



MINISTRY OF EDUCATION

Te Tāhuhu o te Mātauranga

Monitoring research

*A synthesis of Ministry of Education analyses of tertiary education research
2004-2008*

This report forms part of a series called Research and knowledge creation.

Authors:

Warren Smart, Senior Research Analyst

Email: warren.smart@minedu.govt.nz

Telephone: 64-4-463-8035

Fax: 64-4-463-8713

Roger Smyth, Manager

Email: roger.smyth@minedu.govt.nz

Telephone: 64-4-463-8633

Fax: 64-4-463-8713

Acknowledgements:

The authors gratefully acknowledge Virginia Falealili who proof-read this report.

All views expressed in this report, and any errors or omissions, remain the responsibility of the authors.

Published by:

Tertiary Sector Performance Analysis and Reporting

Strategy and System Performance

Ministry of Education

© Crown Copyright

All rights reserved.

All enquiries should be made to the publisher.

This report is available on the Ministry of Education's Education Counts website:

<http://www.educationcounts.govt.nz>

February 2008

ISBN (Web) 978-0-478-13802-3

Monitoring research

Contents

Figures and tables	4
1. Introduction	5
2. Background – the PBRF	6
3. Summary of PBRF Quality Evaluation results	8
4. Analysis of PBRF funding allocations	13
5. Analysis of PBRF results	18
6. Analysis of the impact of weightings in the PBRF Quality Evaluation	24
7. Analysis of PBRF funding incentives	26
8. Establishing baseline data to monitor the effect of the PBRF on research impact	27
9. Analysis of the impact of the PBRF on the retention of doctoral students and on research in the social sciences/humanities	32
10. Ministry of Education publications 2004-2007	36

Figures and tables

Figure 1: Distribution of Performance-Based Research Fund-eligible staff by quality category	9
Figure 2: Average Performance-Based Research Fund quality scores by university	10
Figure 3: Share of the total number of 'A' and 'B' Performance-Based Research Fund-eligible staff by university	11
Figure 4: Share of the total number of 'A' and 'B' Performance-Based Research Fund-eligible staff by subject panel	12
Table 1: Percentage of contestable PBRF funding by sub-sector and university in 2007 compared with research top-ups funding in 2003 and estimated research top up funding for 2007	14
Table 2: PBRF 2007 funding allocations per FTE, by university	15
Table 3: PBRF Quality Evaluation and research degree completions (RDC) funding by university in 2007 – weighted and unweighted	16
Table 4: Correlation coefficients for 2003 PBRF quality scores using individual-level data	19
Figure 5: 2003 PBRF quality scores vs reported research output	19
Figure 6: 2003 PBRF quality scores vs reported research income	20
Figure 7: 2003 PBRF quality scores vs research degree completions	20
Figure 8: 2006 average quality scores vs citations per FTE – biological sciences	21
Figure 9: 2006 average quality scores vs citations per FTE – business and economics	22
Table 5: Strength of association between academic impact (citations per PBRF-eligible FTE staff) and quality (PBRF average quality score) of research	22
Table 6: Strength of association between academic impact (citations per PBRF-eligible FTE staff) and quality (PBRF average quality score) of research	22
Figure 10: PBRF average quality score on a weighted and unweighted basis as a proportion of the University of Auckland score (all PBRF-eligible staff)	24
Figure 11: Relative PBRF Quality Evaluation performance as a proportion of the University of Auckland score (panel-assessed staff only)	25
Table 7: Estimated proportion of government funding for postgraduate research students dependent on completion under the PBRF funding system	26
Figure 12: Relative impact of New Zealand university research 2000-2004 and 2001-2005	28
Figure 13: Boxplot of narrow subject area relative impact scores 2001-2005	29
Figure 14: Share of world-indexed publications and citations by Auckland University of Technology ..	30
Figure 15: Share of world-indexed publications and citations by the University of Auckland	30
Figure 16: Share of world-indexed publications and citations by the University of Otago	31
Figure 17: Predicted probability of doctoral student retention by age group, study load and PBRF status	33
Table 8: Estimated share of total research funding for the arts, humanities and social sciences, 2003 and under PBRF	34
Table 9: Estimated share of total research funding for all lower funded disciplines, 2003 and under the PBRF	35

1 Introduction

In 2003, the government began the phase-in of a new system of funding research in the tertiary education sector – the Performance-Based Research Fund (PBRF). Over the last four years, the Ministry of Education has published several analytical studies examining the research performance of the sector and how it has responded to the introduction of the PBRF.¹ These studies can be sorted into six broad themes:

- Analysis of PBRF funding allocations
- Analysis of PBRF results and of factors influencing PBRF performance
- Analysis of the impact of weightings in the PBRF Quality Evaluation
- Analysis of PBRF funding incentives
- Establishing baseline data to monitor the effect of the PBRF on research impact
- Analysis of the impact of the PBRF on retention of doctoral students and on research in the social sciences/humanities

This report seeks to synthesise the key findings of these analytical studies and provide a summary of this portfolio of work.²

The structure of this report is as follows. In section 2, we present a short introduction to the workings of the PBRF. Sections 3 and 4 provide background to the analyses that follow. In section 3, there is an overview of the results of the 2006 Quality Evaluation and a comment on shifts between the first two Quality Evaluations while section 4 presents an analysis of the 2007 PBRF funding allocations and reports on the extent to which funding shifts have accompanied the introduction of the new system. In section 5, the findings of analyses of the factors that influenced research quality are presented.³ In section 6, the results from an analysis into the impact of weightings that are used in assigning quality categories to staff in the PBRF are presented. This is followed by the presentation of key findings from an analysis of the funding incentives created by the PBRF in section 7. In section 8, the findings from an analysis of bibliometric data that can be used as a baseline to monitor the impact of the PBRF is presented. Finally the findings from two analytical studies examining the impact of the PBRF on research performance are presented in section 9.

¹ A full listing of these studies is presented at the end of this synthesis.

² Please note that where studies have been updated with more recent data the latest analysis is presented.

³ An analysis of the 2006 PBRF Quality Evaluation results is planned for 2008.

2 Background – the PBRF

Until 2003, the government's funding for the research activities of tertiary education providers was based on student enrolments in degree and postgraduate level courses. The funding for all domestic degree and postgraduate level enrolments was supplemented by a research 'top-up'. In developing a new funding system for tertiary education, the government moved to separate funding for research from funding for enrolments and tuition and to align research funding with the research performance of providers. The government reasoned that, in aligning research funding to research performance, it will be creating a climate that will reward excellence in research.

The Performance-Based Research Fund (PBRF) was phased in between 2003 and 2007. The first assessment of research quality was conducted in 2003 and the first funding having been allocated under the new system in 2004 and with the phase-in of the new system completed in 2007.

By aligning the allocation of the funding for research with research performance, the PBRF aims⁴ to:

- increase the average quality of the research conducted in the sector
- ensure that research continues to inform and shape the teaching and learning of degree and postgraduate students
- ensure funding is provided to support postgraduate research students and new researchers in the sector, and
- underpin the existing strengths in tertiary education research.

It was believed that fostering and enhancing the tertiary education sector's research capability and performance would be more likely to contribute to the nation's economic and social advancement.⁵

Allocating funding on the basis of research performance assumes a rigorous means of assessing and quantifying performance, ensuring that the system is both fair and seen to be fair. Therefore, the introduction of the PBRF has been accompanied by the development of an agreed definition of what constitutes research for the purposes of the new system and of a new measurement and assessment system – based on measures of research performance at an individual and institutional level.⁶

The PBRF measures are based on:

- the quality of the research outputs produced in a provider
- the number of research degree completions the provider has achieved in the relevant time period, and
- the amount of external research income generated by the provider.

⁴ Ministry of Education and Transition Tertiary Education Commission (2002).

⁵ Boston et al (2005) and Ministry of Education (2002). It should be noted that a number of other countries have moved to performance linked research funding systems in higher education - the United Kingdom, Australia and Hong Kong, for example.

⁶ Ministry of Education (2003) contains on pp 108 – 110 detailed information on the operation of the PBRF. Tertiary Education Commission (2004) pp 15 – 23 also explains the operation of the new system, while process followed in the most recent the quality evaluation is set out in chapter 2 of TEC (2007)

The research quality assessment comprises three sub-components. The measure is a weighted average of an assessment panel's scoring of each PBRF-eligible staff member's research outputs (RO), the esteem in which he/she is held by his/her research peers (PE) and his/her contribution to the research environment (CRE).⁷

The funding allocated under the PBRF is largely drawn from the money provided for the research top-ups, but this funding has been supplemented by some extra injections of funding – around \$41 million in 2007.

⁷ In each of the three components of the PBRF quality score – research output, peer esteem, and contribution to the research environment - each eligible staff member is assigned a score between 0 and 7. Those scores are then weighted by factors of 70, 15 and 15 respectively to generate the *overall quality score* (OQS) of the staff member – a score out of 700. The OQS is then used to guide the assignment of a quality category – A, B, C or R - which is then used to allocate the staff member's PBRF score – a number between 0 and 10 – that summarises the staff member's research performance over the relevant period. The process is detailed in Tertiary Education Commission (2004) pp 19 to 20 and pp 37 to 38.

3 Summary of PBRF Quality Evaluation results⁸

The quality of the research produced by New Zealand tertiary education organisations was measured explicitly for the first time by the 2003 Performance-Based Research Fund (PBRF) Quality Evaluation. This was followed by a second partial Quality Evaluation in 2006.

The PBRF Quality Evaluations use a system of peer assessment to measure the quality of research by PBRF-eligible staff. A quality category is assigned to each eligible staff member by a panel of experts who assess an evidence portfolio submitted by each staff member that outlines their key research outputs, the esteem in which they are held by their peers and their contribution to the research environment.

An 'A' quality category is awarded to staff who are assessed as producing research that was highly original or innovative and esteemed by the international academic community. A 'B' quality category is awarded to staff assessed as producing research that is original and innovative and recognised beyond the staff member's own institution. A 'C' quality category is awarded to staff assessed as producing research that applies existing research methodologies with acknowledgement by their peers of a sound research basis and an 'R' quality category was awarded to staff who did not meet the standard of a 'C' quality category. For the 2006 quality evaluation, two new quality categories were introduced to measure the performance of new and emerging researchers: 'C(NE)' and 'R(NE)'. This allowed new and emerging staff who may not have had the chance to produce a track record of research, but have nevertheless produced recent research of high quality, the opportunity to attract funding for their institution.

These quality categories are translated into numerical quality scores for the purpose of comparing the quality of research across fields of study and providers. The maximum possible quality score for a provider or a subject area is 10. This score would occur if every single Performance-Based Research Fund-eligible staff member in that provider or subject area was awarded an A quality category.

The 2006 Quality Evaluation was a partial round — staff who had participated in the 2003 Quality Evaluation did not have to resubmit an evidence portfolio to the peer review panels. If they chose not to resubmit, their quality category from the 2003 Quality Evaluation was carried over.

The number of staff awarded an 'A', 'B' or 'C' quality category increased between 2003 and 2006, while the number of staff awarded an 'R' quality category fell. On a full-time equivalent basis, there were 600 staff awarded an 'A' quality category in the 2006 Quality Evaluation, up by 41 percent on 2003. There was an increase of 20 percent in the number of staff awarded a 'B' quality category and an 20 percent increase in the number of staff awarded a 'C' quality category. The number awarded an 'R' quality category fell by 11 percent from 2003). The average quality score increased by 14 percent from 2.59 to 2.96 between 2003 and 2006.

In 2006, 31 tertiary education organisations participated in the Quality Evaluation, compared with 22 in 2003.⁹ In total there were 8,671 PBRF-eligible staff in the 2006 Quality Evaluation, compared with 8,018 in the 2003 Quality Evaluation.

