



MINISTRY OF EDUCATION

*Te Tāhuhu o te Mātauranga*

# Research measures

Comparing seven new measures of research performance  
in tertiary education

**Report**

Research measures: Comparing seven new measures of research performance in tertiary education

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## **1 Introduction**

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The Performance-Based Research Fund (PBRF) signals a new, performance-based approach to the allocation of government research funding to tertiary education organisations. The development of the PBRF has involved the creation of a set of new research performance measures. This note examines the relationships between the new measures.

## **2 Background – a new research funding approach**

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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'. The PBRF is shifting the basis of research funding to a system based on research performance<sup>1</sup>, with the first PBRF quality evaluation having been conducted in 2003 and the first funding having been allocated under the new system in 2004<sup>2</sup>.

In order to allocate funding on the basis of research performance, the government's tertiary education agencies needed to create a rigorous and credible means of assessing and quantifying research performance. Therefore, the introduction of the PBRF has been accompanied by the development of a new measurement and assessment system for research – based on measures of research performance at an individual and institutional level<sup>3</sup>. The PBRF measures are based on:

- a score that reflects the quality of the research produced in a provider
- the number of research degree completions (RDC) the provider has achieved in the relevant time period, and
- the amount of external research income (ERI) generated by the provider.

The research quality measure is a weighted average of an assessment panel's scoring of a PBRF-eligible staff member's scores<sup>4</sup> in three sub-components:

- his/her nominated research outputs
- the esteem of his/her research peers, and
- his/her contribution to the research environment.

In each of the three components of the PBRF research quality score – research output, peer esteem, and contribution to the research environment - each eligible staff member is assigned a score between 0 and 7 by an evaluation panel of experts in the relevant field of study. Those scores are then weighted by factors of 70, 15 and 15

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<sup>1</sup> For an account of the rationale for the change, refer to Ministry of Education (2002).

<sup>2</sup> The results of the first quality evaluation are set out in Tertiary Education Commission (2004).

<sup>3</sup> 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.

<sup>4</sup> Not every PBRF eligible staff member had an evidence portfolio assessed by a panel. Many providers did not submit portfolios for PBRF-eligible staff members who were not active in research.

respectively to generate the *overall quality score (OQS)* of the staff member – a score out of 700. The panel then makes an holistic assessment of the portfolio and assigns a quality category – A, B, C or R. A score of between 600 and 700 generates an A, a score of 400 – 599 generates a B and so on<sup>5</sup>. The quality category is intended as a summary measure of the staff member’s research performance over the relevant period<sup>6</sup>. The quality category is then used to allocate the staff member’s PBRF research quality score – a number between 1 and 10. A staff member earning an A category is given a score of 10, a B earns a research quality score of 6 and a C a score of 2<sup>7</sup>. The purpose of this translation is to enable aggregation and comparison.

The PBRF research quality score, the OQS and the three sub-components are all measured for each PBRF eligible staff member in providers whose research evidence portfolio is submitted by the provider for assessment by a PBRF panel. Thus, the three sub-components can be considered as primary measures of an individual’s research performance. The OQS and the PBRF research quality score are derived measures that also are calculated at the level of the individual staff member. All five of those measures can be aggregated to the level of the tertiary education organisation.

The other two PBRF measures – the ERI and the RDC – are calculated at the provider level.

Therefore, the PBRF enables the calculation of seven research performance measures at the provider level. Five of the seven measure distinct dimensions of performance, while the other two are summaries derived from three of the others.

### **3 The relationship between the PBRF research performance measures**

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While the PBRF research performance scores may measure distinct dimensions of performance, they are obviously not independent. The peer esteem measure, for instance, will be related to the level of contribution the staff member is making to the research environment and to the number and quality of research outputs. The ability of a provider to generate external research income in a contestable market will be dependent on the record of achievement of the researchers in that provider and hence, on such measures as peer esteem and research outputs. And, to take yet another example, the number of research degree completions will depend on the number of students enrolled in research degrees – which will be influenced by such factors as peer esteem and contribution to the research environment. Similar comments can be made about the connections between other dimensions of research performance used in the PBRF.

