been arguing that too many institutions define their "excellence" in terms of either (a) their level of resources or (b) their national reputation as reflected in various polls and surveys. Given that faculty research "stars" are considered to be one of the prime institutional "resources" for enhancing an institution's reputation, it is no surprise that research orientation is highly correlated with a resources and reputation emphasis" (Astin, 1999, p.591).

93. Size and selectivity, discussed earlier, also underpin reputation in the disciplines linked to a profession. In their paper, "Prestige among graduate and professional schools: Comparing the US News' graduate school reputation ratings between disciplines", Sweitzer and Volkwein (2009) find that size (measured by enrollments) is significant in explaining prestige across the fields of business, education, engineering, law and medicine. Admissions selectivity is also related to variation in reputation in all the fields except for education. Faculty publication productivity is significantly associated with reputation except for business schools (p. 831)[34].

Debate about relevance of the curriculum is alive and heated in law as well. A report in *The New York Times* "What they don't teach law students: Lawyering" by David Segal (19th November 2011) claimed that US law schools are turning out graduates unable to practice law. Segal contends "[l]aw schools have long emphasized the theoretical over the useful, with classes that are often overstuffed with antiquated distinctions, like the variety of property law in post-feudal England. Professors are rewarded for chin-stroking scholarship, like law review articles with titles like "A Future Foretold: Neo-Aristotelian Praise of Postmodern Legal Theory."" Segal quotes US Supreme Court Justice Stephen G. Breyer saying in a 2008 speech, "There is evidence that law review articles have left terra firma to soar into outer space."
In medicine, Douglas Altman has written in the *British Medical Journal* (1994) and the *Journal of the American Medical Association* (2002) about the appallingly poor quality of much medical research. He states "put simply, much poor research arises because researchers feel compelled for career reasons to carry out research that they are ill equipped to perform, and nobody stops them. Regardless of whether a doctor intends to pursue a career in research, he or she is usually expected to carry out some research with the aim of publishing several papers. The length of a list of publications is a dubious indicator of ability to do good research; its relevance to the ability to be a good doctor is even more obscure" (1994, p. 283).

[34] The finding for business schools does not imply that research is irrelevant in establishing their reputation; rather, it reflects that business schools serve multiple constituencies and not all of them are best served by the production of top-flight research (defined by publication in top tier academic journals). D'Aveni (1996) studies US business schools that differ in status perceived by three constituencies: the national (US) business community, the academic community and MBA students. He finds that " in general, the results show significant advantages in gathering resources for schools with high status in the national business

94. There is one caveat to the finding that research is important to establishing reputation across faculties. As already discussed, rankings based on reputation can differ substantially from rankings based on bibliometric measures of performance. Bibliometric measures, by their nature, are independently replicable which some interpret to mean they are more valid measures of performance[35]. However, bibliometric measures more accurately track performance in the science, technology, engineering and medical (STEM) fields than they do in the humanities, arts and social sciences (HASS) fields[36]. In recognition of this, in the ARWU system "[a]rts and humanities are not ranked because of the technical difficulties in finding internationally comparable indicators with reliable data. Psychology/Psychiatry is not included in the ranking because of its multi-disciplinary characteristics"[37].

95. The problem lies not in the "bibliometric-resistant" HASS disciplines but in the measures, a point forcefully made by Frank Knight, a co-founder of the *Chicago School* of neoclassical economics[38]. Consistent with Knight's view, Wanner, Lewis and Gregorio (1981) report in

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community. Some of the benefits of such status could be achieved by other means but some could not … Schools are at a disadvantage in competing for student inputs and placing MBA and PhD graduates if they lack status in the national business community. High status in the opinion of students and academics is not associated with all of the advantages afforded by status in the national business community. Hence, teaching and research strategies designed to achieve status among students and academics alone may not be as successful as those that have relevance to the broader "real world"" (p. 166). D'Aveni's point about the value of achieving high status in the business community is consistent with Trieschmann, Dennis, Northcraft & Niemi's (2000) finding that "… [business] schools that excel in research tend to acquire more faculty, and those that excel in MBA education tend to gather more financial resources per faculty member" (p. 1137).

[35] Replicable does not however mean "low cost" or "unproblematic" to implement. Bibliometrics expert Anthony Van Raan (2005) summarises the pervasive technical and methodological issues associated with bibliometric measures. Technical issues can be fixed but often require significant effort to do so; methodological issues concern appropriate research design and "fitness for purpose". Van Raan notes both technical and methodological issues are often glided over by those who commission bibliometric studies for evaluation and ranking purposes.

[36] Linda Butler is Australia's leading expert in bibliometric analysis. In a recent paper, co-authored with Ian McAllister (2011), Butler promotes the bibliometric approach as a cost-effective assessment of performance but concedes that "[i]t is also likely that peer input may still have a necessary role to play in the assessment of HASS disciplines, even in a streamlined metrics based approach" (p. 56).

[37] www.shanghairanking.com/ARWU-FIELD-Methodology-2011.html (last accessed 10 December 2011)

[38] Knight was scathing of the view that measurement is paramount in science. He wrote, "[t]he saying often quoted from Lord Kelvin (though the substance, I believe, is much older) that "where you cannot measure your knowledge is meagre and unsatisfactory," as applied in mental and social science, is misleading and pernicious. This is another way of saying that these sciences are not sciences in the sense of physical science, and cannot attempt to be such, without forfeiting their proper nature and function. Insistence on a concretely quantitative economics means the use of statistics of physical magnitudes, whose economic meaning and

their study "Research productivity in academia: a comparative study of the sciences, social sciences and humanities" that “[i]t is clear from our findings that a unitary model of scholarly or scientific productivity cannot be assumed to operate in all academic disciplines”.

96. Intriguingly, based on their analysis, Wanner et al report that “[i]t is evident that for natural scientists, their decisive edge over social scientists and humanists in article production is due to the sizeable effects of the academic variables on their productivity. Put another way, if the typical natural scientist were in the humanities, his or her research productivity would be much lower - closer to that typical of the humanists. Likewise, were he or she in the social sciences, the social sciences' average would be approximated” (p. 250).

97. In line with other studies, Wanner et al find that “ … weekly time at research has a relatively strong effect on productivity for all sub-samples [i.e, sciences, social sciences and humanities]”. They go on to report that “[t]ime at teaching, however, has a significant effect only for humanists, *and then its effect is positive, i.e., the greater the time spent at teaching, the greater the productivity*” (p.246, emphasis in italics added).

98. In her Australian survey-based study “Teaching, research and scholarship in different disciplines” Ingrid Moses (1990) explains the humanities’ unusual positive association between teaching and research in the humanities in terms of Richard Whitley's (1984) schema for describing key characteristics of research field. Moses claims

    98.1. “teaching in English is not a conveying of factual information or explanation of shared theoretical frameworks and research strategies. But because of the individualistic nature of knowledge, because staff have to model to students how one evaluates evidence, theories, interpretations, so they might derive a new understanding or interpretation, any new subject matter taught requires staff to research this area”

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significance is uncertain and dubious. (Even "wheat" is approximately homogeneous only if measured in economic terms.) And a similar statement would apply even more to other social sciences. In this field, the Kelvin dictum very largely means in practice, "if you cannot measure, measure anyhow!" That is, one either performs some other operation and calls it measurement or measures something else instead of what is ostensibly under discussion, and usually not a social phenomena. To call averaging estimates, or guesses, measurement seems to be merely embezzling a word for its prestige value. And it might be pointed out also that in the field of human interests and relationships much of our most important knowledge is inherently non-quantitative, and could not conceivably be put in quantitative form without being destroyed. Perhaps we do not "know" that our friends really are our friends; in any case an attempt to measure their friendship would hardly make the knowledge either more certain or more "satisfactory"! (Knight, 1940, p. 18, footnote 10).

(p.371).

99. Moses goes on to observe that

99.1. "[i]n addition, English staff feel very much under pressure from heavy teaching commitments. In response to the question "Does the department influence (a) the direction, (b) the amount of research you do?", English staff most often mentioned the necessity of gearing their research to their teaching - it was impossible to separate them - as scholarly occupation with too many diverse subject matters was not possible. All English staff with an interest in teaching, like most Chemistry staff, also strongly felt that the high teaching loads and the large number of students (undergraduates in English, quite apart from graduate students, get more individual feedback than students in many other fields) constrained research time" (p. 371).

99.2. One implication is that the positive relationship between teaching and research in the humanities is a function of classes or courses reflecting academics' research interests. However, the positive relationship only exists when class sizes are small[39].

100. Notwithstanding the positive relationship between teaching and research in the humanities, it is clear that research drives reputation in the arts, humanities and social sciences in much the same way it does in the natural sciences. For UWA to be a comprehensive university with a high reputation across all its Faculties, it needs to ensure that high quality research is encouraged in all fields. One of the questions addressed in the next section (among other things) is whether the quest for a top 50 ranking on the ARWU squeezes the scope for the arts, humanities and social sciences to flourish in their research.

Issues in developing UWA's research reputation

101. Reputation is a function of accomplishment and recognition of that accomplishment. As the studies discussed in this report show, there are good reasons to attend to UWA's research reputation. Research reputation influences recognition of UWA's research and also ability to garner resources. Given the premise that UWA's accomplishments in research have not gained commensurate recognition, what are the levers to address the problem?

102. UWA presently doesn't have a research footprint large enough to vault to the top fifty.

[39] Further, in-so-far that much leading research in the humanities (and, for that matter, in other disciplines as indicated earlier) is not directly or obviously related to current social preoccupations, it will be easy to pin the charge of irrelevance on them.