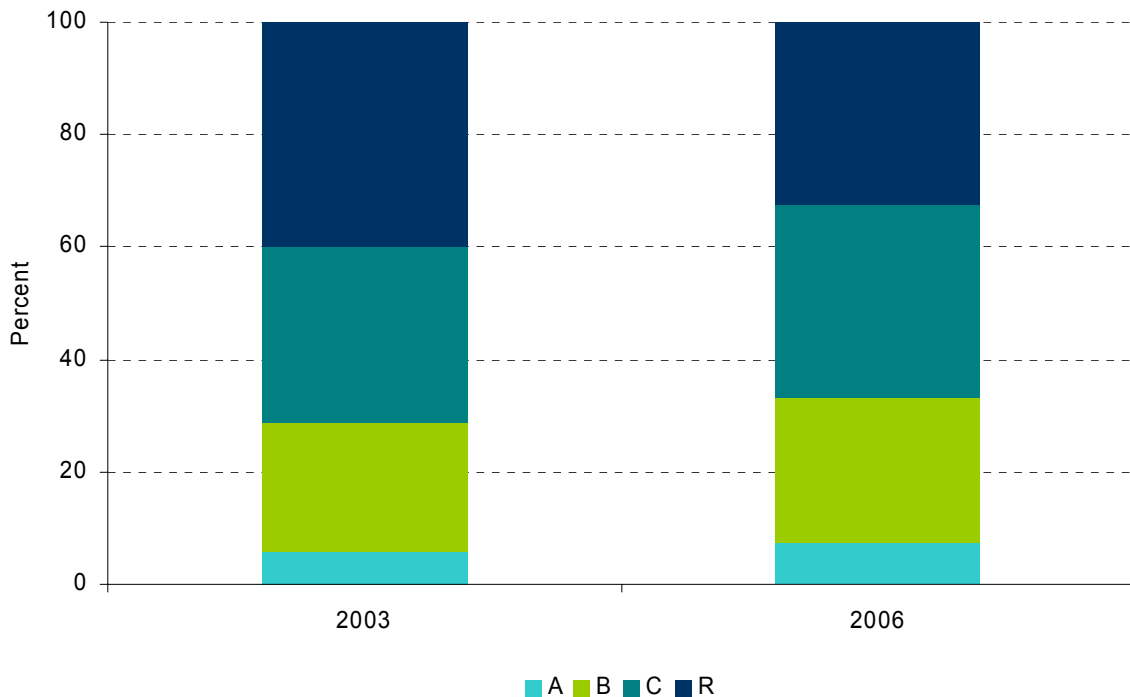
To control for the impact of the increased number of participating tertiary education organisations in the 2006 Quality Evaluation, the number of staff in each quality category are presented as a proportion of total staff in Figure 1. The proportion of PBRF-eligible staff awarded an 'A' quality category

⁸ The results from the two Quality Evaluations have been reported in detail by the Tertiary Education Commission (see Tertiary Education Commission (2004) *Performance-Based Research Fund: evaluating research excellence - the 2003 assessment* and Tertiary Education Commission (2007) *Performance-Based Research Fund: evaluating research excellence - the 2006 assessment*), so this section presents an overall summary of some of the main results of the Quality Evaluations. This section is based on an article previously published by the Ministry of Education (2007).

⁹ Note that the Auckland College of Education and Wellington College of Education merged with the University of Auckland and Victoria University of Wellington in 2004 and 2005, respectively.

increased from 5.7 percent in 2003 to 7.4 percent in 2006. Twenty-six percent of staff were awarded a 'B' quality category in 2006 (23 percent in 2003), 34 percent of staff were awarded a 'C' quality category (31 percent in 2003) and 33 percent an 'R' quality category (40 percent in 2003).

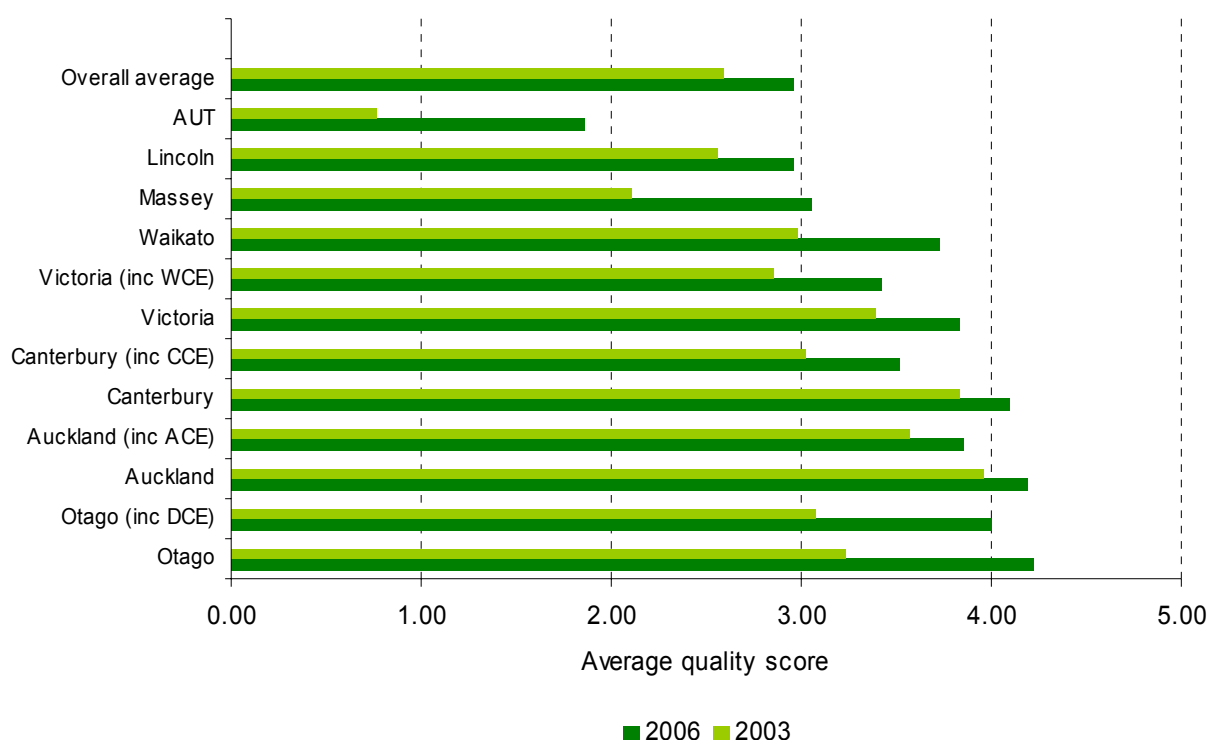
Figure 1: Distribution of Performance-Based Research Fund-eligible staff by quality category



Note: 'C(NE)' researchers are included in the 'C' quality category and 'R(NE)' researchers are included in the 'R' quality category in the 2006 results.

The universities have the vast majority of staff allocated 'A' and 'B' quality categories. In 2006, 98 percent of staff awarded an 'A' or 'B' quality category were from universities, compared with 99 percent in 2003. In addition, the eight universities received the highest average quality scores in the 2006 Quality Evaluation. The average quality score of the eight universities in the 2006 and 2003 Quality Evaluation is presented in Figure 2. Note that the average quality scores of the universities are presented incorporating the colleges of education with which they were merged in Figure 2.

Figure 2: Average Performance-Based Research Fund quality scores by university



Note: ACE = Auckland College of Education, CCE = Christchurch College of Education, DCE = Dunedin College of Education and WCE = Wellington College of Education.

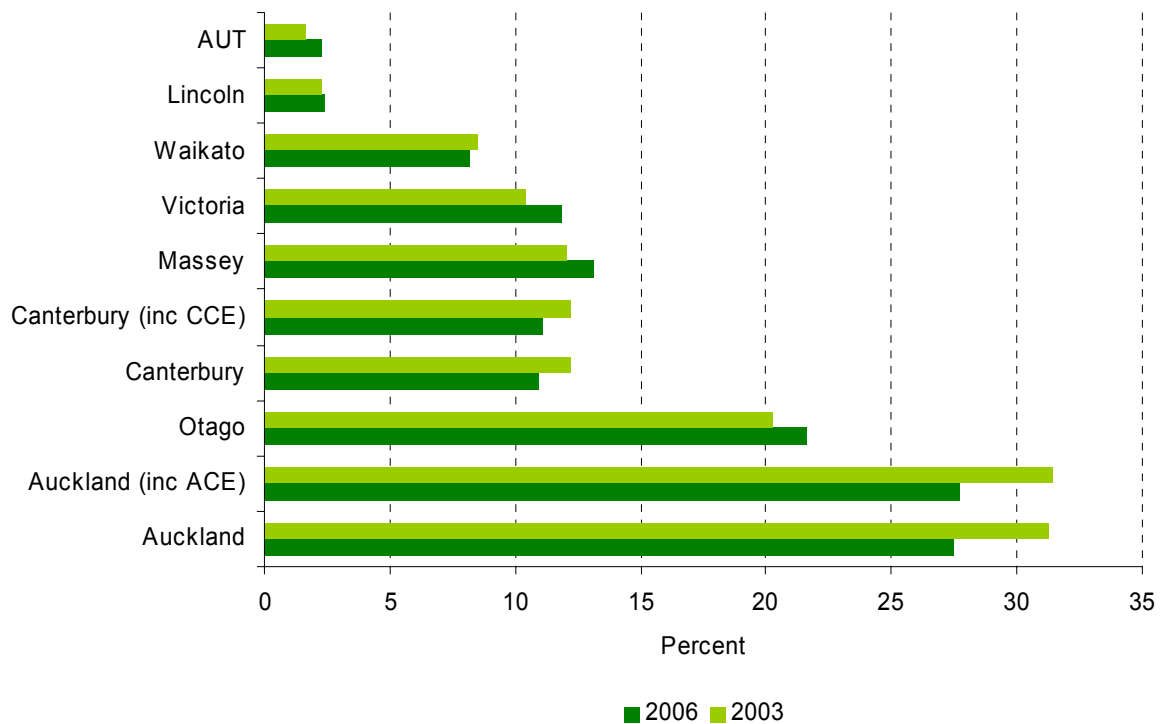
There is very little difference in the average quality score of the top three universities. The University of Otago received the highest average quality score of 4.22 in the 2006 Quality Evaluation, up by 31 percent on the average quality score achieved in 2003. The University of Auckland was second with an average score of 4.19 in 2006 (up by 5.8 percent from 2003) followed by the University of Canterbury with an average quality score of 4.10 (up 7.0 percent from 2003). The greatest increase in the average quality score between 2003 and 2006 was achieved by Auckland University of Technology. The average quality score increased at this university by 142 percent from 0.77 in 2003 to 1.86 in 2006.

When colleges of education scores are incorporated into the university into which they were merged the average quality score for the University of Auckland (including the Auckland College of Education) increased by 8.0 percent from 3.57 to 3.85. The average quality score for the University of Otago (including Dunedin College of Education) increased by 30 percent from 3.07 to 4.00, the average quality score for the University of Canterbury (including Christchurch College of Education) increased by 17 percent from 3.02 to 3.51, and the average quality score for Victoria University of Wellington (including Wellington College of Education) increased by 20 percent from 2.86 to 3.42.

However, determining the degree of improvement in quality between the 2003 and 2006 quality evaluation is difficult, given changes that took place between 2003 and 2006. These included changes in the staff eligibility criteria, new quality categories assigned to new and emerging staff, the impact of the partial round and improvements made by staff to the presentation of their evidence portfolios (Tertiary Education Commission, 2007).

One way of examining the data that avoids this problem is to consider the share of the total A and B staff at each university and see how this changed between 2003 and 2006. Figure 3 presents the share of total staff awarded 'A' and 'B' quality categories by the eight universities in the 2003 and 2006 Quality Evaluations.

Figure 3: Share of the total number of 'A' and 'B' Performance-Based Research Fund-eligible staff by university



Notes:

1. ACE = Auckland College of Education, CCE = Christchurch College of Education.
2. The University of Otago and Victoria University of Wellington shares do not change with the inclusion of the colleges of education they merged with as Dunedin College of Education and Wellington College of Education did not have staff rated A or B in the 2003 and 2006 Quality Evaluations.