Given the interdependence of all seven measures but the fact that performance has been measured on five distinct dimensions, the question arises as to the precise relationship between the different measures. This note explores the relationship using

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<sup>5</sup> Because panels made ‘holistic’ assessments of performance, about 1 percent of researchers were assigned to quality categories different from that indicated by the OQS.

<sup>6</sup> The process is detailed in Tertiary Education Commission (2004) pp 19 to 20 and pp 37 to 38.

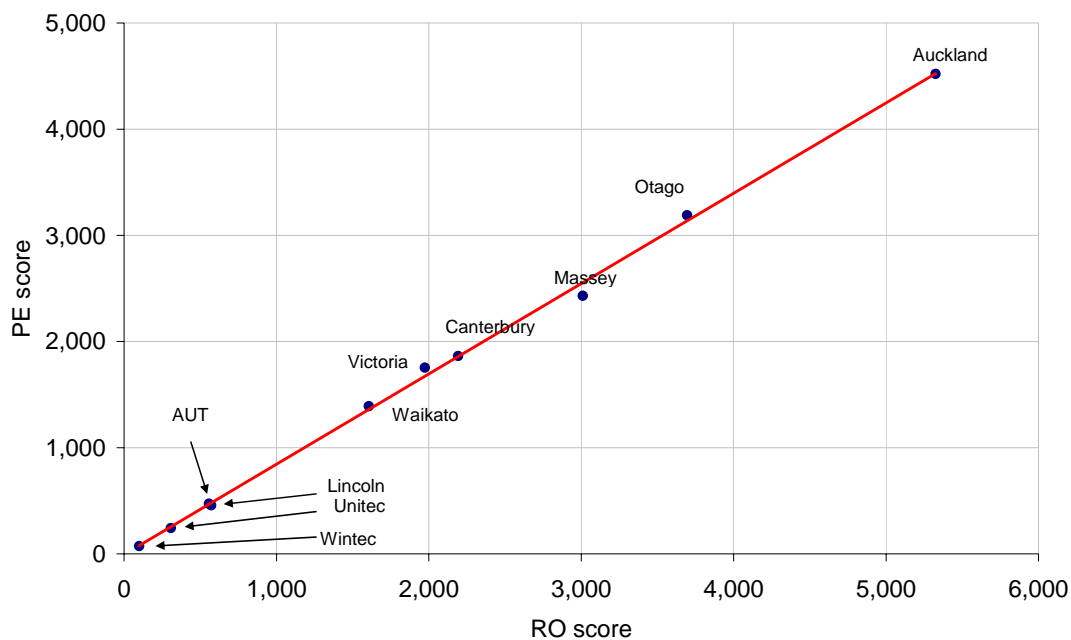
<sup>7</sup> The funding allocation was based on A being treated as 5, B as 3, C as 1 and R as 0. For reporting and presentation purposes, these scores were doubled.

the data from the 2003 PBRF quality assessment. The data on research quality, research outputs, peer esteem and contribution to the research environment have been aggregated to the provider level and then compared with the RDC and ERI results from 2003.

## 4 The results of the analysis

For each of the universities and for the two polytechnics that participated in the 2003 PBRF quality evaluation, the graphs below plot the relationship between the three sub-components of the research quality measure – research outputs, contribution to the research environment and peer esteem. The data used in these analyses relate to those PBRF-eligible staff whose evidence portfolios were assessed by the panels in 2003 PBRF quality evaluation. Had portfolios for all PBRF-eligible staff been assessed by panels, the results of this analysis may have been different<sup>8</sup>.