As discussed, it is relatively small even within Australia, with the second smallest population of "research only" and "teaching & research" staff in the Group of Eight universities.

103. Size of research footprint is a function of resources. Departments and schools have limited scope to increase their resources. However, this is not a counsel of despair: a comparison of UQ's and UWA's performance over the past thirty years shows there is sufficient flexibility even in the relatively constrained Australian funding environment to make policy choices that have perceptible (even substantial) impact on quality of research outcomes, although as Williams and Van Dyke (2008) show with respect to UQ it can take considerable time for reputation to reflect improved outcomes.

104. The policies for research success entail hiring high quality researchers, providing them with resources and accommodating risk-taking. Effective implementation of these policies is dependent on the exercise of academic judgement and commitment to appropriate values.

105. The importance of culture is a commonplace. For instance, Edward Levi, former president of the University of Chicago, has observed,

105.1. "[a]s a rule of thumb, one can predict that the university with detailed rules and many procedures will turn out to be a poor university. The spirit of a university and the customs which reflect the care with which faculty discharge their responsibilities are of much greater significance" (2008b, p. 132).

UWA's clarity of purpose and capacity to intensely pursue that purpose

106. Ann Austin (1990), a former president of the (US) Association of the Study of Higher Education, writes that

106.1. "[r]esearch in both higher education and business indicates that effective leaders should clearly and frequently articulate the primary values, goals, and commitments of the institution … Since individual faculty members may emphasize different values, depending on the cultures that most influence them, a clearly stated and widely understood institutional mission and culture is a necessary foundation for linking many individuals and creating a community" (p.70)[40].

[40] The need to be clear about institutional values arises because there are many valid conceptions of a university. As Austin (1990) observes, "various issues and conflicts develop out of the multiple and interacting cultures in which faculty members work. Though the values of some of the cultures coincide, faculty must make trade-offs between those values that are

107. UWA's "Strategic Directions 2009-2013" provides a categorical expression of the University's purpose.

108. Preamble to "Strategic Directions 2009-2013"**:** The University of Western Australia will be recognised internationally for its excellence in teaching and research and as a leading intellectual and creative resource for the communities it serves.

109. Mission To advance, transmit and sustain knowledge and understanding through the conduct of teaching, research and scholarship at the highest international standards, for the benefit of the Western Australian, Australian and international communities[41].

110. In its forthright expression of commitment to excellence in teaching, research and scholarship at the highest international standards, some might argue that UWA has a basis to claim a clear statement of purpose. The claim is arguable because as Bill Readings, amongst others, has pointed out "excellence" doesn't refer to what should get taught or researched but only that what is taught or researched should be done at an excellent level[42]. One interpretation of Readings' point is that having excellence as an aspiration avoids the University stating to what it actually commits itself.

111. This sense that UWA seeks to keep its options open in terms of what it might aspire to be excellent is consistent with UWA's (then) Deputy Vice-Chancellor (Education) elaboration in 2008 of UWA's top fifty ambition. In an address to the ASEAN University Network Rectors' Conference, Brunei Darussalam, 1 December 2008, Professor Don Markwell stated:

111.1. "The University of Western Australia (UWA) uses in all its materials the motto 'Achieving international excellence'. It does this, not only to describe what it thinks it

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dissonant. Sometimes accommodation of the values of each of the four cultures (the profession, the discipline, the academy, and the institutional type) is impossible; trade-offs become unworkable. Light, Marsden, and Corl (1972, p. 14) call the process of working through these conflicts "the moral career of the academic man [or woman]" (p.68).

[41] The statement goes to state the core values underpinning UWA's activities. These values are a commitment to:

"- a high performance culture designed to achieve international excellence;
- academic freedom to encourage staff and students to engage in the open exchange of ideas and thought;
- continuous improvement through self-examination and external review;
- fostering the values of openness, honesty, tolerance, fairness, trust and responsibility in social, moral and academic matters;
- transparency in decision making and accountability;
- equity and merit as the fundamental principles for the achievement of the full potential of all staff and students."

[42] Readings (1996, p. 13).

is doing, but to focus itself on the need to do so. The University of Western Australia has an explicit goal of becoming one of the top 50 universities in the world within 50 years. *By this, we do not mean being recognised on a particular ranking that currently exists, but by whatever are the generally accepted measures of that time. Our hope is that the rankings of universities then will give full weight to the range of desirable qualities of universities*" (emphasis in italics added)[43].

112. A strategy based on hoping that the generally accepted measures in 2050 of what a university should be like will coincide with what we might consider desirable qualities is a risky strategy. It's also not the strategy one would normally expect a leading institution to adopt[44]. A separate but related issue is that a commitment to excellence in a variety of areas – teaching, research and scholarship – inevitably impairs the intensity with which any one goal may be pursued and therefore compromises the level of achievement that may be attained in any one field.

113. An extreme example illustrates the last proposition with respect to teaching and research: In his case-history that seeks to explain Rockefeller University's record of persistently making breakthrough discoveries in biomedical science, Rogers Hollingsworth (2002) writes:

113.1. "As a research organization, the Institute [as it was before it became a university] had several distinct advantages over most teaching institutions. Most teaching organizations attempt to present an entire field of knowledge to their students and find it awkward to neglect certain subfields. They tend to recruit people not so much because of their research excellence but because of the necessity to cover a particular area of knowledge. Unlike a university, a research institute has no obligation to cover an entire field of knowledge, and it can be very opportunistic in terms of the fields on which research is undertaken. It can neglect or pursue fields, can recruit scientists solely on the basis of their ability to attack selected problems, and it has the flexibility to move into new areas with considerable rapidity. Moreover, the

[43] www.uwa.edu.au/university/governance/executive/education-archive/speech_on_world_class_universities

[44] In the last chapter of Wannabe U: The Rise of the Corporate University Gaye Tuchman provides her prognosis for the university she has spent several years observing as a sociologist[44]. Tuchman states, inter alia: "Wan U's administrators just don't have the confidence *not to* conform by following current best practices on a matter that everyone has agreed is as important as preparing students (and the state) for the global economy. Few people discuss that old service hacksaw "doing what's right". … Wan U will remain a conformist university doing what must be done to elbow its way up the rankings, to survive in and to serve the neo-liberal state. It will increasingly impose an accountability regime" (p. 207/208).

Rockefeller Institute had the luxury of being able to recruit scientists of excellence even if they had limited ability to speak English or could not teach" (p. 19).

114. The necessity of recruiting academics to cover certain fields or of ensuring the ones that are recruited are capable of teaching the requisite subjects and can, in fact, teach … these are all issues familiar to the head of any discipline at UWA. They are indeed issues familiar to the heads of university departments the world over but it is striking that the universities that perform outstandingly well on research clearly acknowledge that teaching and research impose competing demands. For instance, Edward Levi made the following observation to the class of 1971 in a speech headed "*The shape, process and purpose of the University of Chicago*:

114.1. "We believe in research. Possibly the most extreme form of our faith in research was stated by [former president] Robert Hutchins when he said: "A university may be a university without doing any teaching. It cannot be one without doing any research." Mr. Hutchins was pointing to the inevitable stresses and conflicts which arise in an institution dedicated as we are to both research and teaching. If we had to choose, we would take research." (2008, p. 127).

115. Chicago is able to substantially preference research over teaching because, having emphasised pure inquiry right from its start, its development and commitments are heavily weighted towards research[45]. For instance, Chicago has just around 5,000 undergraduates but 10,500 postgraduate students, 2,200 academic personnel and an endowment of US$6.3 billion. In contrast, when UWA was established legislators agreed that "the University not only be free, but also provide tertiary education of a practical nature to help develop Western Australia's pioneering economy"[46].

116. UWA's original mission is reflected in its student mix: UWA has about 22,500 students, of which around 5,300 are postgraduates, and just under 1,500 comprise academic staff. Given its relatively small endowment of Aus$0.326 billion and its very substantial dependency on funding from teaching, it is not feasible for UWA to focus on research to

[45] William Rainey Harper, the founding president of Chicago, aimed "to make the work of investigation primary, the work of giving instruction secondary" (quoted in Levi, 2008a, p. 5) As it happens, Chicago's undergraduate program owes its existence to the whim of its founding benefactor. Delblanco (2012) states that "[i]n the view of William Rainey Harper, first president of the University of Chicago, keeping college students around at all was a 'temporary concession to the weakness of the founder' [John D. Rockefeller], who, inexplicably, had a soft spot for them" (p. 81).

[46] UWA's history (http://www.uwa.edu.au/university/history last accessed 13 Jan 2011)

the same extent as Chicago. UWA no longer provides free education, which shows its aspirations are mutable[47], but its original mission has shaped a trajectory of development and commitments that constrains its capacity to focus as intensely on research as Chicago[48].

117. It should be said that Chicago's emphasis on research does not imply its teaching is second rate. Chicago has led important developments in teaching. For instance, in Katherine Wrightson's (1998) exposition of Chicago's teaching philosophy, she writes that early in its history "Chicago faculty created a handbook, *Teaching by Discussion in the College Class*, which was ordered by over a thousand [US] colleges nationwide" (p. 108)[49]. However, a small undergraduate body relative to its population of postgraduate students and research-focused academics allows Chicago to focus on research to an extent not

[47] It would be interesting to learn the history behind UWA ceding the values that gave rise to it being "the first free university in the British Empire, actively promoting equal access to tertiary education for all social classes" (see: http://www.uwa.edu.au/university/history last accessed July 2012). UWA arguably presently pursues the objective of accessible education no more and no less vigorously than the other Go8 universities. It is remarkable that in arguably more straitened times UWA was a world leader in this regard.