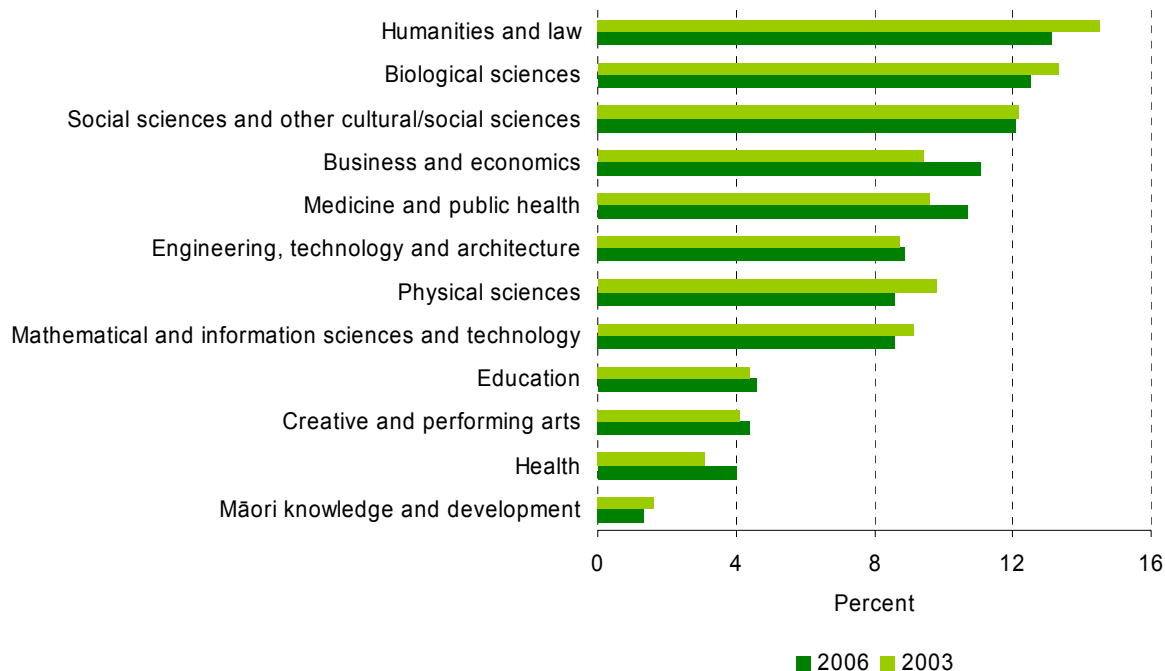
Five of the eight universities increased their share of the total number of 'A' and 'B' researchers. In particular, the University of Otago, Massey University and Victoria University of Wellington showed sizeable increases in their share of the number of 'A' and 'B' staff. The Universities of Auckland and Canterbury exhibited noticeable decreases in their share of 'A' and 'B' staff numbers.

The quality of research by staff can also be examined by subject area. The average quality score increased in all subject panels, with the exception of Māori knowledge and development. The physical sciences panel received the highest average quality score of 4.55 in 2006, followed by the 'medicine and public health' panel with an average quality score of 3.95. The largest increase in the average quality score (46 percent) was achieved by the 'health' panel. In the case of the Māori knowledge and development panel, a number of these staff came from tertiary education organisations that were participating for the first time and did not have a well-developed research culture (Tertiary Education Commission, 2007).

As with the earlier analysis of the average quality score by university, we can also examine the share of total staff assigned 'A' and 'B' quality categories in each subject panel category to examine how these changed between 2003 and 2006.

As can be seen in Figure 4, significant rises in the share of 'A' and 'B' researchers were experienced in the 'business and economics', 'medicine and public health' and 'health' panels. Subject panels that showed a significant decrease in the share of staff allocated 'A' and 'B' quality categories included 'humanities and law', 'physical sciences' and 'mathematical and information sciences and technology'.

Figure 4: Share of the total number of 'A' and 'B' Performance-Based Research Fund-eligible staff by subject panel



Overall, the results of the 2006 Quality Evaluation indicate that the quality of research in New Zealand tertiary education organisations has improved from those reported in the 2003 Quality Evaluation. There was a rise in the average quality score and in the number of 'A' and 'B' quality categories assigned to researchers.

However, changes to the way the Quality Evaluation was conducted in 2006 make it difficult to state with certainty the degree to which this data is capturing actual improvements in quality. For example, of those staff that submitted Evidence Portfolios in both the 2003 and 2006 Quality Evaluations, the average score for the PE and CRE components increased at twice the rate of the RO component between 2003 and 2006. This may indicate that better presentation of Evidence Portfolios played a role in the increase in the average quality score. Further research is planned by the Ministry of Education to attempt to control for these changes and hence get a clearer picture of changes in the quality of research.

4 Analysis of PBRF funding allocations

Key findings:

- The introduction of the PBRF has shifted the share of research funding towards the universities and away from polytechnics, wānanga and private training establishments.
- Although the differences in research quality assessments of the seven older universities are relatively slight, there have been considerable shifts of research funding between the universities.
- The three factors that have most influenced the shift in funding between the universities are:
 - performance in the research degree completion measure,
 - performance in the external research income measure and
 - the weightings assigned to different subjects in the PBRF.

One of the purposes of the Performance-Based Research Fund (PBRF) was to break the link between research funding and performance in recruiting students and instead, to align funding for research with research performance. This raises the question of the extent to which the PBRF has actually caused funding to move.

Funding shifts between subsectors

The universities have focused on research throughout their history and hence, have dominated performance on all of the measures that are part of the PBRF funding model. The eight universities filled the first eight positions in the average quality score in the 2006 quality evaluation. Universities have substantial postgraduate programmes and hence, dominate research degree completions. Between 2003 and 2005, only 2.2 percent of the research degree completions at participating tertiary education organisations were from outside the universities. Likewise, of the external research income won by the participating organisations in 2004, only 1.1 percent was earned outside the universities. Therefore, the universities have dominated the PBRF funding allocations.

Under the previous research funding system – the research top-ups – polytechnics, wānanga and private training establishments earned an increasing share of research funding through their enrolment of degree students. Table 1 below considers the impact of the PBRF on the distribution of funding by looking at the percentage of the contestable PBRF funding won by each of the sub-sectors and by each of the universities in 2007 and compares that to the percentage of research top-ups funding earned in 2003 and to the funding which *would* have been earned in 2007 had the old research top-ups system continued.¹⁰

¹⁰ The estimate of 'what would have been earned' under the research top-up system was reported in Tertiary Education Commission (2007). The analysis assumed that increases in research top-up funding rates would have occurred to the same extent as increases occurred in tuition subsidy rates and that the rules for allocation of funding under that system would have been maintained without change.

Table 1: Percentage of contestable PBRF funding by sub-sector and university in 2007 compared with research top-ups funding in 2003 and estimated research top up funding for 2007

	2007 PBRF	2007 RTUs	2003 RTUs
Universities (including colleges of education)	97.6%	91.4%	94.1%
<i>University of Auckland</i>	30.3%	25.7%	25.8%
<i>University of Otago</i>	21.1%	16.6%	16.1%
<i>Massey University</i>	15.0%	14.0%	15.4%
<i>University of Canterbury</i>	10.2%	11.1%	12.4%
<i>Victoria University of Wellington</i>	9.0%	11.2%	9.4%
<i>University of Waikato</i>	6.4%	5.7%	7.4%
<i>Lincoln University</i>	3.3%	2.4%	2.9%
<i>Auckland University of Technology</i>	2.3%	4.6%	3.8%
Polytechnics	2.1%	7.4%	5.0%
Wānanga	0.2%	0.7%	0.4%
Private training establishments	0.2%	0.5%	0.4%
	100.0%	100.0%	100.0%

Note: College of education allocations have been incorporated into the allocations for the universities into which they were merged.

Had the old research top-ups system continued, the polytechnics would likely have made inroads into the universities' dominance of the research funding pool data,¹¹ with their share of research top-ups funding expected to have grown from 5 percent in 2003 to more than 7 percent by 2007. As a result of the introduction of the PBRF, the universities have been able to increase their share of the pool from 94 percent in 2003 to more than 97 percent in 2007. The polytechnics collectively earned in 2007 \$9.1 million less¹² under the PBRF than they would have under the research top-ups system, a cut of 65 percent.¹³ Likewise, the PBRF has reduced wānanga Vote Education research revenue by about 70 percent from \$1.3 million to about \$0.4 million. Effectively, there has been a transfer of funding to the universities.

Shifts of funding between the universities

While the universities as a group gained a larger share of the funding from the PBRF contestable pool than they would have from the research top-ups, only five universities increased their shares – in order of the scale of increase, Lincoln, Otago, Auckland, Waikato and Massey. If one were to discount for the effects of the government's additional funding for the PBRF – and compare what would have happened had the PBRF been implemented without extra funding injections – then Lincoln would have increased its research funding from this source by 35 percent – representing 2 percent of its annual revenue from all sources. Otago's increase at 26 percent would also represent about 2 percent of its total revenue. The Auckland, Waikato and Massey increases would have been 18 percent, 12 percent and 7 percent respectively of this form of research funding.

Auckland University of Technology (AUT), as a newer university building a research capability from its polytechnic base, predictably lost share. Discounting for the effects of funding injections for the PBRF made by the government in successive budgets, AUT would have lost half of its funding from this source - \$4.4 million or 2.1 percent of its total revenue. Victoria University of Wellington and the University of Canterbury both lost share.¹⁴ In Victoria's case, in the absence of the funding injections, the reduction would have been 20 percent of this source of revenue or 1.6 percent of total institutional revenue. Victoria's reduction reflects the strengths of that institution in social sciences and related fields that are funded at the lowest rate under the PBRF. In Canterbury's case, the loss of share was

¹¹ But note that the university enrolment patterns since 2004 may be reflecting the influence of the PBRF. That is, there is a possibility that in the absence of the PBRF, universities may have attempted to raise undergraduate degree enrolments at a faster rate than has occurred. This effect is, however, considered negligible for the purposes of this analysis.

¹² \$4.85 million compared with \$14.05 million.

¹³ This represents a reduction of about 1 percent of polytechnic revenue. The loss of revenue in the wānanga is about 0.6 percent of total revenue.

¹⁴ Canterbury, however, gained in dollar terms – its reduced share was of the larger pool. Victoria lost both share and funding.

more than balanced by the effects of the additional funding injections; the \$1.7 million reduction was more than offset by the extra \$4 million Canterbury won of the additional funding injected by government.

Table 2: PBRF 2007 funding allocations per FTE, by university

	Quality Evaluation points per FTE	Quality Evaluation allocation per FTE	Research degree completion allocation per FTE	External research income allocation per FTE	Total allocation per FTE	Overall PBRF ranking
University of Auckland	3.85	\$22,842	\$11,753	\$8,024	\$42,619	1
University of Otago	4.01	\$25,575	\$7,867	\$6,647	\$40,089	2
Massey University	3.06	\$18,080	\$8,952	\$4,038	\$31,070	5
University of Canterbury	3.52	\$19,872	\$9,504	\$2,665	\$32,041	4
Victoria University of Wellington	3.42	\$16,948	\$6,353	\$2,667	\$25,968	7
University of Waikato	3.73	\$17,564	\$8,098	\$3,795	\$29,456	6
Lincoln University	2.96	\$20,145	\$5,493	\$9,835	\$35,473	3
Auckland University of Technology	1.86	\$9,948	\$2,731	\$1,280	\$13,959	8
Universities (including colleges of education)	3.50	\$21,058	\$8,992	\$5,400	\$35,450	

Note: College of education results have been incorporated into the results for the universities into which they were merged.

The shifts of funding between the universities may appear reasonably significant given the fact that there is relatively little difference in the research quality scores between most of the universities – the four universities with the highest average quality score had scores in the 2006 quality evaluation in a very narrow band – from 3.52 to 4.01¹⁵ – while the seventh ranked university on that measure (Lincoln) had a 2006 quality evaluation average score of around 74 percent of the highest ranked (Otago). If it were possible to quantify the uncertainties on these scores, there would be little significant difference in performance across this measure between the seven top universities.

Data on research degree completions (RDC) between 2003 and 2005 shows greater variation between the universities than the research quality scores. Auckland earned most completion points per FTE at 0.73,¹⁶ 20 percent above the second ranked university on this measure (Canterbury) and 25 percent above the third (Massey). This performance is reflected in the funding allocations, with Auckland winning \$11,750 per FTE respectively, against \$9,500 by Canterbury. On a per FTE basis, Auckland earned more than twice as much as Lincoln (rated seventh) and 49 percent above Otago the fifth ranked university on this PBRF dimension.