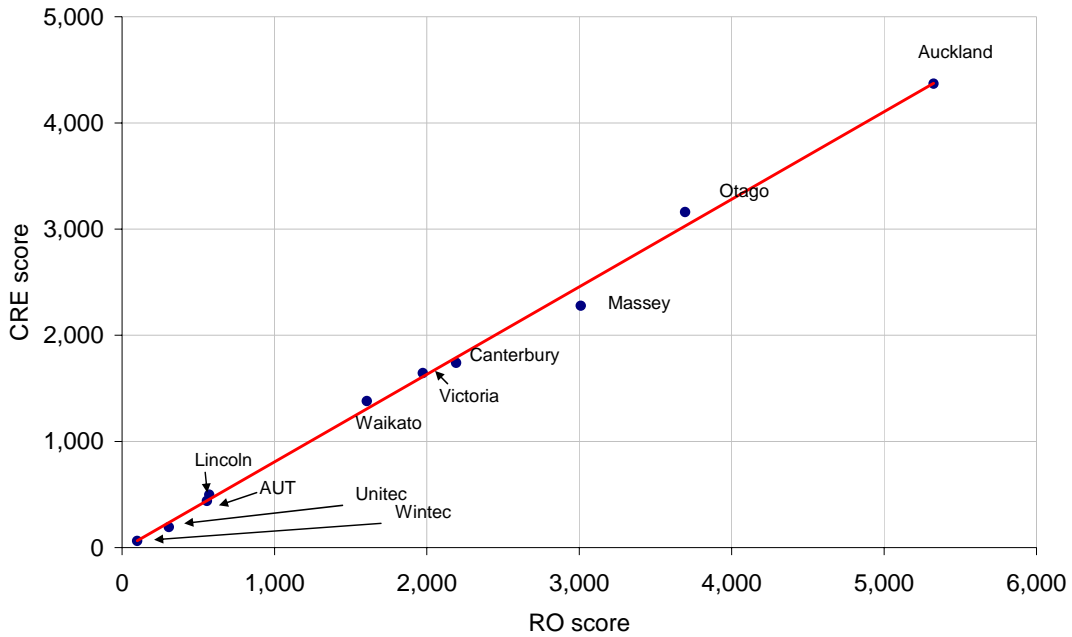
**Figure 1: 2003 PBRF quality evaluation: PBRF research output (RO) score vs peer esteem (PE) score**



Note: The RO and PE scores are measured on an FTE weighted basis.  
Sources: Ministry of Education, Tertiary Education Commission.

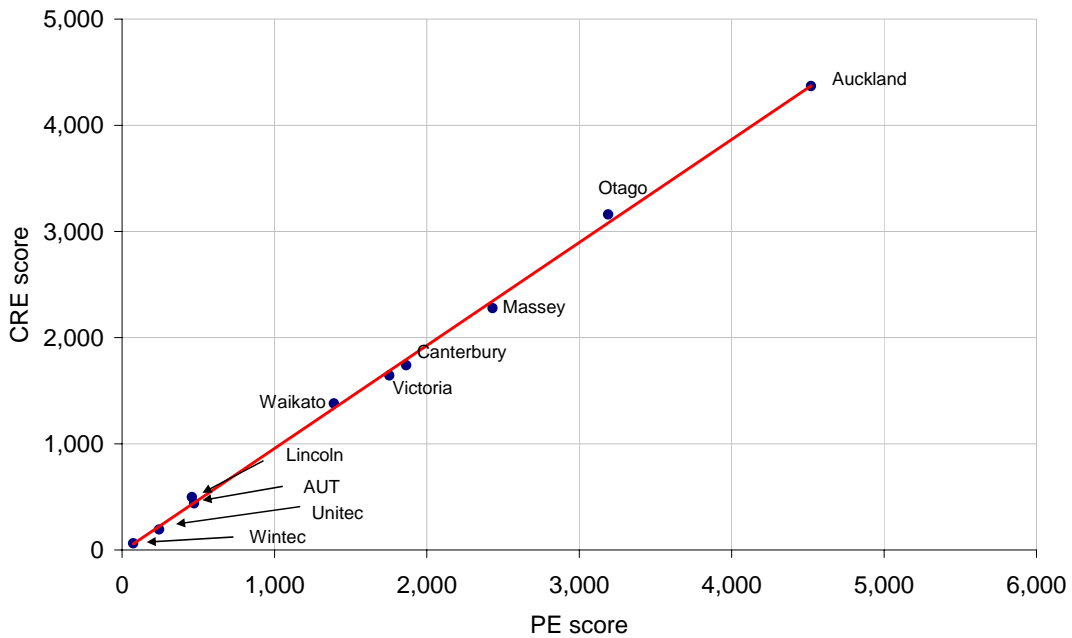
<sup>8</sup> There were about 2,200 PBRF-eligible staff whose evidence portfolios were not submitted for consideration by a panel. This represented about 28 percent of all PBRF-eligible staff. The staff whose portfolios were not submitted for panel assessment represented those with a lower level of research performance.