[48] As a matter of interest, Chicago's smaller undergraduate student body relative to its postgraduate and research population is something of an accident of history. John Boyer, a former Dean of the College of the University of Chicago points out in a fascinating history of the university in the 1960s and 1970s that "since from the founding of the University in 1892 until the collapse of College enrollments in the early 1950s the number of College students on campus had always been larger than the graduate arts and sciences student population" (p. 55). Boyer also comments that although many histories of Chicago assume that the small undergraduate school was always planned; this was not the case. He writes "[t]he College's enrollment disaster of the early 1950s, which led us [the College] to have an entering class by the fall of 1953 of only 275 first-year students and a total College enrollment of only 1,350 students, was the result of a series of unfortunate trends involving tremendous difficulties in student recruitment and negative perceptions about the neighborhood. The result—a "small" College—was an outcome that neither the University administration nor the Board of Trustees had ever sanctioned." Boyer also notes that there continues to be [at least as at 1999] a struggle to overcome academics viewing teaching undergraduates of the College as something that happens apart from the research work of the university's divisions. Boyer's history is pertinent to us at UWA today because it shows, among other things, that in the late sixties and early seventies, Chicago had to meet financial challenges far more severe than the current challenge facing UWA. The crisis was exacerbated by the College failing to meet enrolment targets for its undergraduate students. Boyer observes "… the absence of these students [900 below the level enrolled in 1975] represented a loss in revenue to the University of $2,250,000, or almost half of the structural deficit with which the University struggled by the middle of the decade" (p. 56).

[49] Notwithstanding this record, it is fair to add that the quality of teaching at Chicago has been variable over the years. Boyer (1999) writes in his history that one of the principal complaints of the students who mounted sit-ins and very aggressive protests in 1969 was the quality of teaching. Boyer writes: "I was a first-year graduate student in January 1969 who did not participate in the sit-in, who was strongly opposed to the occupation of the Administration Building and to the radical demands proffered by SDS, but who was very sympathetic with the concerns of the graduate and undergraduate students relating to the quality of teaching on campus" (1999, footnote 26, page 29).

available to UWA.

118. It is also worth noting also that Chicago's small body of undergraduates allows it the freedom to espouse and practice a philosophy of education that is unlikely to be viable to a university that needs to attract students for whom instruction is not only or even principally about expanding the life of the mind but also about what it can do for them materially. Wrightson (1998) reports that

118.1. "[i]n his 1996 report to the faculty of the College of the University of Chicago, Dean John Boyer quoted a 1952 committee report: "The objectives of the College represent a break with the predominant currents of American life. They hold no promise of monetary or social success, but point only to the necessity of enlightened citizenship and the pleasures of rational living" (1997, p. 7)"[50].

119. The number of students for whom the above view of education is sufficiently appealing to be the main motive to pursue a university degree is small and, contrary to what we may like to believe, it has always been small. In his research into patronage patterns at Oxford Colleges between 1300 and 1530, Guy Fitch Lytle (1975) found that

119.1. "if a university degree could not assure students of good jobs after they graduated, the institutions faced imminent decline" (p. 123).

120. Similarly, the philosopher and university historian Hastings Rashdall had this to say about medieval universities:

120.1. "The rapid mulitiplication of universities during the fourteenth and fifteenth centures was largely due to a direct demand for highly educated lawyers and administrators. In a sense the academic discipline of the Middle Ages was too practical. It trained pure intellect, encouraged habits of laborious subtlety, heroic industry, and intense application, while it left uncultivated the imagination, the taste, the sense of beauty, in a word, all the amenities and refinements of the civilised intellect" (p. 6)[51].

[50] This may be so but I have no doubt that Chicago graduates do very well in a material sense too because they are a highly selected group (recall the discussion of Michael Spence's signaling theory of education).

[51] quoted in The University: The Anatomy of Academe by Murray G. Ross, McGraw-Hill Book Company, 1976. The quote is from Rashdall, H *The Universities in the Middle Ages* edited by F.M Porvicke and A.B. Ender, London: Oxford University Press, 1936, vols 1,2,3 (vol. 3, p. 246).

Calibrating UWA's "top 50" ambition

121. Given that UWA is unable to pursue research or indeed the ideal of a liberal arts education with the same intensity as, say, the University of Chicago raises the question whether it makes sense for UWA to attempt to compete in the same league. Professor Markwell, in his afore-mentioned paper, addresses this issue:

121.1. "When a university talks of becoming 'one of the top 50 in the world', or the 'top 30', or whatever it may be, there is a tendency for people to assume that what is meant is actually to be among the 'top 10'. This implicit assumption can lead people to think that the ambition is unrealistic, and should be abandoned. It is, I think, much easier and more realistic for an institution of high quality now to aspire to be in the top 30–50 universities than it is for it to aspire to be in the top, say, 15 or 20".

122. The feasibility of UWA breaking into the top fifty universities by 2050 or even the top 100 universities by 2015 depends on what criteria are used. At present it is the ARWU ranking that is most widely promoted as UWA's measure of excellence notwithstanding that the ARWU excludes entirely measures of teaching and research and scholarship in the arts and humanities.

ARWU rankings are counterproductive

123. One defence of use of the ARWU ranking is that if UWA doesn't attend to its position in the ARWU its capacity to attract students and resources will decline. As the arguments made and evidence discussed earlier show, it is appropriate – important even – to seek to improve UWA's research and reputation. However, this effort does not require use of the ARWU ranking at all. Attracting, developing and retaining high quality researchers and providing them with the resources and confidence to undertake high risk, ambitious research with potential to make high impact has been shown to be the best way to promote outstanding research achievement and reputation in the long run. Effective implementation of this strategy is a function of developing the appropriate university culture rather than of choice of measure of performance.

124. If use of the ARWU ranking as UWA's principal measure of excellence were merely beside the point in terms of improving research reputation it would be largely benign in its impact. Unfortunately this is not the case. There are two channels through which focusing on improving UWA's ARWU ranking has a malign impact:

124.1. (i) Focusing on the ARWU ranking promotes an audit mentality that is

antithetical to the requisite judgements and decisions for high quality research

124.2. (ii) Focusing on the ARWU ranking undermines the proper attention due to teaching and education at UWA.

124.3. The malign impact of these two channels is elaborated below.

Perils of an audit culture in research management

124.4. "'How else would you judge the quality of academic contributions?' an American academic asked, when told that the British Research Assessment Exercise graded faculty publications as good, of national importance or of international importance. *And that is just the point. Auditing quality is so ubiquitous that it is common sense"*.

125. The above passage is from Gaye Tuchman's (2009) book Wannabe U: Inside the Corporate University (p. 109, italics in original). Tuchman is one of many observers who have remarked on the rise of an audit culture[52] in universities geared towards identifying excellence and making failure accountable[53].

126. So, why is an audit culture damaging? It is not that academics don't respond to incentives. They do. The problem is that the research audit measures employed – typically bibliometric-based – systematically sabotage the aims they are intended to achieve. This is a strong claim so it is useful to note that an expert in the field backs it.

Anthony van Raan on ranking of universities by bibliometric methods & the ARWU system

127. Anthony F.J. van Raan is Professor of Quantitative Studies of Science at the Centre for

[52] The term "audit culture" is used by Cris Shore and Susan Wright in their (1999) article "Audit culture and anthropology: neo-liberalism in British higher education" in the *Journal of the Royal Anthropological Institute*.

[53] The connection with the jargon of commerce is no coincidence. In "Elite through rankings – The emergence of the enterprising university" German academics Peter Weingart and Sabine Maasen (2008) note the adoption of the rhetoric and management concepts of business by what they term "enterprising universities". Enterprising universities follow a well-trod, conformist path. Weingart and Maasen observe that enterprising universities homepages "abound with mission statements and visions. Their vocabulary regularly highlight '*centres of excellence*', '*national and international orientation*', '*life-long learning*, '*interdisciplinarity*' – in an effort to render the organisations accountable" (p.77). Earlier in their article, Weingart and Maasen observe that "while busy subjecting themselves to ratings and rankings, evaluations and excellence initiatives, they [the universities] seem to lose sight of the contents: what exactly do they consider high quality *Bildung*, where should research be headed? Are the answers really to be found in the multitude of mission statements presented on the Internet by programs, faculties and universities?" (p. 76).

Science and Technology Studies Leiden University, The Netherlands. van Raan has published research in experimental physics and astrophysics. He is on the editorial board of the international journal *Research Evaluation*. In "*Fatal attraction: conceptual and methodological problems in the ranking of universities by bibliometric methods*" van Raan (2005) states categorically:

> "[r]anking of research institutions by bibliometric methods is an improper tool for research performance evaluation, even at the level of large institutions. The problem, however, is not the ranking as such. The indicators used for ranking are often not advanced enough, and this situation is part of the broader problem of the application of insufficiently developed bibliometric indicators used by persons who do not have clear competence and experience in the field of quantitative studies of science" (p. 133).

128. van Raan goes on to say:

> "I claim, however, that for a substantial improvement of decision-making on matters of scientific activities, advanced bibliometric indicators have to be used in parallel to a peer-based evaluation procedure. Properly designed and constructed … they can be applied as a powerful support tool to peer review. … Bibliometric indicators have great potential, more than many people think, as these indicators provide necessary and even unexpected insight into scientific developments. This is, however, only the case under the following two fundamental conditions: (1) the technical system and (2) the methodology on which these indicators are based, must be sufficiently advanced and sophisticated. This means that the very many pitfalls and sources of error in citation analysis have to be known in detail and that all relevant corrections have to be made" (p. 135).