There is even more significant variation in the funding allocated on the basis of external research income (ERI). Lincoln is the clear leader on this dimension, winning nearly \$10,000 per FTE, about 23 percent above Auckland, the second ranked university, more than twice the earnings of Massey

¹⁵ Note that all data given in this section treats the colleges of education as having been incorporated into the universities with which they have merged. This accounts for some differences in data between this report and Tertiary Education Commission (2007).

¹⁶ The term 'completion point' is the number of doctoral and other research completions recorded over the period relevant for the 2007 funding allocations and weighted to reflect the PBRF funding formula. There are two points of difference between the numbers quoted here and the calculations used by the TEC in allocating RDC funding. The first is that the ethnic weightings are omitted here. The second is that for simplicity's sake, the non-doctoral research degree completions have all been treated as 1.0 EFTS – in practice, some may be weighted at between 0.75 EFTS and 0.99 EFTS. Neither difference is considered significant for the purposes of this analysis. The data source is Tertiary Education Commission (2007).

(ranked fourth) and more than three times the allocation per FTE of Victoria and Canterbury (ranked sixth and seventh).

The Effects of Weightings Assigned to Fields of Study

The three universities with the largest increases in their share of research funding on this analysis all have a substantial proportion of their research activities in higher funded fields.¹⁷ The situation is most evident in the university that made the greatest advance in funding with the introduction of the PBRF – Lincoln University. Much of Lincoln’s current and historical research excellence is in areas related to land-based industries. Yet these fields have attracted relatively fewer enrolments and hence, generated relatively lower research top-ups funding. Lincoln’s research top-ups funding would have been boosted by reasonably strong enrolments in fields such as business and tourism that generate lower funding. On the other hand, much of Lincoln’s PBRF funding would have come from applied sciences such as agriculture and environmental sciences, fields with higher PBRF discipline weightings. By contrast, Victoria University of Wellington, which lost both share and funding, has a traditional research strength in the social sciences – which draw PBRF funding at a lower rate.

These observations raise questions as to the effects of subject area weightings on the PBRF funding allocations – to what extent has the PBRF shifted the source of research funding from lower cost/lower funded fields of study to higher? – and what effect has that had on the allocations made to the universities?

The 2007 PBRF university quality evaluation and RDC allocation data has been recalculated with the differential weightings between fields of study removed from the formula. The results are presented in Table 3 below:

Table 3: PBRF Quality Evaluation and research degree completions (RDC) funding by university in 2007 – weighted and unweighted

	Research quality funding (\$000)		Research degree completions funding (\$000)		Overall funding (\$000)	
	Difference due to the weightings	Percentage difference	Difference due to the weightings	Percentage difference	Difference due to the weightings	Percentage difference
University of Auckland	\$988	2.7%	\$525	2.8%	\$1,512	2.2%
University of Otago	\$2,905	10.4%	\$700	7.9%	\$3,605	7.4%
Massey University	\$466	2.4%	-\$229	-2.2%	\$237	0.7%
University of Canterbury	-\$501	-3.3%	-\$91	-1.3%	-\$592	-2.5%
Victoria University of Wellington	-\$2,220	-14.1%	-\$959	-15.9%	-\$3,179	-15.4%
University of Waikato	-\$1,995	-18.4%	-\$72	-1.7%	-\$2,067	-13.9%
Lincoln University	\$657	17.9%	\$69	6.2%	\$726	9.5%
Auckland University of Technology	-\$301	-7.3%	\$57	5.8%	-\$243	-4.6%

Note: College of education allocations have been incorporated into the allocations for the universities into which they were merged.

Lincoln University and the University of Otago benefited most from the subject weightings with Lincoln gaining more than 9 percent of its PBRF funding from the subject weightings and Otago 7 percent. Victoria University of Wellington and the University of Waikato lost the most funding. Removing the subject weightings would have increased Victoria’s PBRF funding by 15 percent, while Waikato would have gained nearly 14 percent more PBRF funding.

¹⁷ For instance, the University of Otago generated 18 percent of its 2003 research top up funding from categories other than the lowest funded categories, compared with 28 percent for all universities. The corresponding figure for Lincoln was 17 percent and Auckland 24 percent.

A similar analysis of the 2003 quality evaluation results and the 2004 funding allocations shows a similar pattern – Lincoln University, the University of Otago and the University of Auckland all benefited from the weightings.¹⁸ As in 2007, the two universities that would have gained substantially in 2004 if the weightings were removed were Victoria University of Wellington (14 percent) and the University of Waikato (11 percent).

Conclusion

The principal effect of the PBRF has been to shift research funding to the universities and away from the polytechnics. Between the universities, the effects are more complicated. If we exclude AUT, a newer university that is still building its research capability, there is little difference between the universities on the PBRF research quality assessment. Discounting for the effects of subject-based weightings, there are five universities whose research quality allocations are clustered between \$19,800 and \$23,200 per FTE. The other two dimensions of the PBRF – research degree completions and external research income – produce greater variations of performance and thus are more important drivers of funding shifts.

Another significant influence on where money goes is the subject weightings. The PBRF subject weightings tend to shift funding towards those universities with substantial research activities in the sciences and the applied sciences – more sharply than the old research top-ups system. In large part, this is a consequence of the fact that in some universities, these fields are the focus of considerable research activity but may not attract large numbers of enrolments. Conversely, some lower-funded fields that draw significant enrolments may have lower research performance.

¹⁸ Compared with the actual PBRF allocation. Lincoln University would have lost 12 percent of its 2004 PBRF allocation, the University of Otago 7 percent and the University of Auckland 2 percent had the PBRF been implemented with no subject weightings.

5 Analysis of PBRF results

Key findings:

- Age, position, full-time equivalent status, gender, subject and provider were significant factors in determining the performance of PBRF-eligible staff in the 2003 Quality Evaluation.
- At the individual staff member level, there was a high degree of correlation between the research output, peer esteem and contribution to the research environment scores in the 2003 Quality Evaluation.
- At the university level, there was a positive association between PBRF quality scores and research output, reported research income and Research Degree Completions.
- At the university level, there was a positive association between PBRF quality scores and citation counts, but the strength of the relationship varied among subject areas.

Statistical modelling was applied to 2003 Quality Evaluation data to analyse the factors that had an impact on the peer-assessed quality of research achieved by participating staff.¹⁹

The results of the analysis showed that:

- *Age*: The modelling showed that the quality of research initially increases with age, then declines for lecturers and senior lecturers. The performance of associate professors declined with age, but age did not have an effect on the research quality of professors.
- *Gender*: The gender of staff had an impact on the allocated research output (RO) score, with men achieving a slightly higher level of performance than women, holding other factors constant. This was especially the case for lecturers, while gender had no impact at the professor, associate professor and senior lecturer level. Generally, gender had no statistically significant effect on the peer esteem (PE) and contribution to the research environment (CRE) scores allocated to staff, although, in the case of associate professors and senior lecturers, women had higher CRE scores on average than men, once other factors (such as tertiary education organisation, subject area and age) were controlled for.
- *Ethnic group*: The ethnic group of staff had only a limited impact on the performance of staff.²⁰
- *Full-time equivalent status (FTE)*: A higher FTE status was associated with a higher level of research quality.
- *Position*: Professors had the highest level of research quality, followed by associate professors, senior lecturers and lecturers.
- *Subject*: Overall, subjects in the science area generally had the highest level of research performance. In particular, staff in subjects such as 'ecology, evolution and behaviour', 'earth science', 'anthropology and archaeology' and 'human geography' performed well. A notable feature was the high relative performance of these staff in terms of the PE and CRE scores they received. Staff in the areas of 'philosophy' and 'Māori knowledge and development' also performed well.
- *Provider*: After controlling for other factors, there was little difference in the research quality of the Universities of Auckland, Canterbury and Otago.

An analysis of the various Performance-Based Research Fund (PBRF) Quality Evaluation scores – research output (RO), peer esteem (PE) and contribution to the research environment (CRE) – found

¹⁹ See Smart (2005d).

²⁰ However, there are significant issues with the degree of reporting of this staff characteristic in the staff census.

a high degree of correlation between the measures, with the strongest association between the PE and CRE scores.²¹ Table 4 below presents the Pearson correlation coefficients for these variables. A correlation coefficient value close to 1 indicates a strong positive linear relationship exists between the quality measures.

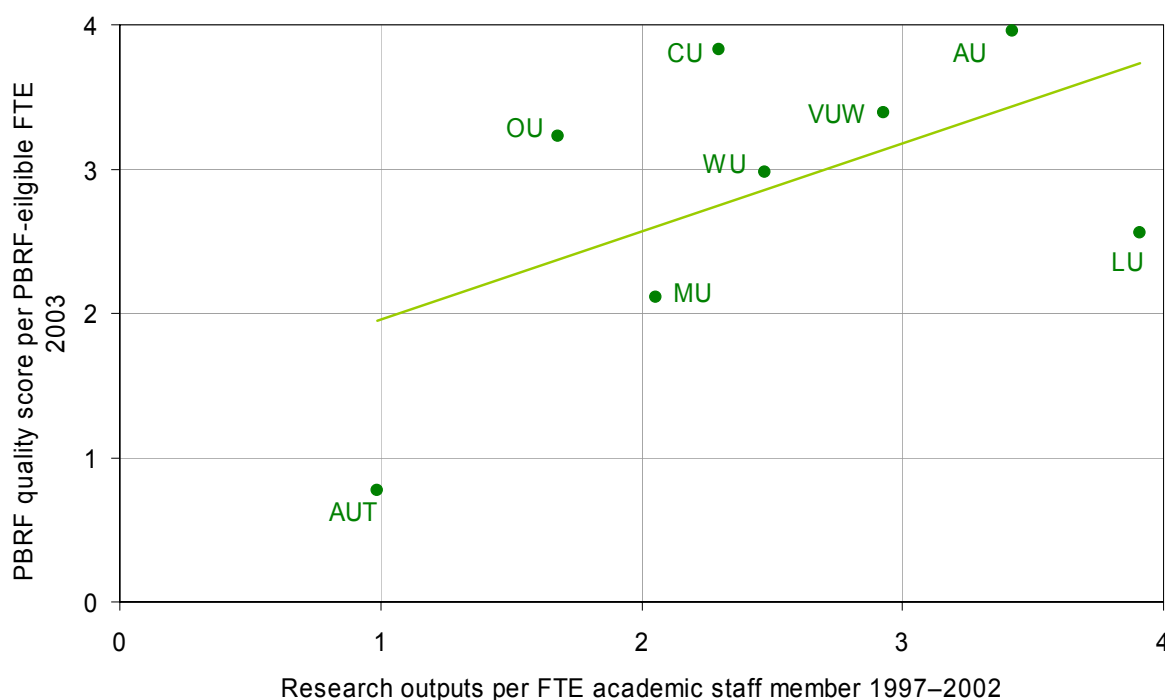
Table 4: Correlation coefficients for 2003 PBRF quality scores using individual-level data

	Research output	Peer esteem
Peer esteem	0.77	
Contribution to research environment	0.71	0.84

The performance of the universities in the 2003 Quality Evaluation was also compared to other measures of research performance.²²

A comparison of reported research output over the same period as the 2003 Quality Evaluation window found a modest positive relationship between the quantity and peer-assessed quality of research.²³

Figure 5: 2003 PBRF quality scores vs reported research output



Similarly, a comparison of quality scores with reported research income²⁴ over a similar period to the assessment window showed there was a relatively modest positive correlation between the measures.

