



CHAPTER TWELVE

RESEARCH IN THE TERTIARY EDUCATION SECTOR // 148-164

Overview and the 2007 year // **149**

Highlights // **150**

The impact of New Zealand's tertiary education sector's research // **154**

Measuring the quality of research in New Zealand's tertiary education sector // **160**

AN OVERVIEW

The research performance of the tertiary sector improved in several areas in 2006. In the area of research training, enrolments in doctoral degrees increased substantially. This was driven by a significant rise in international enrolments, which occurred in response to a change in government funding policy that funds international doctoral students on the same basis as domestic students. The number of people completing a doctoral degree decreased slightly in 2006, with men and international students especially showing a noticeable decline.

In the area of research output, the universities showed improvement in a number of areas. The external research contract income earned by the universities per academic staff member rose in real terms between 2004 and 2005. Total research output increased at four out of the six universities that reported research outputs in 2006. The academic impact of research by the New Zealand universities relative to the world average increased between 2000-2004 and 2001-2005 in four out of 10 broad subject areas monitored. Two subject areas – health, and medicine and public health – had an academic impact above the world average in 2001-2005.

THE 2007 YEAR

In 2007, the findings of the Performance-Based Research Fund 2006 Quality Evaluation were released by the Tertiary Education Commission. The next quality evaluation is scheduled to take place in 2012.

The Ministry of Education released two reports that used a newly available bibliometric dataset to examine the academic impact of New Zealand's university research. The first report – *(ex)Citing research* – analysed the relative academic impact of university research (measured by citations per publication) in broad and narrow subject fields between 1981 and 2005. The report found that the academic impact of New Zealand's university research was generally above the world average in the specialist research areas of the universities.

The second report – *Quality vs impact* – compared Performance-Based Research Fund quality scores from the 2003 and 2006 Quality Evaluations with the number of citations per full-time equivalent researcher in 10 broad subject areas. The report found that there was a positive relationship between the number of citations per full-time equivalent researcher and the Performance-Based Research Fund average quality scores, but that the strength of the relationship varied among subject areas.

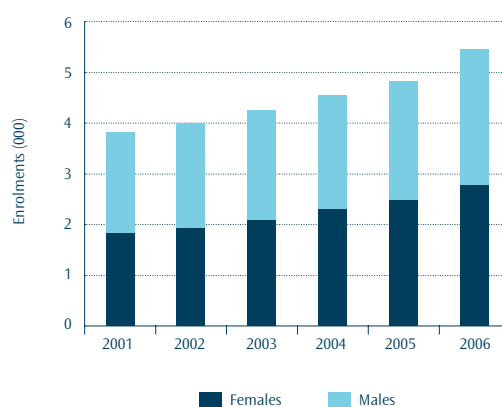
DOCTORAL ENROLMENTS

The number of doctoral enrolments continued to rise in 2006. While women still represented a majority of doctoral students' enrolments by men rose at a faster rate than those by women.

Doctoral enrolments in 2006:

| | | |
|--------|-------|------------------|
| Total | 5,467 | (up 13% on 2005) |
| Female | 2,778 | (up 11% on 2005) |
| Male | 2,689 | (up 15% on 2005) |

Figure 12.1// Doctoral enrolments by gender



MORE INTERNATIONAL AND PASIFIKA STUDENTS ENROL IN DOCTORAL STUDY

There was significant growth in the number of international students and Pasifika students enrolled in doctorates in 2006. The increase in international students is partly a result of a change to the funding regime for new international doctoral students.

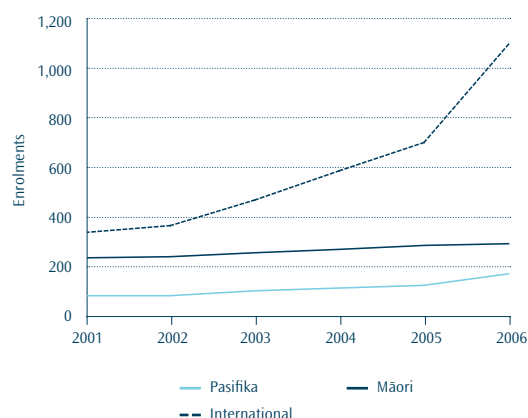
Doctoral enrolments by selected groups in 2006:

| | | |
|---------------|-------|-------------------|
| Māori | 282 | (up 1.8% on 2005) |
| Pasifika | 161 | (up 36% on 2005) |
| International | 1,084 | (up 56% on 2005) |

Notes:

1. Each student is shown in each ethnic group he/she identifies with.
2. Pasifika enrolments include domestic and international students.