129. The distinction between "technical" issues which concern competent collation of measures and "methodological" issues which relate to fitness for purpose is an important one. van Raan contends that:

129.1. "[t]he question of the appropriateness of the methodology is certainly in both a scientific and in a practical sense most crucial. But in contrast to what is thought generally, still the quality of the technical system is the first source of problems to be tackled. Methodological problems are certainly also present, but it is not very useful to discuss them if basic technical problems in order to arrive at a reliable data system on which, as a next step, a bibliometric indicator methodology can be based are not

solved" (p. 135/6)

130. van Raan concludes with the following damning indictment:

130.1. "From the above considerations we conclude that the Shanghai [ARWU] ranking should not be used for evaluation purposes, even not for benchmarking. … Rankings such as the Shanghai one are part of a larger problem in the science evaluation circus. Quite often I am confronted with the situation that responsible science administrators in national governments and in institutions request the application of bibliometric indicators that are not advanced enough. They are aware of this insufficient quality level, but they want to have it "fast" and in "main lines", and "not too expensive". Many of the problems mentioned … such as the easy use of journal impact factors for research performance assessments of individuals scientists or groups simply should not exist: there are already better indicators for quite a long time. But still heads of institutions demand their librarians to do quickies, i.e., rapid and, particularly, cheap evaluations with help of standard journal impact factors. The fault of these leading scientists and administrators is asking too much and offering too little. The responsible persons do not want to pay a reasonable amount for a study of better quality. They do pay a considerable amount for the data, but want to have a competent evaluation study based on these data for a small fee: "the data are already there, so please press the button" (p. 140/141).

<u>Implications of van Raan's views on usefulness of UWA's Socrates Index</u>

131. How much of Van Raan's analysis is applicable at UWA? The available evidence suggests van Raan would have very serious misgivings about the technical soundness – and therefore validity for use - of a key bibliometric tool used here, the vaunted Socrates Index which is intended, in part, to help UWA achieve its top 50 goal. A recently released (July 2012) survey of 105 UWA academics who were members of the National Tertiary Education Union (NTEU) showed that 57% did not think the Socratic Index accurately reflected their research output. The report accompanying the summary of survey question results noted:

131.1. "Comments throughout the questionnaire suggest that a number of respondents do not think that the Socratic Index is even a reasonably well functioning metric, citing such things as missing data, an unreasonably lengthy time lag between publication and credit on the Index, errors in calculation, mathematically inappropriate statistical

metrics, difficulties in gaining access to it, difficulties in correcting errors and omissions and an inadequate support staff"[54].

132. Notwithstanding van Raan's argument, a potential response might go along the following lines:

132.1. "OK, the Socratic Index has problems and they ought to be fixed but in the interim it remains an objective "rough and ready" guide to research productivity that is more reliable or even just less biased for evaluation purposes than subjective assessments of performance."

133. The above view is based on a misconception about the reliability of peer review. The accuracy and validity of peer review is a direct function of what van Raan (2005) has termed "cognitive distance"[55]. van Raan observes

133.1. "there is ample empirical evidence that the judgements of typical, 'short cognitive distance' peer review correlate substantially with the results of advanced bibliometric analysis … Both are focused on recent past performance. And recent past performance is the best predictor of future success."

134. One implication is that using anything less than advanced bibliometric measures is unnecessary – not to say damaging - when peer review will yield results equivalent to advanced bibliometric analysis[56]. Recall also van Raan's point that even when advanced bibliometric measures are available they should be used in parallel with a peer-based evaluation procedure for a substantial improvement of decision-making in matters of scientific activities. Resorting to bibliometric measures as the principal basis of a system to evaluate research productivity and quality and allocate resources implies the university's

[54] Those experiencing these issues may find it ironic that the web portal to the Socratic Index includes the following quote: *"The unexamined life is not worth living." Socrates in Plato's Apology 38a*.

[55] Cognitive distance is short when, in van Raan's words, "peer review is applied on a relatively small scale, ranging from the review of a submitted paper or a research proposal by two or three referees, the review of the record of candidates for a professorship by, say, five experts in the field, and the assessment of research groups and research programs within a specific discipline by between five and ten peers … This implies two important things. First, the peer can be regarded as an expert with respect to the quality of the object. Second, the object to be evaluated has a 'size' which is comparable with the normal direct working environment of the peer, namely a research group or a research program and, thus, surveyable for individual peer judgement" (p. 7).

[56] Recall van Raan states that "for a substantial improvement of decision-making on matters of scientific activities, advanced bibliometric indicators have to be used in parallel to a peer-based evaluation procedure".

academic culture has failed in a core task: to provide effective, competent peer review at the right cognitive distance. Addressing this issue directly promises to be far more effective than control by bibliometric measures.

Economists Bruno Frey and Katja Rostin on use of bibliometric rankings

135. The argument that bibliometric measures should be, at best, a supplementary aid to peer review within the university is widely held amongst experts. For instance, in their (2010) paper "Do rankings reflect research quality?" economists Bruno Frey and Katja Rostin conclude:

135.1. "[w]e do not think that one superior, objective ranking can possibly capture all the necessary criteria. We argue that public management, especially university management, should stop the mass euphoria of rankings and return to approved methods, such as engaging independent experts who in turn provide measurements of research quality that is applicable to their specific research community" (p. 4).

Australian bibliometric experts Claire Donovan and Linda Butler on issues in using bibliometric measures to foster interdisciplinary research

136. Another instance: leading bibliometric experts Claire Donovan and Linda Butler (2007) note

136.1. "applying 'standard' publication and citation measures to the social sciences is fast becoming an outmoded practice, yet we have still to develop credible quantitative alternatives to inform research evaluation exercises" (p. 231).

137. Pertinently, in light of UWA's recent efforts to foster interdisciplinary research, Donovan and Butler comment

137.1. "[p]erhaps one of our most striking findings [from their investigation of alternative measures] was that the interdisciplinary and highly policy-oriented unit [i.e., discipline or department], which was ranked lowest by every impact and 'esteem' indicator, was ranked highest by the novel 'user engagement' indicators[57]. While this was a discrete pilot study, if this finding is replicable in other fields, then there are major implications for how we think about the quantitative assessment of

[57] "User engagement" refers to the practical impact of research; proxies for this impact used by Donovan and Butler included number of commissioned studies, research linkages with non-academic entities, and provision of advice.

multidisciplinary and applied research" (p. 241).

138. Donovan and Butler conjecture "[t]his inversion was seen as a trade-off between being an applied and policy-focused unit engaged in consultancy work for various non-academic 'end-users' of research" (p. 241).

Bibliometric expert Diana Hicks on bibliometric measures and industry interaction

139. The trade-off between undertaking the research recognised in the standard bibliometric measures of esteem and impact and that which is "industry relevant" is a particularly problematic one for universities, including UWA, that seek to simultaneously foster closer ties with industry (in part to help fund research)[58] and increase their research reputation. The problem is a general one. Diana Hicks (2012) reviews the outcomes from performance-based university research funding systems" (PRFS) in 14 countries and concludes, inter alia:

139.1. "First, a PRFS will not be a good way to encourage interaction with industry and application of research, activities with demonstrable economic benefits. Enhancing universities' contributions to the economy is a common policy goal that is not well addressed in current PRFSs. The Australian RQF included measures of broader impact, but this was dropped due to complexity" (p. 259).

140. Hicks (2012) goes on to note another disquieting aspect of performance-based funding systems:

140.1. "Equity and diversity are also important public values in relation to universities. Excellence and equity have always been in tension in research policy. PRFSs encourage excellence at the expense of equity. A more subtle conflict may arise in a PRFS because of the strong reliance on the academic elite in its design and

[58] For instance, the website of UWA's Energy and Mining Institute includes the following message from the Vice-Chancellor, Professor Paul Johnson: "Behind every leading economy, there is a leading University and in our State that university is The University of Western Australia. … At UWA we nurture and promote a culture of innovation, education and high ambitions. We have the facilities to assist in developing creative solutions and a proven record of doing so. Our intellectual capacity is applied to creative thinking for technological challenges facing industries through medicine, engineering, law, environmental science and other disciplines. The driving force behind the Western Australian economy is the resources sector. … Together with industry, we can create a world-class innovation hub here in Western Australia – tackling solutions that challenge the resources sector. UWA is a natural research partner for this sector and our Energy and Minerals Institute has a key role in facilitating those partnerships." (http://www.emi.uwa.edu.au/vice-chancellors-message - last accessed July 2012).

implementation and the possibly enhanced effect if the rest of the funding system is entrained by the PRFS" (p. 259).

Linda Butler and Ian McAllister on national performance-based funding and research excellence

141. In fact, even the ostensible success of PRFS in facilitating the narrow objective of research excellence may be illusory. Britain has the longest history of implementing a PRFS. Butler and McAllister (2009) follow the conventional view by acclaiming the outcomes as follows:

141.1. "[t]he results of this periodic assessment have been impressive: following the 1996 RAE, 43 per cent of the research that was evaluated was rated as of 'national' or 'international' standard; the same figure after the 2001 RAE was 63 per cent. In 2001, nineteen universities had an average departmental score of 5 or above, up from three in 1996" (p.14)

142. However, in reviewing the impact of Britain's research assessment exercise on the quality of business research at Britain, Saunders, Wong and Saunders (2011) claim

142.1. "[t]o find that increased proportions of Britain's research output was 'worldleading' in RAE 2008 meant that the definition of world-leading had to be diluted to the point that several institutions were recognized as having more than 25% of their output world-leading while making no contribution to the internationally recognized world-leading journals" (p. 412).