**Figure 2: 2003 PBRF quality evaluation: PBRF research output (RO) score vs contribution to the research environment (CRE) score**



Note: The RO and CRE scores are measured on an FTE weighted basis.  
Sources: Ministry of Education, Tertiary Education Commission.

**Figure 3: 2003 PBRF quality evaluation: PBRF peer esteem (PE) score vs contribution to the research environment (CRE) score**



Note: The PE and CRE scores are measured on an FTE weighted basis.  
Sources: Ministry of Education, Tertiary Education Commission.

It is apparent that the performance on each of these dimensions is highly correlated. Contribution to the research environment, peer esteem and the research output measures are obviously *distinct* – they are measures based on distinct features of research quality. The high correlation, however, implies there is little *difference*

between the results of these assessments at a provider level; strong performance on one of the measures is strongly associated with strong performance on the others.

Similar results, obviously, apply to the two measures that summarise the three subcomponents of the research quality measure – the OQS and the research quality measure.

Table 1 below sets out the correlation coefficients that quantify the strength of the relationships between the five measures.

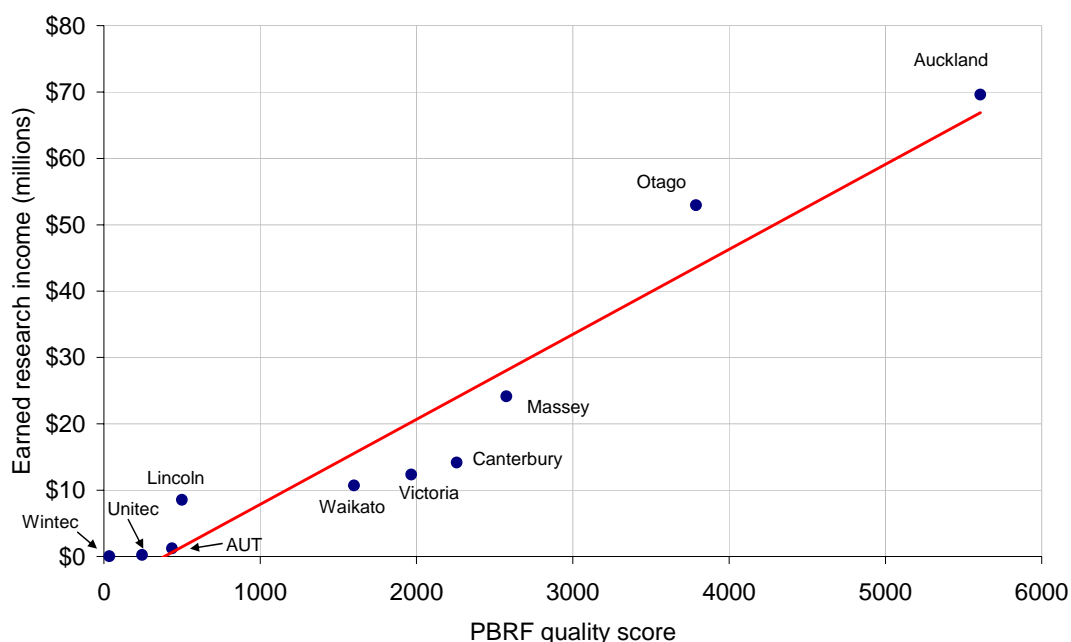
**Table 1: 2003 PBRF quality evaluation: quality score correlation coefficients**

	PBRF quality score	OQS	RO	PE
OQS	0.9964			
RO	0.9956	0.9999		
PE	0.9975	0.9997	0.9993	
CRE	0.9977	0.9988	0.9981	0.9993

Note: All measures are calculated on an FTE weighted basis.  
Sources: Ministry of Education, Tertiary Education Commission.