Figure 12.2// Doctoral enrolments by selected groups



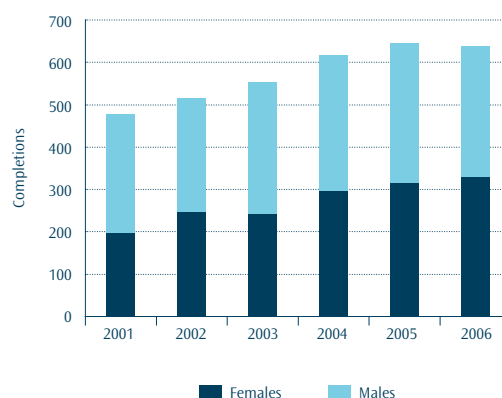
SLIGHTLY FEWER DOCTORAL COMPLETIONS

The number of doctoral completions fell slightly in 2006, mainly as a result of a fall in the number of men completing doctorates. The fall in the number of men completing doctorates reflects a fall in men starting doctorates in 2000 and 2001.

Doctoral completions in 2006:

| | | |
|--------|-----|---------------------|
| Total | 639 | (down 1.1% on 2005) |
| Female | 330 | (up 4.1% on 2005) |
| Male | 309 | (down 6.1% on 2005) |

Figure 12.3// Doctoral completions by gender



MORE MĀORI AND PASIFIKA DOCTORAL COMPLETIONS

The number of doctoral completions by Māori and Pasifika increased in 2006, while the number of completions by international students fell.

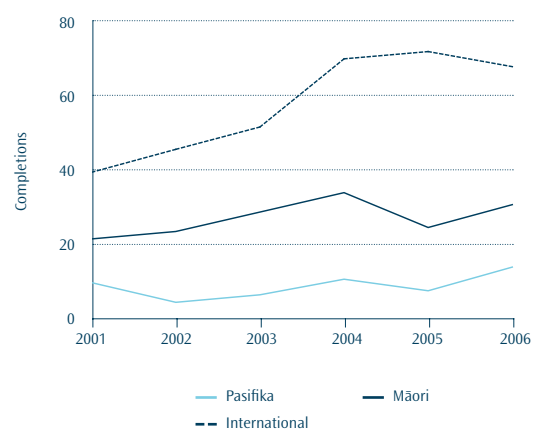
Doctoral completions by selected groups in 2006:

| | | |
|---------------|----|---------------------|
| Māori | 30 | (up 25% on 2005) |
| Pasifika | 13 | (up 86% on 2005) |
| International | 67 | (down 5.6% on 2005) |

Notes:

1. Each student is shown in each ethnic group he/she identifies with.
2. Pasifika enrolments include domestic and international students.

Figure 12.4// Doctoral completions by selected groups



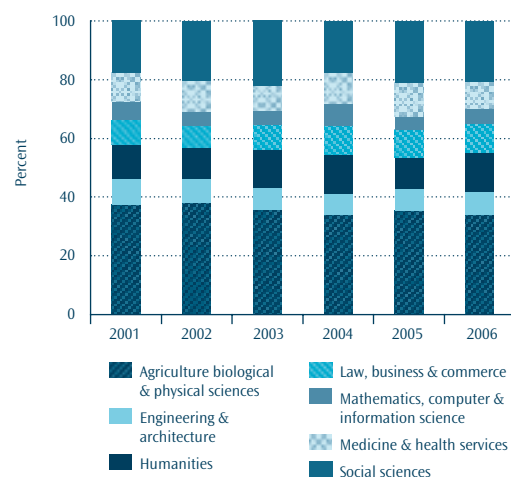
COMPLETIONS BY FIELD OF STUDY

The largest proportion of students completing doctorates in 2006 studied in the areas of the social sciences and biology/biological sciences.