143. Performance-based research funding systems are typically rationalised in terms of improving research excellence whilst fostering accountability and efficiency (i.e., the aim is "more bang for the buck", as it were). The evidence to date is that they do neither, although curiously there seems an entrenched reluctance to impose the same standards of accountability and evaluation on the actual evaluation processes[59]. For instance, Saunders et al (2011) report:

143.1. "the Roberts Report (Joint Funding Council, 2003) [on Britain's RAE] concluded that the process was an 'extremely successful . . . competition for funding . .

[59] In attempting to explain this phenomenon, Peter Weingart and Sabine Maasen (2008) note it social theorists have conjectured that "the audit explosion represent a distinct need to process risk; a process designed to provide visions of control and transparency which satisfy the self-image of managers, regulators and politicians" (p. 97).

. successfully retaining its original function of driving up standards through reputation incentives', although the Report provided no evidence in support of the eulogy [sic]. In contrast, this analysis suggests that the process presided over a period of stagnation. Both Britain and Australia were early into research evaluation and after decades manipulating their metrics and reward systems have just about the same share of top publications as 40 years ago" (p. 411).

144. Glaser, Jochen and Grit Laudel (2008) in their investigation "*Evaluation without evaluators: the impact of funding formulae on Australian university research*" write that

144.1. "[a]s a result of the described adaptive behaviour, research becomes more applied, approximates the mainstream, narrows, and its results become less reliable (less rigorously tested). The increasing orientation towards applications is produced by the internal priority setting of universities and better chances of grant funding for such research … By following these fashions, the Australian grant funding system favours the mainstream against nonconformist perspectives. Researchers drop lines of research that are 'too basic' or 'unfashionable' and advance the remaining research lines towards more applied and 'hot' topics" (p. 146).

144.2. "The strong pressure of the funding environment has been the most signifiant influence that has forced most of the interviewed academics to adapt their research strategies. As a result of this adaptation, their research is becoming less diverse, less fundamental, and less reliable. We did not observe moves towards "better" research by addressing more fundamental problems and providing surprising solutions to them Except for the abandonment of whole lines of research, changes were topical and incremental" (p. 147)

145. In terms of cost-efficiency, Hicks (2012) points out in relation to Britain's 2001 RAE:

145.1. "[o]ne author noted that the exercise was conducted as if it was to appraise 50 000 individual researchers and their 180 000 pieces of work in order to make 160 funding decisions … which seemed disproportionate" (p. 256).

145.2. Hicks also notes "[a]nalysts consistently emphasise the small amounts of money involved or the small amount that moves in any one year as a result of evaluation" (p. 257)[60].

[60] Earlier in her analysis, Hicks concludes "[a]lthough the importance of PRFSs seems based

Pursuit of a higher ARWU ranking and the undermining of teaching excellence

146. In the last chapter of Wannabe U: The Rise of the Corporate University Gaye Tuchman provides her prognosis for the university she has spent several years observing as a sociologist[61]. Tuchman states, inter alia:

146.1. "Wan U's administrators just don't have the confidence *not to* conform by following current best practices on a matter that everyone has agreed is as important as preparing students (and the state) for the global economy. Few people discuss that old service hacksaw "doing what's right". … Wan U will remain a conformist university doing what must be done to elbow its way up the rankings, to survive in and to serve the neo-liberal state. It will increasingly impose an accountability regime" (p. 207/208).

147. How closely does the above describe UWA? There are arguably some parallels with UWA in Tuchman's description of Wannabe U[62]. However, it would be unfair and inaccurate to describe UWA as being focused exclusively on improving its ARWU ranking. After all, the university has just completed – at great expense, large institutional effort and significant risk - a restructuring of its degree courses to promote a broad, liberal education to its students. This landmark reshaping of the university's course offerings was not prompted by any expectation it would improve UWA's ARWU ranking[63]. It was aimed

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on their distribution of universities' research funding, this is something of an illusion, and the literature agrees that it is the competition for prestige created by a PRSF that creates powerful incentives within university systems" (p. 251). Saunders, Wong and Saunders (2011) report that the Netherlands has improved the impact of research produced by its business schools in recent years, noting that "an analysis of the UTD database for the last RAE period (2002–2008) showed that many individual Dutch born and trained professors in Groningen, Tilburg and Erasmus business schools had more A-journal publications than all the British-born and affiliated academics put together" (p. 412). It is interesting therefore that Hicks observe that "[t]he Netherlands implements an evaluation system based on peer review which is not used for distribution of funding …." (Hicks, 2012, p. 253).

[61] The university is allegedly the University of Connecticut (UC) (see http://www.insidehighered.com/news/2009/10/06/wannabe). UC's 2011 ARWU ranking is between 201-300.

[62] Tuchman completed her fieldwork at Wannabe U around 2007. She writes in her book about what is likely to happen in the near future: "[t]he last time a full academic plan was presented to the board, trustees criticized it for being too vague. … This time the academic plan is much more specific. It names academic fields in which the university should invest. It offers a plan to identify disciplines where the university should divest. In theory at least, the plan should eliminate organisational ambivalence. In practice, it probably will not. The pressure to get grants will not abate. Grants will probably be part of the productivity measures used to decide which programs will fold" (p.206).

[63] A statement from the university issued on 16th December 2008 headed "New course structure for UWA" included the following points: "The University of Western Australia is moving towards a new framework for undergraduate and postgraduate study, designed to equip

squarely at delivering better education, an outcome the ARWU does not count.

148. That UWA undertook its course restructure whilst promoting its ambition to rank amongst the top 50 in the ARWU shows the university is committed to both education and research. The issue is not UWA's intent but as discussed earlier its ability to attend to both education and research to the extent required to achieve the standards UWA aspires for each activity. Undertaking "cutting edge" research whilst providing an education of commensurate quality is a difficult challenge that even a fantastically well-endowed university such as Harvard which has less than half the number of UWA's undergraduate students has struggled to address[64].

149. Delbanco (2012) indicates the pervasiveness of the problem when he observes:

149.1. "As the man who created one of the world's great universities, the University of California, acknowledged with unusual honesty, 'a superior faculty results in an inferior concern for undergraduate teaching'. It has been nearly fifty years since Clark Kerr identified this 'cruel paradox' as 'one of our more pressing problems'. Today it is more pressing than ever" (p. 3)[65].

150. As noted earlier and as the above quote indicates, the tension between teaching and research manifested long before the ARWU ranking were conceived. Doing away with the

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students with a global outlook and a community conscience. … The simple and flexible framework for undergraduate courses has an emphasis on the development of a broader knowledge base as well as comprehensive research and communications skills, and a community service component. … UWA degrees, undergraduate and postgraduate, will have research skills development and inquiry-based learning as a hallmark, giving students the foundation for problem-solving and continuous learning throughout their lives". Available at http://www.news.uwa.edu.au/business-briefing/new-course-structure-uwa - last accessed July 2012.

[64] Harry R. Lewis, a former Dean of Harvard College, makes the case in Excellence without a Soul: How a Great University Forgot Education (2006, New York: Public Affairs Press) that Harvard has not just struggled but failed to meet this challenge. (A later (2007) edition of the book had the revised title Excellence Without a Soul: Does Liberal Education have a Future?)

[65] Delbanco (2012) sees no contradiction in identifying the University of California as one of the world's great universities despite its architect, Clark Kerr, associating a "superior faculty" with "an inferior concern for undergraduate teaching" because he distinguishes college from university. Delbanco contends "… a college and a university have – or should have – different purposes. The former is about transmitting knowledge of and from the past to undergraduate students so they may draw upon it as a living resource in the future. The latter is mainly an array of research activities conducted by faculty and graduate students with the aim of creating new knowledge in order to supercede the past. Both of these are worthy aims, and sometimes they converge, as when a college student works with a scholar or a scientist doing "cutting edge" or "groundbreaking" research – terms that would have been incomprehensible before the advent of the modern university. More often, however, these purposes come into competition, if not conflict, especially as one moves up the world of prestige" (p. 2/3).

push to improve UWA's ARWU ranking will not solve the problem. Also, as the first half of this paper shows, there are good grounds for striving to enhance UWA's research reputation so giving up research in favour of teaching isn't the answer either. What we need to do is more effectively address the challenge of giving research and teaching the due attention each activity requires.

151. In this cause, it would help to explicitly acknowledge teaching and research are not complementary activities[66]. Continued insistence - in the face of institutional experience and scholarly evidence to the contrary - that research and teaching are complementary activities results in teaching being systematically given second place in the university's status pecking order because research, which has features that make it ostensibly more "measurable" will inevitably supplant teaching and efforts to redress the balance will be deflected by the argument that the two activities are complementary.

152. Delbanco (2012) makes the point that to achieve good teaching we need:

152.1. "to try to produce more teachers who care about teaching. This elementary but essential point has been made in one way or another by many recent critics of academia – Anthony Kronman, Louis Menand, Andrew Hacker, and Claudia Dreifus, to cite just a few. For all of them, the bogeyman is research – in the sense of narrowly focused inquiry into matters of marginal interest to young people in need of a general education. I am obviously sympathetic to this view, which takes seriously the fact that the talents of the research scholar or scientist are not necessarily those of the teacher. If the same person gives evidence of both, it is a fortuitous coincidence" (p. 166)[67].

[66] In their highly cited (2002) paper "The relation between research productivity and teaching effectiveness: complementary, antagonistic or independent constructs?" leading education researchers Herbert Marsh and John Hattie flatly state "it is important not to perpetuate the myth that there is a positive and reciprocal relation between teaching and research. There is no doubt that many would like such a positive relation to be true, and there is a strong conviction that research and teaching are closely linked" (p. 631).