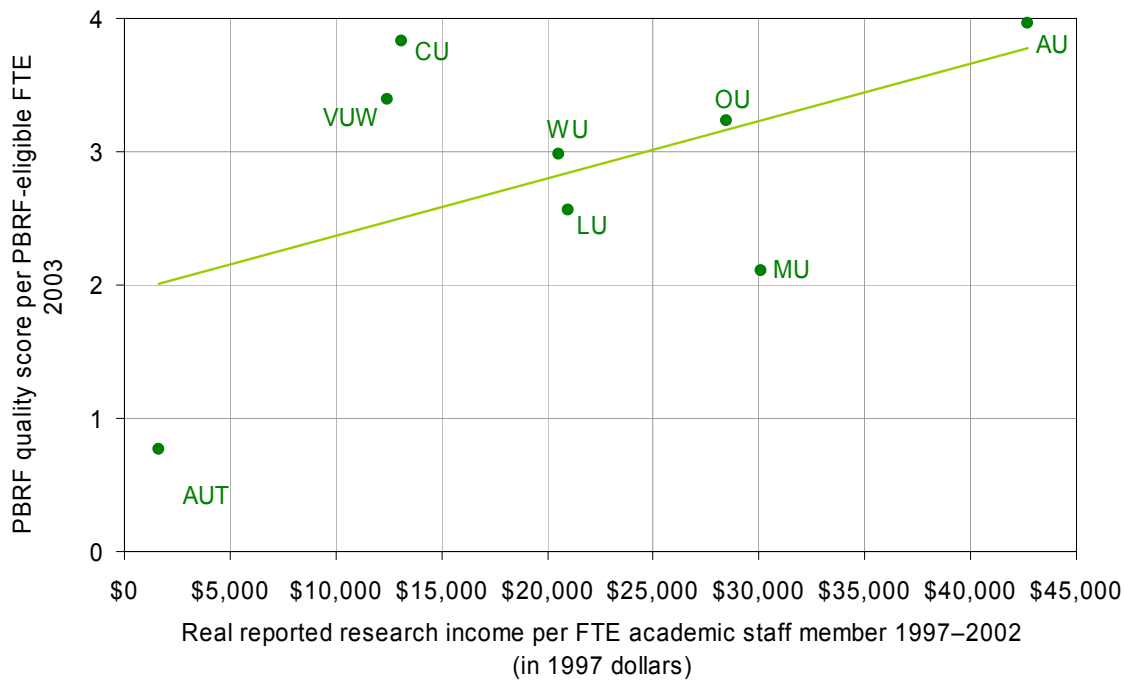
²¹ See Ministry of Education (2005c).

²² See Smart and Smyth (2005a, 2006).

²³ One difficulty with this comparison is that the universities use different thresholds for reporting research output.

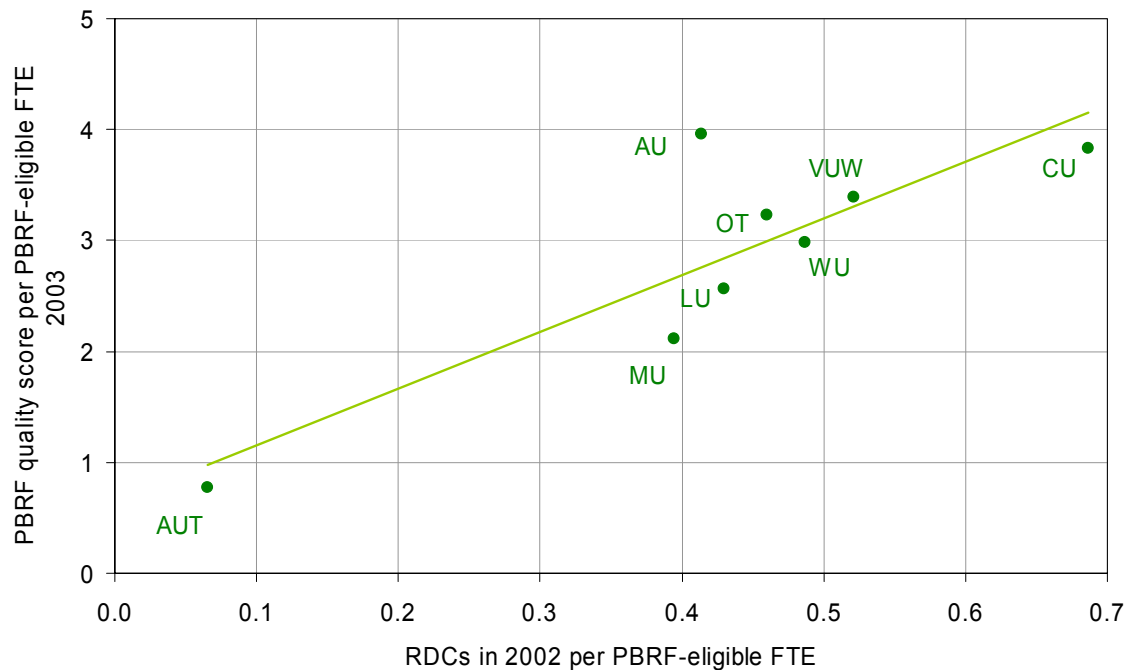
²⁴ Note that this is not the same as the external research income reported by universities for funding purposes in the PBRF. For example, the PBRF external research income measure excludes research income earned via partnerships and joint ventures.

Figure 6: 2003 PBRF quality scores vs reported research income



The average quality scores were also compared with the number of research degree completions (RDCs) per full-time equivalent (FTE) academic staff and showed a reasonable degree of positive correlation.

Figure 7: 2003 PBRF quality scores vs research degree completions



The PBRF average quality scores were also compared to the number of citations per FTE PBRF-eligible staff in a similar assessment window to that used in the Quality Evaluations.²⁵ Two measures of association were used to assist in quantifying the relationship between research quality and the

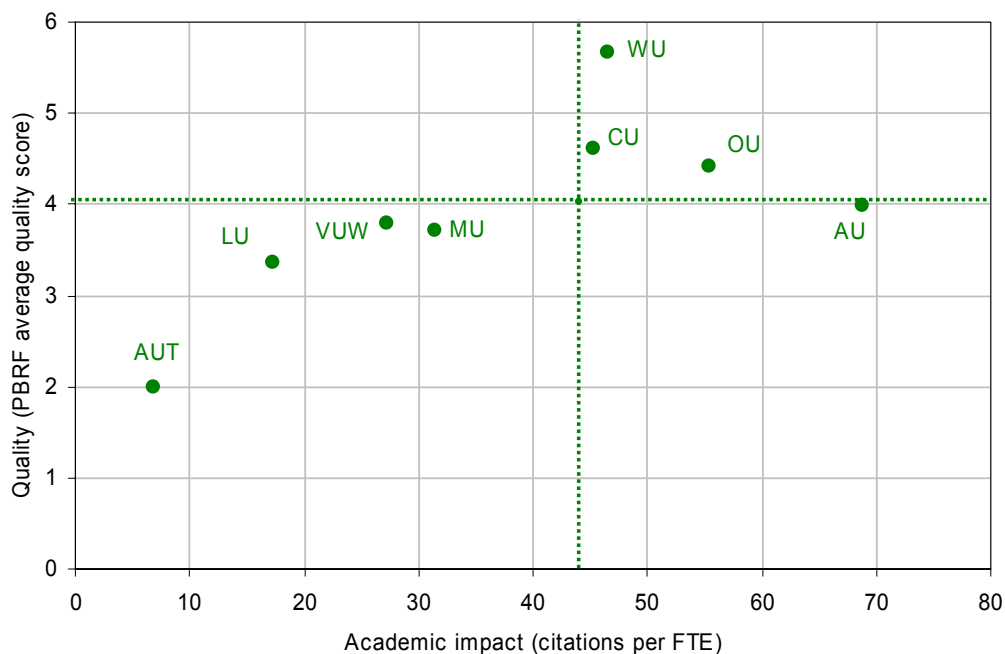
²⁵ See Smart (2007a).

academic impact of research. Pearson's correlation coefficient was used to measure the degree of linear association between the two measures. The closer the absolute value of the Pearson's correlation coefficient is to 1, the stronger is the linear association between the two measures. A value of 1 indicates that there is a perfect linear relationship between the two measures – a value of 0 indicates there is no linear association between the two measures. The sign of the correlation coefficient indicates whether there is a positive or negative linear relationship between the measures. It was expected that the Pearson correlation coefficients should have a positive sign – a higher level of research quality should be associated with a higher level of academic impact.

The second measure of association used was Spearman's rank order coefficient. This is a non-parametric measure of association that compares the ranking of the universities using the research quality measure with the ranking of the universities using the academic impact measure and indicates the strength of that relationship. A value close to 1 indicates that the two measures provide a similar ranking of universities. A measure close to 0 indicates that the ranking of the universities is very different in terms of research quality and academic impact. As with the Pearson's correlation coefficient, the sign indicates whether the relationship is negative or positive. It was expected that the sign of the Spearman's coefficients would be positive, indicating that a university ranked highly under one measure should be ranked highly under the other.

The results showed that a higher average quality score was associated with a higher number of citations per FTE staff, although the strength of the relationship varied between subjects (see Tables 5 and 6). One of the strongest correlations was in the 'biological sciences', a subject area with reasonable coverage in the bibliometric database (see Figure 8). Note that the dotted lines in Figures 8 and 9 represent the overall mean value for the universities in that performance measure.

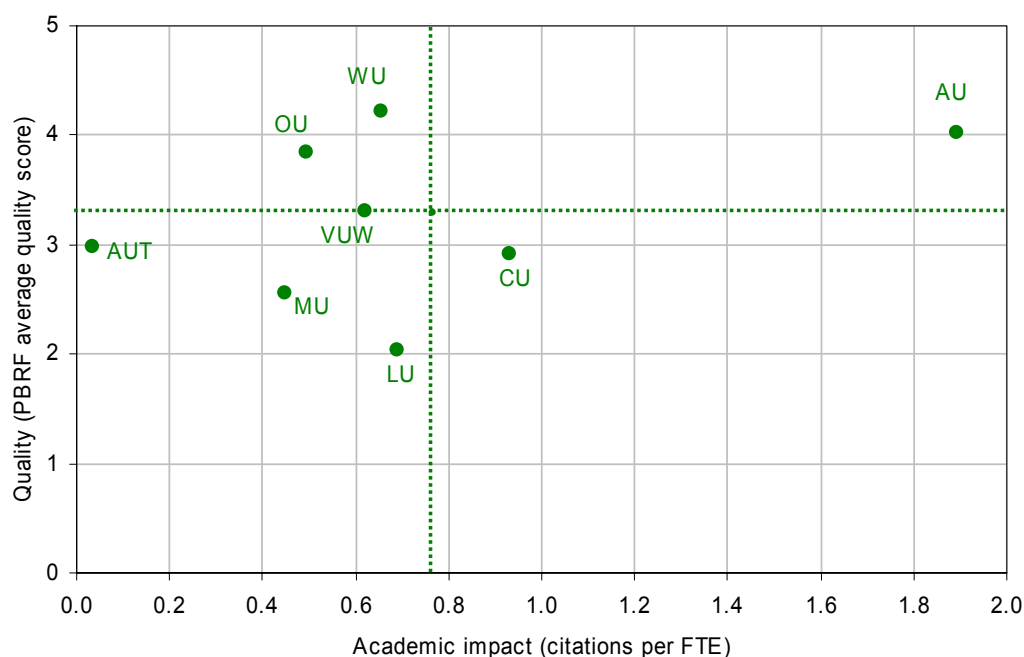
Figure 8: 2006 average quality scores vs citations per FTE – biological sciences



Note: The dotted lines represent the overall mean value for the universities in that performance measure.

The 'business and economics' subject area showed one of the weakest correlations (see Figure 9), which is not surprising given the coverage of research output in this area in the bibliometric database.

Figure 9: 2006 average quality scores vs citations per FTE – business and economics



Note: The dotted lines represent the overall mean value for the universities in that performance measure.

Table 5: Strength of association between academic impact (citations per PBRF-eligible FTE staff) and quality (PBRF average quality score) of research

PBRF panel	Pearson's correlation coefficient		
	2003	2006	2003 & 2006
Engineering, technology and architecture	0.67	0.52	0.56*
Mathematical and information sciences and technology	0.70	0.51	0.57*
Physical sciences	0.05	0.72	0.36
Biological sciences	0.86*	0.69	0.74*
Medicine and public health	0.89*	0.49	0.74*
Health	0.18	0.76	0.49
Business and economics	0.63	0.35	0.45
Education	0.79*	0.70	0.74*
Social sciences and other cultural/social studies	0.61	0.66	0.60*
Humanities and law	0.93*	0.56	0.70

Note: * denotes significant at the five percent level.