The proportions of doctoral completions by subject area in 2006:

| | | |
|--|------|----------------|
| Agriculture, food, forestry and environment | 3.9% | (3.8% in 2005) |
| Biology/biological sciences | 21% | (17% in 2005) |
| Engineering and architecture | 7.7% | (7.3% in 2005) |
| Humanities | 13% | (11% in 2005) |
| Law, business and commerce | 10% | (9.6% in 2005) |
| Mathematics and computer and information science | 5.4% | (4.5% in 2005) |
| Medicine and health sciences | 9.0% | (12% in 2005) |
| Physical sciences | 9.6% | (15% in 2005) |
| Social sciences | 21% | (21% in 2005) |

Figure 12.5// Doctoral completions by field of study



DOCTORAL STUDENTS PER ACADEMIC STAFF MEMBER

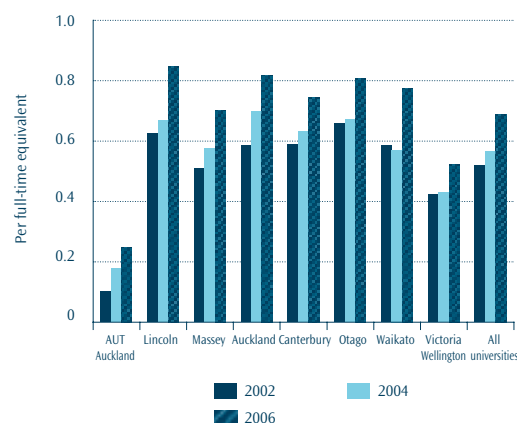
The ratio of doctoral enrolments per academic staff member rose substantially across all universities in 2006. This increase was mainly a result of the rise in international enrolments.

The ratios of doctoral enrolments to academic staff in 2006:

| | | |
|-----------------------------------|------|-------------------|
| All universities | 0.69 | (up 15% on 2005) |
| Auckland University of Technology | 0.25 | (up 14% on 2005) |
| Lincoln University | 0.85 | (up 28% on 2005) |
| Massey University | 0.70 | (up 19% on 2005) |
| University of Auckland | 0.82 | (up 6.8% on 2005) |
| University of Canterbury | 0.74 | (up 19% on 2005) |
| University of Otago | 0.81 | (up 14% on 2005) |
| University of Waikato | 0.77 | (up 24% on 2005) |
| Victoria University of Wellington | 0.52 | (up 27% on 2005) |

Note: This data treats the colleges of education as being merged with the universities for the entire time period.

Figure 12.6// Ratio of doctoral enrolments to academic staff



COMPLETIONS PER ACADEMIC STAFF

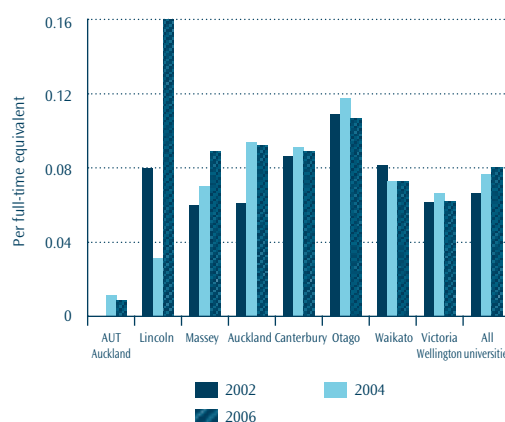
While the ratio of doctoral completions per academic staff member rose slightly overall for the universities in 2006, three universities exhibited a fall in the number of doctoral completions per academic staff member.