The relationship between the five measures of research output quality and the other two dimensions of the PBRF is more complex. Figure 4 below plots the providers' PBRF quality scores against the ERI recorded by the Tertiary Education Commission for the allocation of PBRF funding in 2004.

**Figure 4: 2003 PBRF quality evaluation: PBRF quality score vs external research income (ERI)**



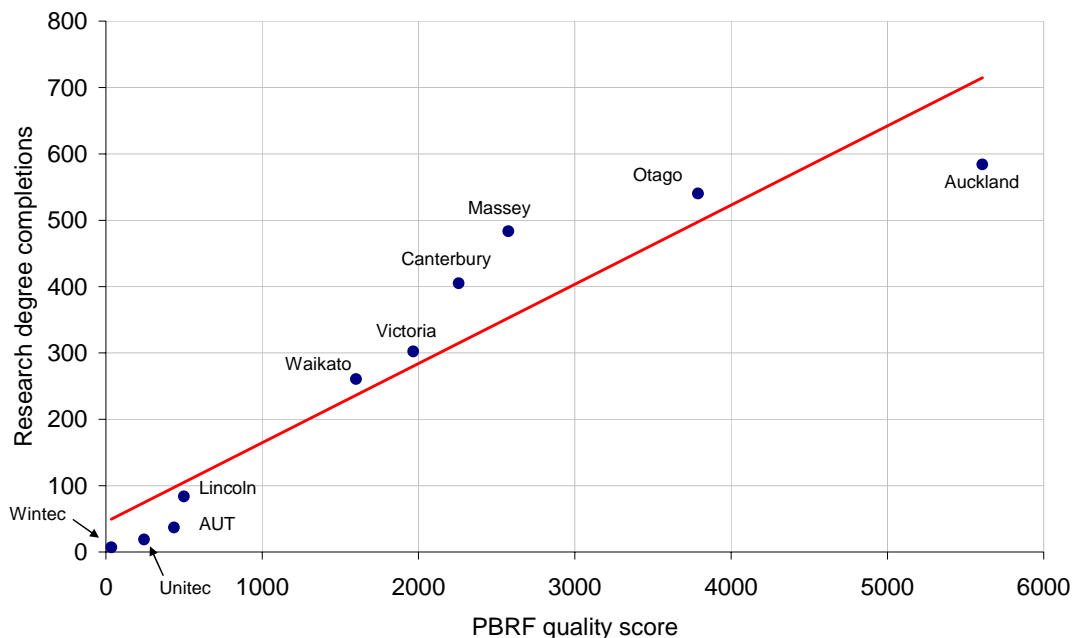
Note: The PBRF quality score is calculated on an FTE weighted basis.  
Sources: Ministry of Education, Tertiary Education Commission.



The relationship is strong. There were three universities – Lincoln, Otago and Auckland – with a particularly strong record in generating external research contract income<sup>9</sup>. Their plots appear above the line of best fit, implying that in each, their PBRF funding was boosted by their ERI performance. Victoria University of Wellington, by contrast, has a particular strength in fields that have traditionally attracted lower levels of research contract income; the plot for Victoria sits beneath the line of best fit. Victoria and the other universities that appear below the line had a relatively smaller proportion of their PBRF funding generated by their ERI scores.

In Figure 5, the measure of research degree completions (RDC) used in allocating PBRF funding for 2004 is plotted against the PBRF research quality score in each of the providers studied. Again the fit is strong.

**Figure 5: 2003 PBRF quality evaluation: 2003 PBRF quality evaluation: PBRF quality score vs RDC**



Notes:

1. The PBRF quality score is calculated on an FTE weighted basis.
2. The RDC measure used in this graph is the value of the “volume of research factor” (VRF). The VRF assigns a value of 1 for masters degree completions with a 1.0 equivalent full-time student (EFTS) thesis and a value equivalent to the EFTS value of the research component between 0.75 and 1.0 EFTS. The VRF assigned a value of 3 for doctoral student completions. These values are aggregated for each TEO.