Table 6: Strength of association between academic impact (citations per PBRF-eligible FTE staff) and quality (PBRF average quality score) of research

PBRF panel	Spearman's rank order coefficient		
	2003	2006	2003 & 2006
Engineering, technology and architecture	0.48	0.86*	0.59*
Mathematical and information sciences and technology	0.75*	0.74*	0.70*
Physical sciences	-0.22	0.57	0.04
Biological sciences	0.91*	0.76*	0.83*
Medicine and public health	0.90*	0.30	0.70*
Health	0.54	0.77	0.57*
Business and economics	0.52	0.17	0.31
Education	0.82*	0.86*	0.85*
Social sciences and other cultural/social studies	0.71*	0.64	0.64*
Humanities and law	0.72	0.43	0.62*

Note: * denotes significant at the five percent level.

Although there are limitations to the citations data collected – in that the citations were not linked directly to the authors of each paper – the strength of the correlation would suggest that although there is a positive relationship between the PBRF average quality score and academic impact, the two measures are not interchangeable.

6 Analysis of the impact of weightings in the PBRF Quality Evaluation

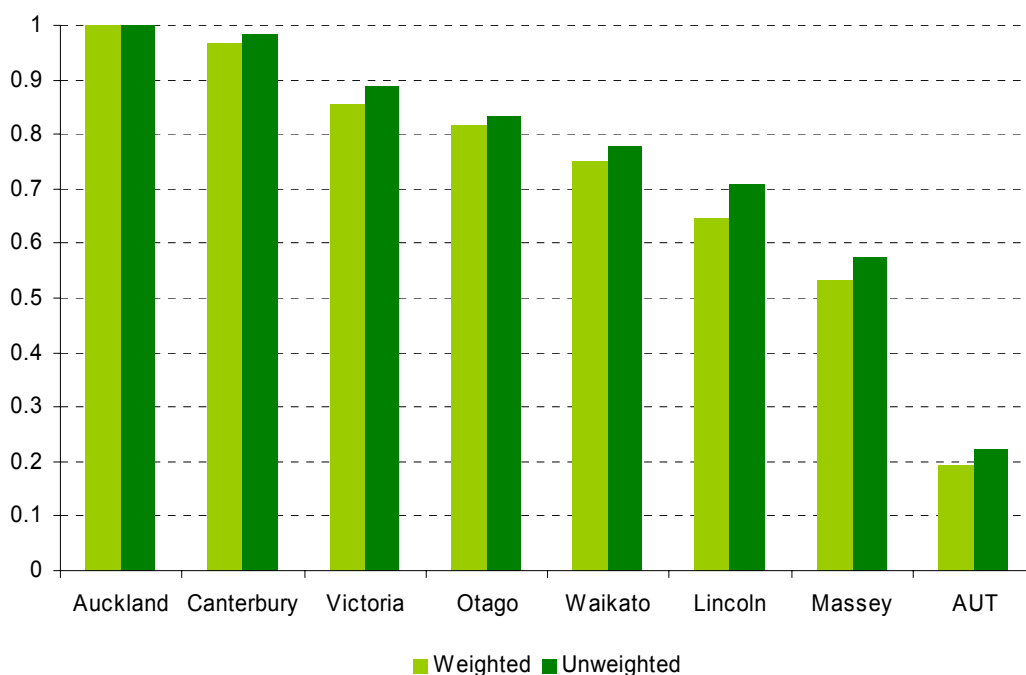
Key finding:

- Removal of the weightings in the 2003 Quality Evaluation reduced the scale of the variation in performance between institutions, but had only a limited impact on the ranking of performance of the main research institutions.

The results of the 2003 Quality Evaluation were examined to see how sensitive the rankings were to the weightings for the quality categories.²⁶ There were two areas examined in this study. The weightings applied to the quality category received by staff and the weightings that applied to the research output (RO), peer esteem (PE) and contribution to the research environment (CRE) score. A comment on the weightings between different subject areas can be found in section 3 of this paper.

To remove the extra weightings applied to higher performance the 10, 6, 2, 0 scores for the 'A', 'B', 'C' and 'R' quality categories were changed to 3, 2, 1 and 0. The removal of the weightings showed that the rankings of the universities remained the same, but the degree of variation was reduced.²⁷

Figure 10: PBRF average quality score on a weighted and unweighted basis as a proportion of the University of Auckland score (all PBRF-eligible staff)



The impact of weightings on the RO (70%), PE (15%) and CRE (15%) components in the Quality Evaluation were then examined on a subgroup of PBRF eligible staff – those that had evidence portfolios examined by the peer-review panels.

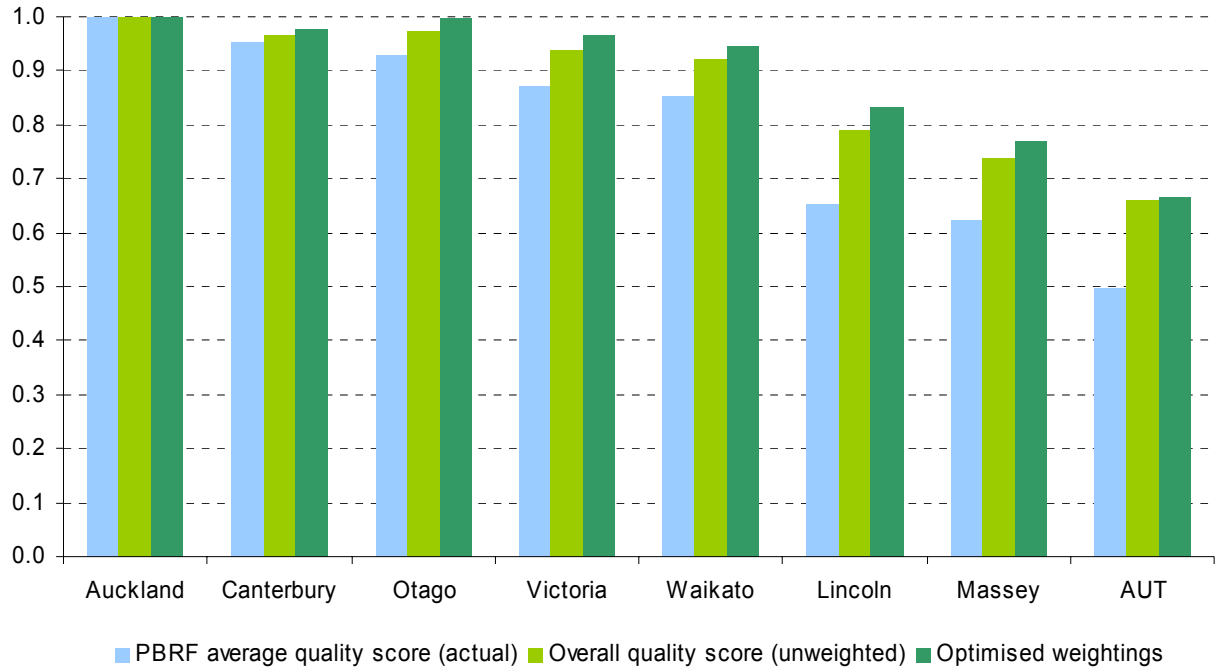
As can be seen by comparing the Performance-Based Research Fund (PBRF) average quality score with the overall quality score (unweighted) in the Figure below, the gap in relative performance of the universities narrows once the weightings are removed.

²⁶ See Smart (2005a).

²⁷ The original analysis was of all participating tertiary education organisations, however, only the results of the universities are reported here.

The gap in performance narrows still further if the weightings applied to the RO, PE and CRE measures are set at a level that optimises the performance of each individual university.²⁸

Figure 11: Relative PBRF Quality Evaluation performance as a proportion of the University of Auckland score (panel-assessed staff only)



²⁸ The optimal weightings were applied using Data Envelopment Analysis (DEA). DEA is a non-parametric linear programming method that assesses the relative efficiency of decision making units. For more detail see Smart (2005a).

7 Analysis of PBRF funding incentives

Key findings:

- The PBRF has created significant financial incentives to encourage the completion of postgraduate research courses.
- A simulation showed that around 41 to 79 percent of government funding for each postgraduate research student would be reliant on successful completion of the research course.
- A comparison of payments to research staff and for research degree completions showed that the estimated income from an 'A' or 'B' researcher was greater than for the Research Degree Completion (RDC) – however, a 'C' level researcher attracted less funding than an individual RDC.

Another area of analysis was estimating the financial impact of the incentives created by the Performance-Based Research Fund (PBRF).²⁹ This involved comparing how money was allocated via the research top-ups system with the PBRF, assuming the PBRF had been in place at the time.

This analysis shows that powerful incentives have been created to ensure the completion of advanced research courses by students. The percentage of the payment that is dependent upon the successful completion of a course by the student was 0 under the research top-ups system, but ranged from 41 to 79 percent under the PBRF system.

Table 7: Estimated proportion of government funding for postgraduate research students dependent on completion under the PBRF funding system³⁰

Cost category	Doctorate		Masters	
	Māori + Pasifika	Other	Māori + Pasifika	Other
Low	74%	58%	58%	41%
Medium	78%	65%	64%	48%
High	79%	65%	65%	49%

An analysis was also made of the potential funding allocations to institutions for staff in the different quality categories and subject areas. This analysis, which assumed the PBRF had already been fully implemented in 2004, showed that funding could range from around \$62,000 for an 'A' level researcher in a high-cost subject area to around \$5,000 for a 'C' researcher in a low-cost subject area.

A comparison of the PBRF allocations for staff and research degree completions showed that higher performing researchers attract more income for a tertiary education organisation than individual research degree completions. However, the funding attracted by 'C' level staff was significantly less than that earned by individual research degree completions across all cost categories.

²⁹ See Smart (2005a, 2006)

³⁰ This analysis assumed a student studied full-time and completed within the shortest period.

8 Establishing baseline data to monitor the effect of the PBRF on research impact

Key findings:

- In their specialist areas, the academic impact of New Zealand university research is generally above the world average.
- In their specialist areas, the academic impact of New Zealand university research compares favourably with the research intensive Australian Group of Eight (G8) universities, although the G8 universities have a higher level of performance overall.

Much of the Ministry of Education's recent analysis in the research area has been devoted to developing baseline data³¹ of the academic impact of tertiary education sector research in New Zealand.³² Although the use of bibliometrics has important caveats,³³ the bibliometric data adds to the stable of performance measures that now exist in the research area and can be used to help monitor the impact of the PBRF over time.

The academic impact of research can be measured by the number of times subsequent researchers cite a research paper, with research that is of higher quality attracting a greater number of citations. In this database, the citations attached to publications listed in the bibliometric database in a five-year window are reported.

Relative impact is measured as the ratio of average citations per publication at New Zealand universities divided by the worldwide average of citations per publication.³⁴ A relative impact score greater than 1 indicates the academic impact of the New Zealand research was above the worldwide average.

In broad subject areas, the academic impact of New Zealand university research was above the world average in the areas of 'health' and 'mathematics and information sciences and technology' in the 2001-2005 period.