[67] Delbanco's view is supported by systematic inquiry on this issue. Marsh and Hattie (2002) report ,"[t]he results of [our] present investigation - coupled with the comprehensive Hattie and Marsh (1996) meta-analysis - clearly indicate that teaching effectiveness and research productivity are nearly uncorrelated, thus supporting the hypothesis that they are independent constructs. … Good researchers are neither more nor less likely to be effective teachers that are poor researchers. Good teachers are neither more nor less likely to be productive researchers than are good teachers" (p. 635). Marsh and Hattie also note sociologist ""[Mary F.] Fox (1992) concluded that there was a strain between research and teaching in that academics trade off one set of investments against another. Thus, teaching and research 'do not represent aspects of a singe dimension of interests, commitments, and orientation, but are different dimensions that are at odds with each other' (p. 301)" (p. 612). A local anecdote consistent with

153. It has always been worthwhile giving teaching its due attention and resources, however, it is now more urgently a matter of institutional survival or ability to thrive because of the development of "massive open online courses" (MOOC) by the likes of Harvard and MIT that threaten the viability of UWA's (and other universities) funding model. Relying on research-derived prestige to attract students will not work when they can get world-class lectures from the world's best. How to solve this problem is outside the scope of this paper; the principal point here is that focusing on improving UWA's ARWU ranking without commensurate attention to teaching makes UWA more rather than less vulnerable to an imminent institutional threat.

Making space for the "life of the mind"

154. Finally, it is noteworthy that UWA tends to emphasise the pragmatic benefits of education so that for instance the announcement of the new course structure promoted the attribute that "UWA degrees, undergraduate and postgraduate, will have research skills development and inquiry-based learning as a hallmark, giving students the foundation for problem-solving and continuous learning throughout their lives". These are worthy competencies and entirely consistent with improving our research reputation and also consistent with what students want from us but we may consider signalling more prominently to our students that an education is about more than the acquisition of qualities directed towards achieving success or "excellence".

155. The great universities strive to convey this message even though it is not counted in the ARWU. For instance, it is striking that whilst Stanford sets the benchmark for combining outstanding research with education that has exceptional utilitarian value, the university wishes more for its students. In a report The study of undergraduate education at Stanford University released in January 2012 the opening paragraph of the chapter headed "*The aims of a Stanford education*" ran as follows:

155.1. "Stanford's founding grant states the university's "object" succinctly: "to qualify its students for personal success, and direct usefulness in life." Today, more than a century later, we still subscribe to that goal. But we also hope for more. We

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Marsh and Hattie's findings: A few years back, Emeritus Professor Charles Oxnard, recounted at a UWA Staff Association forum on peer review of teaching of the times when he audited his colleagues' lectures at Chicago in his capacity as Dean of the College of Letters, Arts and Science (1973-1978). Milton Friedman a Nobel laureate in Economics was a star performer in the classroom, with his lectures attracting many people not enrolled in the course. On the other hand, Saul Bellow, a Nobel laureate in Literature, had a lecturing style that fell considerably short of the quality of his writing!

want our students not simply to succeed but to flourish; we want them to live not only usefully but also creatively, responsibly, and reflectively"[68].

156. Learning to live creatively, responsibly and reflectively or just learning how to enjoy life[69] are not outcomes likely to be incorporated in any quantifiable measure of a great university either now or in 2050 but they are part of the education that students may get at UWA if they choose and adequate provision of this opportunity should loom just as large in our planning as UWA's wish to excel at research[70].

Concluding comment

157. As Walt Whitman did not quite say, "universities are vast, they contain multitudes". The several objectives of universities – teaching, research and service – are not contradictory but they compete for institutional focus and resources. UWA's mission, historical development and commitments preclude it being able to attend to research with the same intensity as some universities with a different history. However, even within its constraints UWA has the freedom to make policy choices that make an appreciable difference to the quality of its research. Abandoning conformity to the auditable measures of the ARWU rankings and similar metrics and reinvigorating a culture where capable

[68] It seems that Stanford, to its credit, is intent on addressing the curious phenomenon that Harry Lewis, a former dean of Harvard College identified: "Universities affect horror when students attend college in the hope of becoming financially successful but they students neither a coherent view of the point of a college education nor any guidance on how they might discover for themselves some larger purpose in life" (quoted by Delbanco, 2012, p. 24)

[69] Delbanco (2012) reports that after he had provided a talk on what he called the Jeffersonian argument for education, ie, education for citizenship to a group of former Columbia University students, "an elderly alumnus stood up and said more or less the following: 'That's very nice, professor, but you've missed the main point'. With some trepidation, I asked him what that point might be. 'Columbia,' he said, 'taught me how to enjoy life'. What he meant was that college had opened his senses as well as his mind to experiences that would otherwise be foreclosed for him" (p. 32).

[70] This sentiment implies that the university's priorities as reflected in its allocation of resources should display some independence from other institutions' priorities. Edward Levi, president of the University of Chicago from 1968 to 1975 (and subsequently US Attorney-General) understood this point as the following quote from a speech he made to the Chicago's class of 1971 shows:

> "[o]ver the last eleven years the greatest increases in the regular budget of the university have gone, with the exception of one professional school, to the College, and then to the Humanities Division. This reflects the determination of the university at a time when greatly needed scientific support has been coming in part from governmental sources, but which in turn has been matched in considerable amounts by university funds, not to permit a distortion of university life and goals" (Levi, 2008b, p.129-130).

researchers are free to undertake risky but potentially high impact investigations is the key policy decision UWA needs to make.

Appendix A

Selected passages from

"Research organisations and major discoveries in twentieth-century science: a case-study of excellence in biomedical research"

by J. Rogers Hollingsworth (2002)

Social Science Center Berlin, discussion paper; WZB P 02-003, Berlin.

Page 1: The paper addresses the problem of how the structure and culture of research organizations influence the creation of fundamental new knowledge.

[Note: Rockefeller University was founded in 1901 as the Rockefeller Institute for Medical Research. It became The Rockefeller University in 1965, after expanding its mission in 1955 to include postgraduate education]

<u>The scale of Rockefeller University's achievement</u>

Page 14: Understandably, leaders and scientists of the Rockefeller did not always correctly understand and respond to the changes in the global world of science. They did not always anticipate the major institutional and scientific patterns of change in America, nor did the organization consistently have the same level of excellence in its flow of ongoing work. Even so, why would Rockefeller University—a small organization in New York City not known by millions of Americans—have had more major discoveries in biomedical science throughout the twentieth century than such renowned organizations as Harvard, Yale, the University of California at Berkeley, and Stanford University in the United States; Cambridge and Oxford Universities in Britain; and the Pasteur Institute in Paris? And, in the biomedical sciences, why would it have had more major breakthroughs in biomedical science than all the Kaiser Wilhelm and Max Planck Institutes combined (see Appendix One for Rockefeller scientists who made major breakthroughs in biomedical science across the last century)? The key to this problem requires some comprehension of the development of a culture of excellence at Rockefeller shortly after its foundation.

Page 13: In our research there have been only six organizations worldwide which have had large numbers of major breakthroughs in biomedical science in the twentieth century, so many breakthroughs that we refer to them as "national champions." These are the Institut Pasteur in France, the University of Cambridge in Britain, and in the United States, California Institute of Technology, the College of Arts and Sciences at Harvard University (as distinct from the

Harvard Medical School), the Johns Hopkins University School of Medicine, and Rockefeller University. However, Rockefeller University led all other organizations in the number of major breakthroughs in biomedical science across the twentieth century. What follows is a case study of Rockefeller University, designed to shed some light on how it achieved and retained this level of excellence.

Six organisational characteristics identified as most important

Page 8-9: "As a result of our case studies, we have identified the following [six] organizational characteristics as most important in facilitating the making of major discoveries.

(1) *Organizational autonomy***.** The capacity of an organization to make scientific appointments, engage in new lines of research, and organize new laboratories or departments according to the criteria which it develops independently of external disciplinary norms and governing authorities (for a discussion of this issue, see Hollingsworth, 2000).

(2*) Organizational flexibility*. The ability of an organization to shift rapidly to new and different research areas.

(3) *Moderate scientific diversity*. The existence of a variety of biomedical disciplines and subspecialties. For scientific diversity to exert maximal beneficial effect, there must be depth (e.g., individuals highly competent in the following task areas: theoretician, methodologist, scientist highly conversant with literature in various fields, scientist highly competent in the latest instrumentation in diverse fields). The greater the proportion of the scientific staff who internalize scientific diversity, the greater the likelihood that scientific breakthroughs will occur. For additional details on diversity, see below.

(4) *Communication and social integration among the scientific community*. The bringing together of different cognitive perspectives through frequent and intense interaction in types of activities such as (a) joint publications, (b) journal clubs, (c) sharing meals and leisure time activities.

(5) *Leadership capacity to understand the direction in which scientific research is moving and to develop strategies for integrating scientific diversity***.** Outstanding leaders have been able to engage in tasks which are both task oriented and socio-emotional in nature. At both the organizational and the laboratory level, they have been individuals with (a) strategic vision for integrating diverse areas and for providing focused research, (b) ability to secure funding for these activities, (c) ability to recruit sufficiently diverse personnel for research groups to be constantly aware of significant and "doable" problems, (d) ability to provide rigorous criticism

in a nurturing environment, (e) capacity to orchestrate a diverse group of scientists in the present and at the same time to orient a scientific staff toward future directions.

While the diversity of perspectives creates problems of communication because of the cognitive distances among individuals, in organizations having recurrent major discoveries leadership plays a critical role in providing the means to overcome these difficulties. Our data demonstrate that one important function of the emotionally supportive leader is to encourage people to take intellectual risks and to participate in an open give-and-take climate of communication. Under these circumstances, hidden assumptions are often expressed, implicit knowledge may become codified, and radical ways of thinking about problems are more likely to slowly emerge.