Sources: Ministry of Education, Tertiary Education Commission.

The universities with plots above the best fit line – Massey and Canterbury in particular - scored relatively well on the RDC measure. Those below the line – the University of Auckland, AUT and the two polytechnics participating had a somewhat

<sup>9</sup> In the cases of the Universities of Auckland and Otago, performance on this measure is boosted by the fact that they have medical schools; medicine is a discipline that traditionally has attracted significant external research funding. In New Zealand, the government earmarks a substantial proportion of the Crown’s funding for research for medicine through its funding of the Health Research Council. Lincoln’s strong performance on this measure derives from its strength in research on issues that relate to land-based industries; this too is an area that has attracted significant research contract funding.

lower level of research degree completions than would be expected given their quality scores.

The strengths of the correlations between the seven PBRF measures is summarised in Table 2 below where the correlation coefficients are set out.

**Table 2: 2003 PBRF quality evaluation: research measure correlation coefficients**

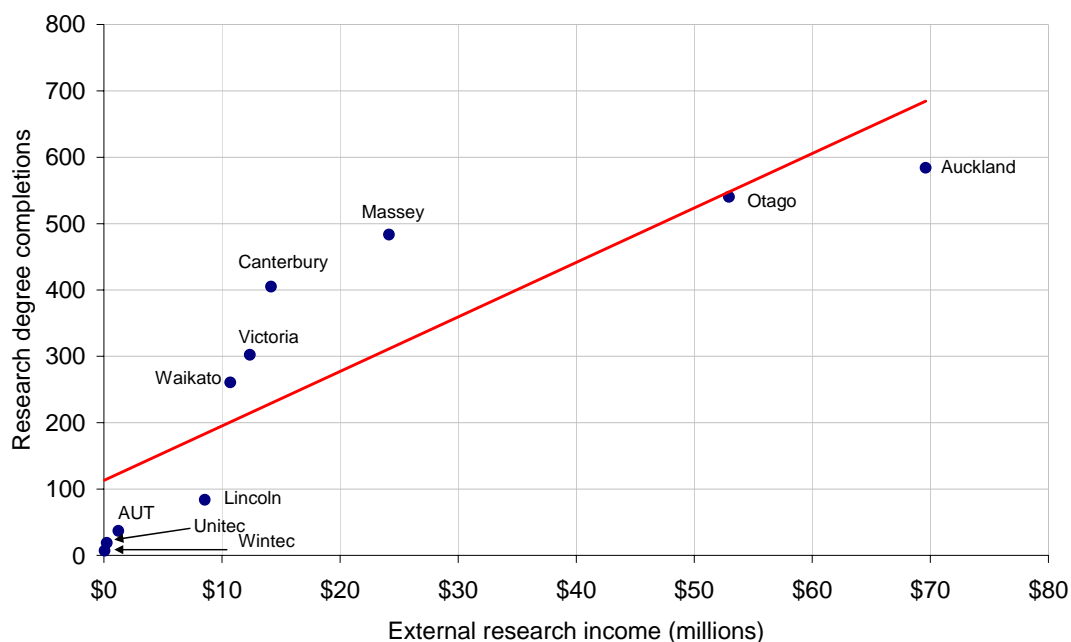
	PBRF quality score	OQS	RO	PE	CRE	ERI
<b>OQS</b>	0.9964					
<b>RO</b>	0.9956	0.9999				
<b>PE</b>	0.9975	0.9997	0.9993			
<b>CRE</b>	0.9977	0.9988	0.9981	0.9993		
<b>ERI</b>	0.9626	0.9550	0.9534	0.9550	0.9623	
<b>RDC</b>	0.9389	0.9544	0.9550	0.9536	0.9503	0.8592

Note: RDC is the value of the “volume of research factor” (VRF). The VRF assigns a value of 1 for degree completions of masters students with a 1.0 EFTS thesis and a value equivalent to the EFTS value of the research component between 0.75 and 1.0 EFTS. The VRF assigned a value of 3 for doctoral student completions. These values are aggregated for each TEO.