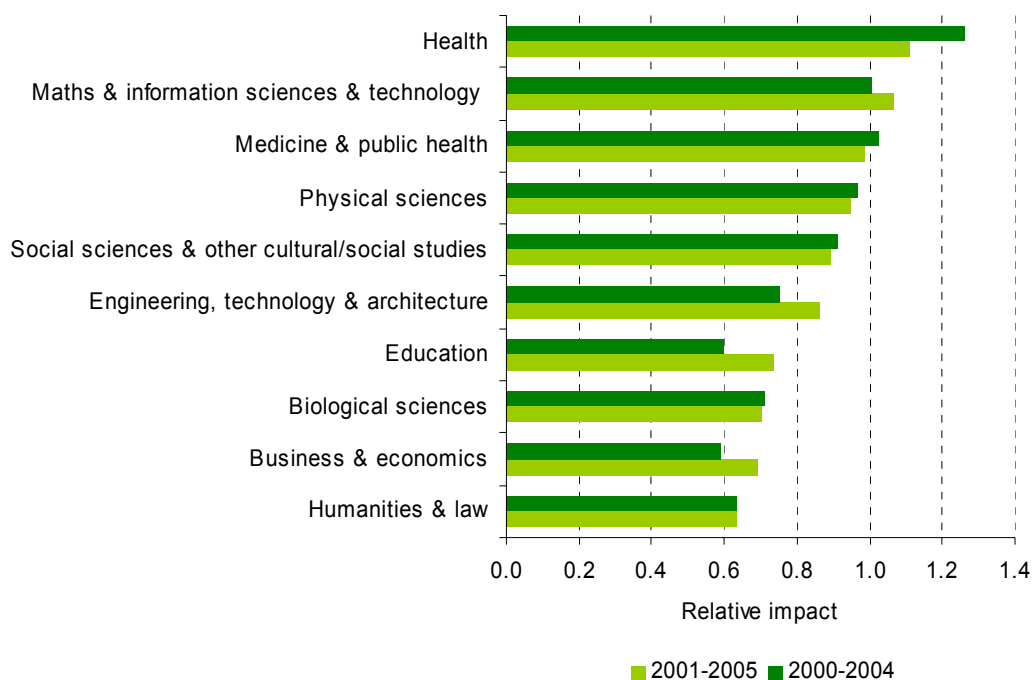
³¹ This involved the Ministry of Education working closely with Thomson Scientific to create a unified database of citations and indexed publications for New Zealand tertiary education institutions.

³² See Smart and Weusten (2007a).

³³ Such as the coverage of research output in the social sciences and humanities.

³⁴ Relative impact is reported here because raw citation rates vary between subject disciplines and there has been a natural increase in citation over time.

Figure 12: Relative impact of New Zealand university research 2000-2004 and 2001-2005



Source: Thomson Scientific

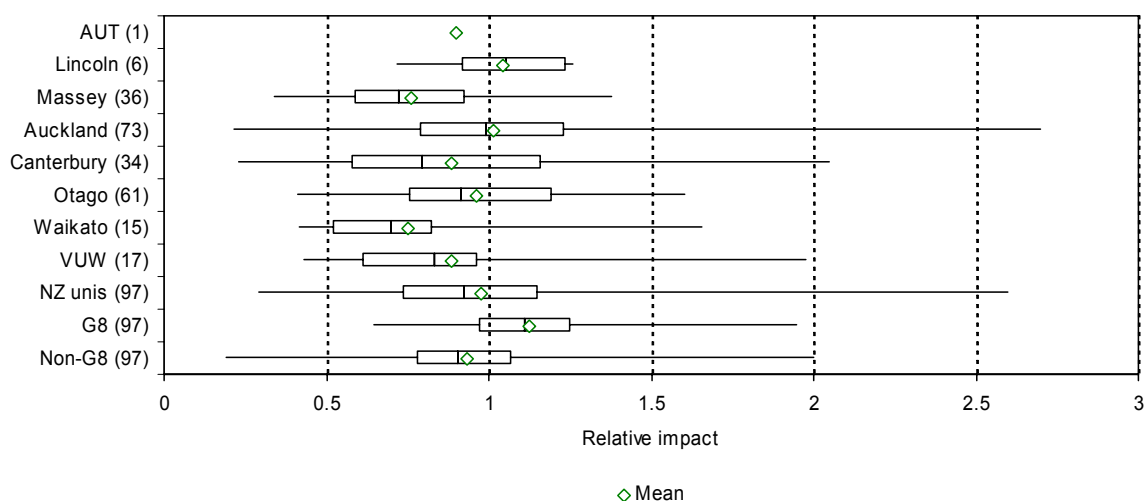
Bibliometric data at the individual institution level shows that in each university's specialist areas, the academic impact of New Zealand university research is generally above the world average.

The bibliometric analysis also included a comparison of the performance of New Zealand universities with groups of Australian universities.³⁵ The relative impact of research has been compared with the research intensive Group of Eight (G8) and the non-Group of Eight (non-G8) universities.

The results indicate that the relative impact of New Zealand university research overall is below that of the G8 universities and above that of the non-G8 universities (see boxplot below). However, individual New Zealand universities perform relatively well compared to the G8 universities in their areas of specialisation.

³⁵ See Smart and Weusten (2007b).

Figure 13: Boxplot of narrow subject area relative impact scores 2001-2005



Note: The number in brackets following the name of the university/group of universities is the number of narrow subject categories the boxplot is based on.

An analysis was also made of the share of world citations and publications by nine New Zealand tertiary education institutions.³⁶ The increased focus on research that has come from the introduction of the Performance-Based Research Fund (PBRF) may result in a stimulation of research activity and hence output. In addition, if the quality of research increases, this is likely to result in a higher rate of citation of that research. Therefore, monitoring of indicators such as share of world citations and indexed publications will be useful in helping to analyse the long term impacts of the PBRF.

The two specific measures of institutional research performance are:

- Share of world publications produced in five-year overlapping time periods by an institution, and
- Share of world citations attached to those publications produced in the five-year overlapping time periods by an institution.³⁷

Overall, analysis shows that the share of world citations and indexed publications by the nine New Zealand tertiary education institutions in the analysis increased, in some cases substantially, over the period between 1981 and 2005. Those institutions that have the shortest research history, Auckland University of Technology and Unitec, displayed the strongest growth, although this was off a very low base. In the case of Lincoln University, it would appear that its change in status to an autonomous university in 1990 resulted in a significant increase in its share of world indexed publications and citations in the years following this event.

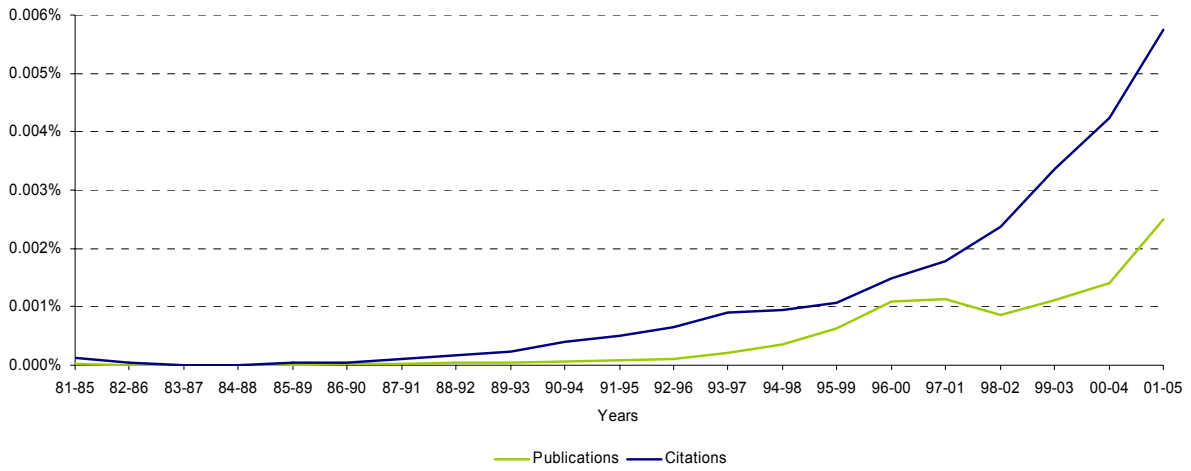
The data for three of the tertiary education institutions is graphed below.³⁸ These include the two largest producers of indexed publications, the Universities of Auckland and Otago, and the newest university, Auckland University of Technology.

³⁶ See Ministry of Education (2007) Chapter 12.

³⁷ The citations measured in this analysis are only counted up to a maximum of five years following the listing of the publication in the Thomson Scientific database. Therefore the citations data will not capture the impact of seminal research that may attract citations for many years after publication.

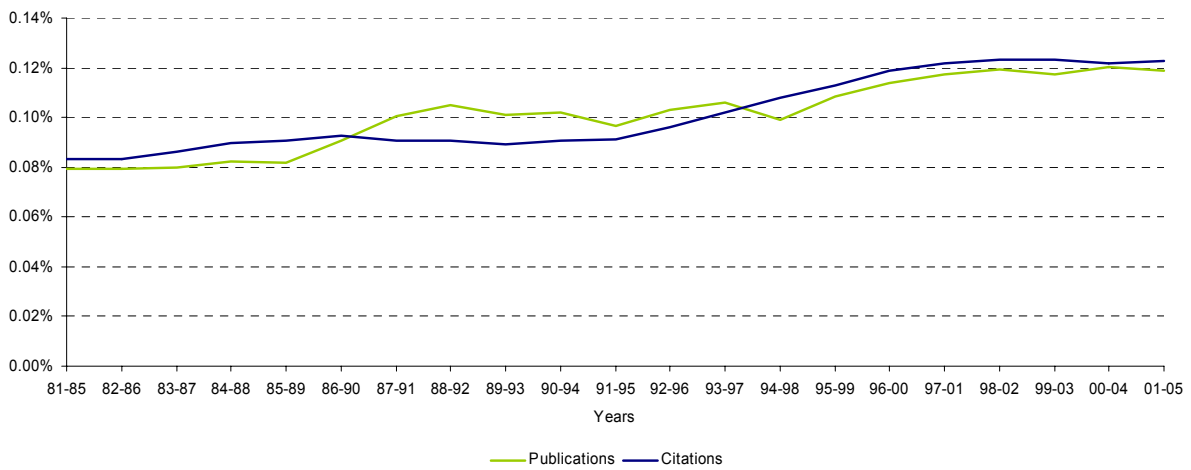
³⁸ Graphs for all nine tertiary education organisations in the analysis can be found in Ministry of Education (2007), Chapter 12.

Figure 14: Share of world-indexed publications and citations by Auckland University of Technology



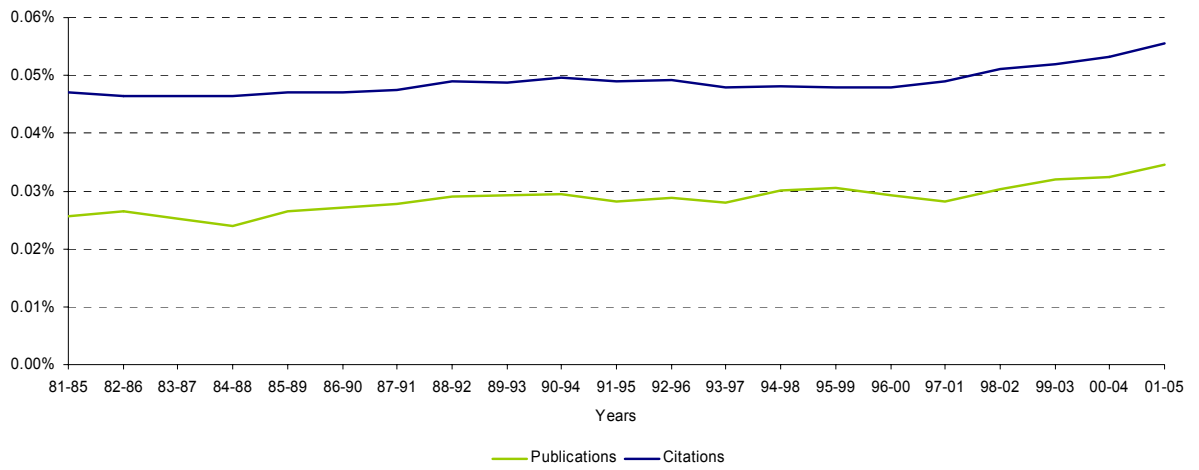
Source: Thomson Scientific

Figure 15: Share of world-indexed publications and citations by the University of Auckland



Source: Thomson Scientific

Figure 16: Share of world-indexed publications and citations by the University of Otago



Source: Thomson Scientific

9 Analysis of the impact of the PBRF on the retention of doctoral students and on research in the social sciences/humanities

Key findings:

- The period following the introduction of the PBRF has been associated with a slight increase in the retention rate of younger full-time doctoral students and a slight decrease in the retention of older part-time students.
- The subject, year of study, and ethnic group of doctoral students impacted on the likelihood of retention.
- In the two PBRF Quality Evaluations, the natural sciences and related fields of research have tended to perform above the social sciences, humanities and other fields funded at lower rates.
- While there has been some transfer of the source of research funding in the universities from the arts, humanities and social sciences to higher-funded subject areas, the shift has not been large.
- The extent of the shift from lower-to higher-funded subjects has been greater when all lower-funded areas – including business – are included.