(6) *Recruitment.* Organizations which have major discoveries time and time again tend to be ones where there is a moderately high level of scientific diversity which is well integrated. Organizations which have this kind of routine tend to recruit for permanent positions scientists who internalize moderately high levels of diversity at the time of their permanent appointments. These scientists tend to have very broad research interests.

Page 10: With most research organizations, it is only after there has been substantial decline in organizational performance that there is a realization that fundamentally new strategy, structure, personnel, and leadership are needed if the organization is to have the potential to remain at the frontiers of science. An organization which can anticipate the need to make radical changes at the same time that it is vigorously continuing its productive present is an unusual organization. Rockefeller Institute/University—the subject of this paper—was highly successful in making numerous major breakthroughs over the last century precisely because of its ability to carry out this dual activity: to maintain its established practices at high levels of performance, and to look beyond the near future to make radical changes in its practices.

Three organisational characteristics that impede the making of major discoveries

Page 11: Our research has revealed that the following organizational properties have hampered the making of major discoveries:

(1) *Differentiation*. Differentiation is concerned with sharp boundaries among scientific areas, that is, with formal, structural properties of units, such as (a) the number of biomedical departments and other kinds of units, (b) delegation of recruitment exclusively to the department or other subunit, (c) responsibility for extramural funding solely at department or other subunit level. Organizations which are highly differentiated into departments which, in

turn, are fragmented into subspecialties tend to recruit scientists who are highly specialized and somewhat narrow in their research interests.

(2) *Hierarchical authority and bureaucratic coordination*. This involves (a) centralized budget controls, (b) centralized decision-making about research programs, (c) centralized decision-making about number of personnel, (d) standardization of rules/procedures.

(3) *Hyperdiversity*. The presence of scientific diversity to such a deleterious degree that there cannot be effective communication among actors across diverse fields of science. Significantly, these properties have been more pronounced in very large research organizations. Larger organizations have tended to be highly differentiated and bureaucratic, and thus rarely to have major breakthroughs in biomedical science.

Advantages from being devoted principally to research

Page 19: From the beginning, the Institute did not organize the production of knowledge around academic disciplines, the usual practice in major universities. In organizations in which academic disciplines were dominant for organizing and coordinating the production of knowledge, there was a tendency to recruit specialists in disciplines, scientists who by definition internalized less scientific diversity (and, often, less cultural diversity). The distinctive Rockefeller recruitment of scientists socialized in several cultures, subsystems, disciplines, or working environments meant a staff with more potential to acquire new styles of thought and scientific competence. From the outset, Rockefeller was a place where scientists were willing to participate in multiple scientific worlds simultaneously, fostering the cross fertilization of ideas and the opportunity for communication across diverse fields of research. These conditions facilitated the development of the hybridization of ideas which over time leads to scientific creativity, sudden insights, and the opening of novel pathways to difficult problems.

As a research organization, the Institute had several distinct advantages over most teaching institutions. Most teaching organizations attempt to present an entire field of knowledge to their students and find it awkward to neglect certain subfields. They tend to recruit people not so much because of their research excellence but because of the necessity to cover a particular area of knowledge. Unlike a university, a research institute has no obligation to cover an entire field of knowledge, and it can be very opportunistic in terms of the fields on which research is undertaken. It can neglect or pursue fields, can recruit scientists solely on the basis of their ability to attack selected problems, and it has the flexibility to move into new areas with considerable rapidity. Moreover, the Rockefeller Institute had the luxury of being able to

recruit scientists of excellence even if they had limited ability to speak English or could not teach.

Importance of hiring being grounded on views of well informed experts

Page 21: The original Board of Trustees consisted of John D. Rockefeller Jr., Gates, and their lawyer Starr J. Murphy. Welch and Flexner served on both the Board of Trustees and the Board of Scientific Directors, providing communication between the two boards. The existence of two boards lasted until 1953, when the two were merged into a single Board of Trustees. Since then, the Rockefeller organization has not had a separate board of world-class scientists making the final decisions about personnel. The quality of recruitment, while continuing to be high, has not had the same degree of extraordinary consistency as during the time when the Institute had a Board of Scientific Directors with distinguished scientists intimately involved in making staff appointments and overseeing the scientific research of the Institute. The Board of Scientific Directors met three or four times a year and focused in great detail on the quality of Rockefeller appointments. Since 1953, there have been scientists on the Board of Trustees, but they have never exercised the same degree of oversight on the organization's appointments as when there was a separate board for scientific affairs.

Nurturing of risk-taking, importance of expert monitoring (and mentoring) and tolerance of long lead times for outcomes to manifest

Page 24 Even if they [young investigators] failed in particular investigations, he [Simon Flexner, first director of the Rockefeller Institute] would encourage and console them and give them new opportunities. When a depressed young investigator told him that he had accomplished nothing worthy of publication, Flexner warmly consoled him by remarking, "Nothing? . . . you don't seem to realize that to have nothing is to have something." Flexner was wise enough to know that for the young people coming to the Institute, it was one of the great experiences of their lives, and he encouraged his senior colleagues to make certain that this was the case. Even if Flexner did not retain a young scientist, he frequently paid the investigator a salary for a year after his departure as an incentive for another academic institution to recruit the person. This kind of practice let young people know that if they went to the Rockefeller Institute, they would have an excellent opportunity to have a position upon exiting, and this did much to keep a steady stream of able young scientists.

Page 26: Flexner had a great deal of information about the research potential of almost everyone in the Institute, and he and his colleagues were in an excellent position to make well-informed decisions about what was high risk and low risk research, and who had the abilities to

conduct high risk, long-term projects and who did not. They were well positioned to monitor investments in scientific research, as a result of periodic scientific reports and their ability to discuss and advise about the progress of specific research projects. Moreover, having the Journal of Experimental Medicine , and other high-quality journals, edited at the Rockefeller Institute provided the director with a great deal of information about papers produced at the Institute. In sum, the Institute strategy for funding science was highly flexible because of the large amount of information possessed by those making scientific investment decisions.

Page 26-27: From the very beginning, the culture of the Institute was entrepreneurial and high risk oriented. Flexner regarded trivial and unimportant research with contempt. He had no objection if labs were unproductive for lengthy periods of time, as long as they were addressing important problems. He would wait a long time before concluding that a young scientist was not suitable for the Institute. Mindful of the weakness of his own early education, he took the view that one of the missions of the Institute was to provide research training for young postdoctoral researchers. And because of the Institute's rich scientific diversity and the excellent internal communication among the scientific staff, he frequently encouraged scientists to move into totally new fields of research. On one such occasion, he informed a young scientist who was moving to a new problem that it would take at least two years to begin to understand the parameters of his new problem. "I will not expect anything of you until after that," he said. Flexner's ability to identify, and to fund new areas of research—as with the work of Peyton Rous—was emblematic of the Institute's capability to anticipate new directions, even radically different directions, and move towards them rapidly.

Page 27: Gates and the two Rockefellers did much to set the tone for the research strategy of the Institute. From the beginning, they told the original Board of Directors that they expected no short-term utilitarianism or results. Indeed, Gates and the Rockefellers had early concluded that no important discoveries were likely to result from the Institute. Their major hope was that the Institute would conduct high-quality research, be a training ground for young investigators, and serve as an example for other philanthropists. Research on important problems, even if long periods of incubation were necessary, was encouraged at the outset. Thus, without pressure to produce results in the short term, Flexner could encourage his staff to think "big," to take risks, but to be aware that rigorous standards of excellence would be the criteria by which all results would be assessed.

<u>Importance of cultivating frequent and intense interaction amongst scientists with moderately high diversity and complementary interests</u>

Page 31: The experience of the Rockefeller Institute demonstrates that diversity and depth of knowledge in a well-integrated research organization have the potential to change the way people view problems and to minimize their tendency to make mistakes and/or to work on trivial problems. Frequent and intense interaction among people with low of diversity tends not to lead to major breakthroughs, but if scientists work in environments where there is moderately high scientific diversity and depth, and have frequent and intense interaction with those having complementary interests, they increase the probability that the quality of their work will improve. It is the diversity of disciplines and paradigms to which individuals are exposed in frequent and intense interactions that increases the tendency to develop new ways of thinking about fundamental problems. For such a process to continue over the longer term, the organization must not only provide the stimulation, resources, and environment for today, but also, in a sense, anticipate the future by undertaking whole new lines of research.

Page 31: Intellectual and social integration were maintained at the Rockefeller Institute by a variety of devices. Eating meals together while conversing about serious scientific matters was an important part of the Rockefeller culture and an important means of integrating the scientific diversity and depth of the Institute. There was good food at lunch, served at tables for eight. The idea was that a single conversation could take place at such a table, but not at a larger one.

Page 32: The degree of intellectual and scientific diversity was much lower at the Rockefeller Institute than that at the colleges of Oxford and Cambridge, where eating at "high table" was also an important part of the culture. At the English colleges, diversity ranged all across the board (e.g., from archaeology and ancient and modern languages to chemistry, physics, biology, and mathematics). With so much diversity, it was considered poor etiquette to talk about one's work at the "high" table of the colleges, as many of those present would be unable to comprehend the line of discussion. At Rockefeller, in contrast, diversity was only within the biomedical and related sciences, and the norm was to carry on lively lunchtime discussions about these fields. The lunch table was a great learning experience where people had intense discussions about new approaches to research. Indeed, these luncheon experiences led not only to new factual information and changes in philosophical viewpoints, but also to collaborative research projects across fields (Dubos, 1976: 31). Without the kind of culture exemplified in the lunch experiences at the Institute, some of the major discoveries made at the Institute would not have occurred.