Sources: Ministry of Education, Tertiary Education Commission.

Table 2 shows that all five of the research quality measures are highly correlated to both the ERI measure and the RDC measure. Where the relationship is less strong is between the RDC measure and the ERI measure. This reflects the fact that several of the universities below the best-fit line in Figure 4 were above the line in Figure 5.

**Figure 6: 2003 PBRF quality evaluation: external research income vs research degree completions**



Sources: Ministry of Education, Tertiary Education Commission.

The capacity of a provider to earn external research income and the ability to recruit research students and carry them through to completion are both associated with the

quality of research performance in the provider. It appears, however, that the nature of the relationship between the PBRF measures of research quality and ERI differs from the nature of the linkage between research quality measures and RDC. It is also possible that universities give a different emphasis to these two aspects of their research performance.

## **5 Discussion and conclusion**

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The correlation coefficients set out above indicate a close and positive relationship between measures of distinct dimensions of research quality. The close correlation results from the interdependence of the dimensions. While the measures of research quality are closely aligned to the number of research degree completions (RDC) and the performance of the provider in attracting external research contract income (ERI), the relationship is somewhat less strong between the ERI and RDC components of the PBRF.

While the various PBRF measures may be closely connected, this is not to imply that there is a case for compressing the measures or for simplifying the PBRF measures. The PBRF measures are performance measures that are also funding allocation measures. When a measure is used to allocate funding, it has an important signalling effect, creating incentives for providers to put effort in particular activities<sup>10</sup>. In selecting the measures included in the PBRF, the government has attempted to establish a balanced performance measurement system that avoids the perverse incentives that sometimes arise from goal displacement in overly simple indicator systems. It has indicated what behaviours it values and wishes to encourage in research in tertiary education organisations.

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<sup>10</sup> It may also be worth noting that the initial PBRF round conducted in 2003 reflects patterns that existed before the PBRF was created – because, for instance, many of the research contracts that determined performance under the ERI measure were set up several years before, while the PhD students who completed in 2003 would mostly have started their studies in 2000 or earlier.

## Appendix

**Table 3: PBRF quality scores, ERI and RDC for universities and polytechnics**

TEO	Panel assessed FTE	PBRF eligible FTE	Total PBRF quality score	Total OQS	Total RO	Total PE	Total CRE	ERI (million)	RDC
University of Auckland	1,284.2	1411.8	5,607	506,142	5,326	4,520	4,370	\$69.6	584
University of Canterbury	542.9	590.1	2,257	207,580	2,193	1,864	1,740	\$14.2	405
Victoria University of Wellington	516.8	579.3	1,966	189,136	1,973	1,754	1,645	\$12.4	302
University of Otago	932.5	1,174.9	3,788	353,896	3,695	3,189	3,161	\$52.9	540
University of Waikato	429.8	536.3	1,601	154,042	1,607	1,391	1,381	\$10.7	261
Lincoln University	175.5	195.3	500	54,484	573	458	498	\$8.6	84
Massey University	945.4	1,225.8	2,574	281,370	3,010	2,431	2,279	\$24.1	484
Auckland University of Technology	201.5	567.7	436	52,723	557	472	441	\$1.2	37
Unitec	100.2	345.8	245	28,108	308	243	194	\$0.2	19
Wintec	52.9	108.0	35	9,009	99	73	63	\$0.1	7

Notes:

1. The quality scores are weighted on an FTE basis.

2. RDC is the value of the "volume of research factor" (VRF). The VRF assigns a value of 1 for degree completions of masters students with a 1.0 EFTS thesis and a value equivalent to the EFTS value of the research component between 0.75 and 1.0 EFTS. The VRF assigned a value of 3 for doctoral student completions. These values are aggregated for each TEO.

Sources: Ministry of Education, Tertiary Education Commission.

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