Impact of the PBRF on retention of doctoral students

The impact of the PBRF on the retention rate of doctoral students was examined to see if the Performance-Based Research Fund (PBRF) had improved performance in this area.³⁹

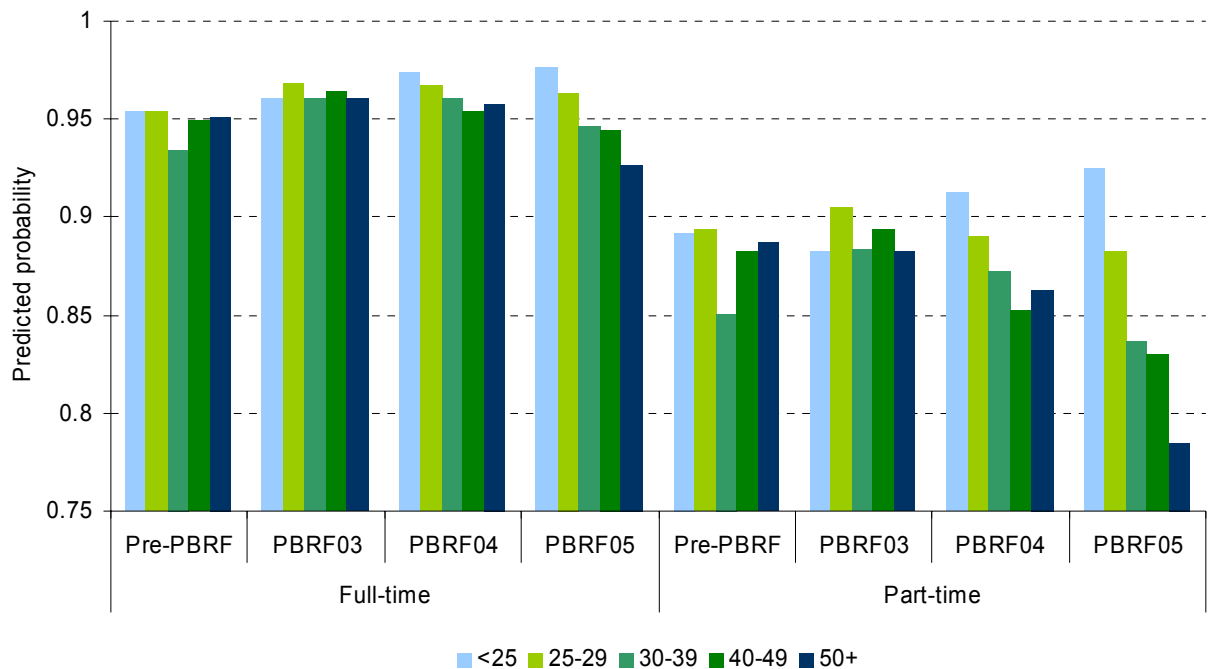
Results of statistical modelling suggest that the introduction of the PBRF has been associated with a small, but statistically significant, impact on the likelihood of retention of doctoral students in New Zealand. Interestingly, the modelling suggests that the impact of the PBRF has varied, depending on the age and study load of the student. It would also appear that the impact of the PBRF is increasing over time.

The effect of the PBRF on the likelihood of retention can best be illustrated by showing the predicted probabilities for doctoral students by age group and study load over time for a selected reference group. The likelihood of retention for younger doctoral students, especially those aged under 25, has increased in the time period following the introduction of the PBRF for the selected reference group.

This compares with a decrease in the likelihood of retention for older students, especially those aged over 40, as time has gone on.

³⁹ See Smart (2007b).

Figure 17: Predicted probability of doctoral student retention by age group, study load and PBRF status



Notes:

1. The reference group is a European doctoral student, studying society and culture, in their first year of study at an average New Zealand university.
2. PBRF03 refers to the impact of the PBRF in 2003, PBRF04 refers to the impact of the PBRF in 2004 and PBRF05 refers to the impact of the PBRF in 2005.

The results of the regression modelling also indicate that although part-time students have always had a lower likelihood of retention than full-time doctoral students, this gap has widened in the period following the introduction of the PBRF.

The modelling also showed the following factors impacted on the retention of doctoral students.

- *Ethnic group:* Pasifika and Asian students were slightly less likely to be retained than European students.
- *Subject:* Students enrolled in the sciences, agriculture and health had a slightly higher likelihood of retention than students enrolled in society and culture.
- *Year of study:* The likelihood of retention was highest for doctoral students in their first year of enrolment.

Impact of the PBRF on the social sciences, the arts and humanities

Overall and with a few exceptions, the 2003 and 2006 Quality Evaluation results show that the highest performing subject areas tend to be in the sciences and applied sciences. In the 2006 Quality Evaluation, four of the five highest performing subject areas were sciences or applied sciences. Of the twelve PBRF Quality Evaluation panels, the three panels with the highest average quality scores in the 2006 Quality Evaluation were physical sciences, medicine and public health and biological sciences. The 2003 evaluation showed similar results. This raises questions as to the possible impact of the

PBRF on areas such as the social sciences and humanities. The 2003 Quality Evaluation results were analysed for the implications of the PBRF for research in the social sciences.⁴⁰

The analysis by Boston et al (2005) showed that the social sciences rated above the average score for all 41 subject areas and just ahead of the average score for the subject areas assessed by the Humanities and Law panel. However, the overall quality score for the social sciences was lower than the average scores for the physical sciences, the biological sciences and medicine. This is despite the fact that bibliometric analysis (Smart and Weusten 2007a) shows that the relative impact of social sciences research by New Zealand universities is fifth of the ten PBRF panels whose performance was analysed – close to that of the physical sciences and above that of the biological sciences.

The Boston et al analysis sought to determine if one of the effects of the PBRF was to transfer the source of research funding away from the social sciences and other fields funded at the lowest funding rates and towards the sciences, medicine and similar areas.

In 2003, the arts, humanities and social sciences generated nearly 16.6 percent of all of the research top-ups funding in the tertiary education sector. In 2004, those fields generated 17.2 percent of the PBRF quality funding. If the estimate of the research degree completion (RDC) funding attributable to the arts, humanities and social sciences is also included, the proportion falls to 16.5 percent. Only a relatively small proportion of all university external research income is currently generated by social scientists so that the social sciences will generate a relatively small proportion of the 15 percent of total PBRF funding allocated on the basis of the external research income (ERI) measure.

Table 8: Estimated share of total research funding for the arts, humanities and social sciences, 2003 and under PBRF

Field of Study	Percentage of research funding		
	2003 Research top-ups	2004 PBRF quality funding	Estimated percentage of research degree completion and quality funding
Arts, Humanities Social Science	16.6%	17.2%	16.5%
Other	83.4%	82.8%	83.5%

Note:

1. Research degree completion funding attributed to classification #03 disciplines is estimated using the number of #03A4-funded EFTS as a proportion of all A4-funded EFTS.

2. In this table "Arts, Humanities and Social Sciences" excludes public health, economics and psychology. It includes education, but excludes teaching.

Source: Tertiary Education Commission 2004a.

On a weighted basis,⁴¹ the staff classified in the social sciences in the Boston et al analysis represented 13.3 percent of all PBRF eligible staff in the 2003 quality evaluation. Yet those staff generated 15.6 percent of all quality funding, reflecting the fact that the assessment of their research standing was, on average, above the mean for all staff.

The research funding generated by the social sciences may be relatively less affected by the introduction of the PBRF than other disciplines funded at lower rates. The PBRF is expected to reduce the share of research funding for the lower-funded fields of study as a whole (including business and teaching, as well as the arts, humanities and social sciences). Table 9 indicates that the lower-funded subject areas are likely to experience a reduction in their share from 29 percent to 24 percent – even without taking into account the uneven allocation of the ERI component of the PBRF. To a considerable extent, this shift results from the fact that some of the lower-funded subject areas – management and marketing are good examples – are likely to generate relatively limited PBRF

⁴⁰ See Boston, Mischewski and Smyth (2005)

⁴¹ The weighting applied for the purposes of this analysis reflected the PBRF funding subject weightings.

funding, yet earned substantial research top-ups funding in the past because of large undergraduate degree classes.

Table 9: Estimated share of total research funding for all lower funded disciplines, 2003 and under the PBRF

		Percentage of research funding	
	Funding categories	2003 Research top-ups	Estimated percentage of research degree completion and quality funding
Lower cost	A, I	28.8%	23.5%
Higher cost	B, C, G, H	71.2%	76.5%

Overall, the analysis suggests that the introduction of the PBRF is likely to result in a small shift of research funding from the arts, humanities and social sciences to higher-funded subject areas.

10 Ministry of Education publications 2004-2007

2004

- Ministry of Education (2004) *Profile & trends 2003 – New Zealand's tertiary education sector*, Chapter 5, Wellington: Ministry of Education.

2005

- Boston, J., Mischewski, B., & Smyth, R. (2005) Performance-Based Research Fund – Implications for research in the social sciences and social policy, *New Zealand Social Policy Journal*, Issue 24, March 2005, pp 55-84.
- Ministry of Education (2005) *Profile & trends 2004 – New Zealand's tertiary education sector*, Chapters 14 & 15, Wellington: Ministry of Education.
- Smart, W. (2005a) *The measurement of the research performance of Tertiary Education Organisations: an analysis of the impact of weightings in the Performance-Based Research Fund*, Wellington: Ministry of Education.
- Smart, W. (2005b) *An analysis of funding allocations for staff and research degree completions in the Performance-Based Research Fund*, Wellington: Ministry of Education.
- Smart, W. (2005c) *Technical postscript: comparing research measures*, Wellington: Ministry of Education.
- Smart, W. & Smyth, R. (2005a) *Research measures: comparing seven new measures of research in tertiary education*, Wellington: Ministry of Education.
- Smart, W. & Smyth, R. (2005b) *Research measures: comparing the old with the new*, Wellington: Ministry of Education.
- Smart, W. (2005d) *What determines the research performance of staff in New Zealand's tertiary education sector? An analysis of the Performance-Based Research Fund Quality Evaluation*, Wellington: Ministry of Education.

2006

- Ministry of Education (2006) *Profile & trends 2005 – New Zealand's tertiary education sector*, Chapters 11 and 12, Wellington: Ministry of Education.
- Smart, W. & Smyth, R. (2006) Performance-Based Research Fund: What the data are telling us, in Bakker, L., Boston, J., Campbell, L. & Smyth, R. (eds) *Evaluating the Performance-Based Research Fund*, pp 147-158, Wellington: Institute of Policy Studies.
- Smart, W. (2006) Performance-Based Research Fund: an analysis of the incentives for research degree completion in Bakker, L., Boston, J., Campbell, L. & Smyth, R. (eds) *Evaluating the Performance-Based Research Fund*, pp 159-184, Wellington: Institute of Policy Studies.

2007

- Ministry of Education (2007) *Profile & trends 2006 – New Zealand's tertiary education sector*, Chapters 12 and 13, Wellington: Ministry of Education.
- Smart, W. (2007a) *Quality vs impact: a comparison of Performance-Based Research Fund quality scores with citations*, Ministry of Education, Wellington.

-
- Smart, W. (2007b) *Persistence in doctoral research: analysing the impact of the PBRF on doctoral retention*, Wellington: Ministry of Education.
 - Smart, W. & Weusten, M. (2007a) *(ex)Citing research: a bibliometric analysis of New Zealand university research 1981-2005*, Wellington: Ministry of Education.
 - Smart, W. & Weusten, M. (2007b) *Comparing the academic impact of research by New Zealand and Australian universities 1981-2005*, Wellington: Ministry of Education.

2008

- Ministry of Education (2008) *How the PBRF has shifted research funding*, Wellington: Ministry of Education.



MINISTRY OF EDUCATION

Te Tāhuhu o te Mātauranga