<u>Summary by Hollingsworth of factors associated with a persistent record of making fundamental breakthroughs</u>

Pages 62-64: This case study of the Rockefeller suggests that the following factors are associated with organizations which have fundamental breakthroughs time and time again across a number of decades:

Organizational flexibility: Knowledge changes rapidly, and if an organization is to be continuously at the frontiers of fundamental new knowledge, it must be highly flexible so that it can frequently move into new areas of research. Most research organizations, hampered by organizational inertia, have great difficulty being flexible enough to develop fundamental new knowledge or to operate continuously at the frontiers of knowledge. Most organizations experience a great deal of organizational inertia, tending to reproduce research units or traditions when scientists retire or resign, rather than moving into new research areas.

Scientific diversity and integration: Organizations which make major breakthroughs time and time again are those with a moderately high degree of scientific diversity. For fundamental breakthroughs to occur time and time again in an organization, scientists in diverse fields must have intense and frequent interactions with one another. In short, there must be a good degree of scientific integration. How this is attained varies from organization to organization, but the integration of scientific diversity is facilitated by scientists' socializing with each other. Examples are the sharing of lunch and/or tea, scientific retreats, journal clubs held jointly by different research units, or lectures which all the scientific staff are expected to attend. For intense and frequent interaction to occur on a scale comparable to that at the Rockefeller, an organization's scientific staff must avoid absences of weeks or months at a time.

Leadership: If an organization is to have major breakthroughs over a long period of time, a particular kind of leadership is needed—leaders with a good sense of the direction in which science is moving, the ability to identify talent, to skill to facilitate the movement of the organization in the desired direction, the ability to generate funding to move into new fields of knowledge, and, finally, the capacity to provide a nurturing environment (an environment in which there is rigorous criticism, meted out with a high degree of sensitivity).

At the Rockefeller, the president has always been directly involved in the recruitment and promotion of all permanent staff. All presidents not only provided scientific leadership, but were also involved in the administration of the organization. The philosophy of the Rockefeller was (and still is) that the scientific agenda had to be well integrated with administrative services, and the best way for this to occur was for the same person to direct the scientific and administrative activities.

Recruitment: The Rockefeller had extremely high standards for making permanent

appointments. For many years, for every young scientist who was promoted internally to a permanent appointment, there were between twenty and twenty-five scientific staff who were not retained. Indeed, the Rockefeller historically has treated every permanent staff position as its most precious asset. Not only has the president been intimately involved in every permanent appointment, but the president historically has had the right to veto an appointment, and over the years has exercised this veto power frequently. In addition, the Rockefeller has always depended on external advisors in the making of permanent appointments. During the first fifty years, there was a board of scientific directors made up of some of the most distinguished scientists in America, and not a single appointment was made without their extensive participation. During the last half century, the board of trustees has included a group of distinguished scientists and they, too, have been intimately involved in exercising oversight over permanent scientific appointments. They have frequently exercised veto over appointments which they have considered of insufficiently high quality.

Historically, most senior scientists at the Rockefeller have been promoted through the ranks. Indeed most, though not all, of the Nobel prizes awarded to the Rockefeller staff went to scientists who arrived at the Rockefeller as very young scientists and who rose to be world-class scientists at the institution. Very few of its most distinguished scientists were recruited from the outside as senior scientists.

Organizational autonomy: The Rockefeller University has been embedded in a weak institutional environment during most of its history. As a result, it has had the capacity to appoint scientists to senior positions without being constrained by externally imposed norms of credentialing (e.g., habilitation, formal training in the fields of appointment), and the organization has been relatively independent of control by state bureaucracies and their rules. Because of its autonomy, it has had a high degree of flexibility to carry out almost any line of activity which its leaders have wanted to conduct.

Finally, the excellence of the Rockefeller has been due to the fact that it has had a very rich learning environment. Its staff have long been engaged in educating one another across fields. A great research organization is one in which most of the participants have a high degree of curiosity about, and familiarity with, what all the permanent staff in the organization are doing. At the same time, the Rockefeller has been a rich training environment for young people recruited primarily as young postdoctoral scholars, who have been expected to move on after three or four years at the most. Part of the Rockefeller's great learning excitement has resulted from the fact that its senior and junior staff have been recruited from many parts of the world, and this cultural diversity, added to its scientific diversity, has enhanced very high levels of

creativity within the organization.

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Table One Full-Time Equivalent (FTE) Staff at Australian Universities in 2011
&
Numbers of Enrolled Students in 2010

University	(I) Total FTE	(II) Research Only FTE	(III) Teaching & Research FTE	(IV) Research Only FTE + Research & Teaching FTE as % of Total FTE at institution	(V) % Share of total FTE in Sector in Research Only and Research & Teaching Positions	(VI) % Share of Total Research Only FTE in Sector	(VII) Teaching Only FTE	(VIII) Total Students in 2010	(IX) % Share of Total Students in Sector in 2010	(X) Ratio of total students to FTE in teaching only and research & teaching positions
University of Queensland	6,548	1,850	1,331	48.60%	7.80%	13.20%	165	43,830	3.90%	29.3
University of Melbourne	6,403	1,428	1,395	44.10%	6.92%	10.20%	107	46,867	4.20%	31.2
Monash University	6,324	1,058	1,444	39.60%	6.13%	7.50%	196	62,550	5.60%	38.1
University of Sydney	6,228	1,273	1,809	49.50%	7.56%	9.10%	0	51,435	4.60%	28.4
University of New South Wales	5,373	1,171	1,638	52.30%	6.89%	8.30%	66	49,517	4.50%	29.1
Aust. National University	3,819	1,137	711	48.40%	4.53%	8.10%	0	18,569	1.70%	26.1
Qld. University of Technology	3,568	430	955	38.80%	3.40%	3.10%	90	41,946	3.80%	40.1
University of Western Australia	**3,554**	**759**	**813**	**44.20%**	**3.85%**	**5.40%**	**57**	**23,119**	**2.10%**	**26.6**
Griffith University	3,506	436	981	40.40%	3.47%	3.10%	75	42,619	3.80%	40.4
Curtin University of Technology	3,061	264	800	34.80%	2.61%	1.90%	188	45,884	4.10%	46.4
University of Adelaide	3,027	888	856	57.60%	4.28%	6.30%	< 10	23,917	2.20%	27.9
Deakin University	2,723	241	922	42.70%	2.85%	1.70%	46	38,520	3.50%	39.8
RMIT University	2,652	191	906	41.40%	2.69%	1.40%	0	51,865	4.70%	57.2
La Trobe University	2,631	274	926	45.60%	2.94%	2.00%	0	32,179	2.90%	34.8
University of South Australia	2,575	313	735	40.70%	2.57%	2.20%	49	35,940	3.20%	45.8
University of Newcastle	2,444	354	587	38.50%	2.31%	2.50%	156	32,737	2.90%	44.1
University of Tasmania	2,333	172	706	37.60%	2.15%	1.20%	111	23,354	2.10%	28.6

University of Technology, Sydney	2,302	231	726	41.60%	2.35%	1.60%	10	34,634	3.10%	47.1
University of Western Sydney	2,196	27	682	32.30%	1.74%	0.20%	91	37,856	3.40%	49.0
Macquarie University	2,145	200	736	43.60%	2.29%	1.40%	< 10	37,085	3.30%	50.4
Charles Sturt University	1,939	51	592	33.20%	1.58%	0.40%	106	37,789	3.40%	54.1
University of Wollongong	1,938	241	698	48.50%	2.30%	1.70%	0	27,127	2.40%	38.9
Flinders University of South Australia	1,814	257	555	44.80%	1.99%	1.80%	0	18,435	1.70%	33.2
James Cook University	1,700	199	517	42.10%	1.76%	1.40%	< 10	18,835	1.70%	36.4
Edith Cowan University	1,551	51	452	32.40%	1.23%	0.40%	28	27,622	2.50%	57.5
Victoria University	1,498	82	401	32.20%	1.18%	0.60%	105	24,063	2.20%	47.6
Murdoch University	1,301	84	428	39.40%	1.26%	0.60%	22	18,101	1.60%	40.2
Australian Catholic University	1,253	54	467	41.60%	1.28%	0.40%	0	20,004	1.80%	42.8
Swinburne University of Technology	1,219	58	387	36.50%	1.09%	0.40%	164	23,216	2.10%	42.1
University of Southern Queensland	1,176	20	370	33.20%	0.96%	0.10%	40	25,572	2.30%	62.4
University of New England	1,124	52	376	38.10%	1.05%	0.40%	< 10	18,068	1.60%	48.1
Central Queensland University	1,010	51	233	28.10%	0.70%	0.40%	88	19,519	1.80%	60.8
Southern Cross University	861	58	196	29.50%	0.62%	0.40%	56	15,749	1.40%	62.5
University of Canberra	807	19	349	45.60%	0.90%	0.10%	< 10	14,011	1.30%	40.1
Bond University	715	< 10	213				64	0		0.0
University of Ballarat	602	17	176		0.47%		30	11,643	1.00%	56.5
University of the Sunshine Coast	600	< 10	211				< 10	8,956	0.80%	42.4
Charles Darwin University	490	42	159		0.49%		16			
Uni of Notre Dame Australia	449	< 10	154				83			
Batchelor Institute	169	0	46		0.11%		< 10			
Avondale College	147	< 10	61				< 10			
Melbourne College of Divinity	102	0	44		0.11%		< 10			
Total FTE in 2011	**95,873**	**14,045**	**26,741**	**42.50%**			**2,228**			
% of total FTE in 2011		**15%**	**28%**				**2%**			