The ratio of doctoral completions to academic staff in 2006:

| | | |
|-----------------------------------|------|---------------------|
| All universities | 0.08 | (up 0.9% on 2005) |
| Auckland University of Technology | 0.01 | (down 32% on 2005) |
| Lincoln University | 0.16 | (up 41% on 2005) |
| Massey University | 0.09 | (up 2.4% on 2005) |
| University of Auckland | 0.09 | (down 14% on 2005) |
| University of Canterbury | 0.09 | (down 3.3% on 2005) |
| University of Otago | 0.11 | (up 2.8% on 2005) |
| University of Waikato | 0.07 | (up 65% on 2005) |
| Victoria University of Wellington | 0.06 | (up 8.1% on 2005) |

Note: This data treats the colleges of education as being merged with the universities for the entire time period.

Figure 12.7// Ratio of doctoral completions to academic staff



UNIVERSITY RESEARCH OUTPUT

The Universities of Canterbury and Otago, Victoria University of Wellington and the Auckland University of Technology reported an increase in research activity in 2006, with the fastest growth occurring at Victoria University of Wellington.

The number of research outputs reported for 2006:

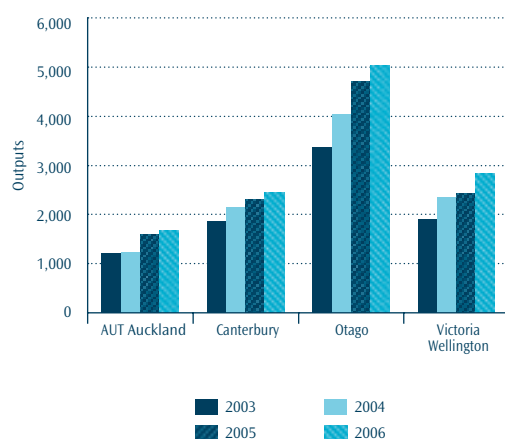
| | | |
|-----------------------------------|-------|-------------------|
| University of Otago | 5,034 | (up 7.0% on 2005) |
| University of Canterbury | 2,455 | (up 6.8% on 2005) |
| Auckland University of Technology | 1,678 | (up 5.1% on 2005) |
| Victoria University of Wellington | 2,843 | (up 17% on 2005) |

Notes:

1. This data treats the colleges of education as being merged with the universities for the entire time period.
2. Care should be used when comparing the research output of the universities due to differences in the way

Source: Annual reports of universities.

Figure 12.8// Reported research outputs of selected universities



UNIVERSITY RESEARCH PRODUCTIVITY

The Universities of Canterbury and Otago, Victoria University of Wellington and the Auckland University of Technology reported an increase in research output per full-time academic staff member, with the fastest growth occurring at Victoria University of Wellington.

Ratio of reported research outputs per academic staff for 2006:

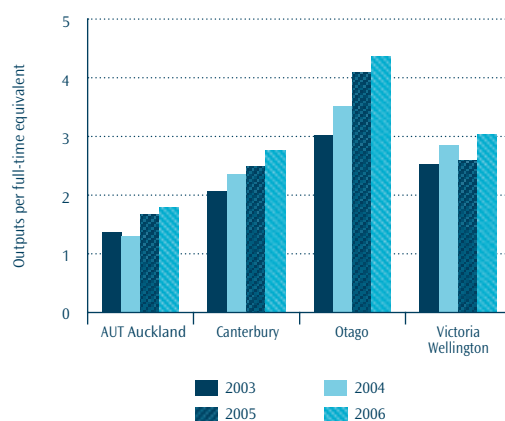
| | | |
|-----------------------------------|-----|-------------------|
| Auckland University of Technology | 1.9 | (up 6.5% on 2005) |
| University of Canterbury | 2.8 | (up 11% on 2005) |
| University of Otago | 4.4 | (up 6.5% on 2005) |
| Victoria University of Wellington | 3.0 | (up 18% on 2005) |

Notes:

1. Victoria University of Wellington changed the way they measure full-time equivalents from 2005. This resulted in a higher count of full-time equivalents compared with previous years.
2. This data treats the colleges of education as being merged with the universities for the entire time period.
3. Care should be used when comparing the research productivity of the universities due to differences in the way they count research outputs.

Source: Annual reports of universities.

Figure 12.9// Reported research outputs of selected universities per academic staff



UNIVERSITY RESEARCH CONTRACT INCOME

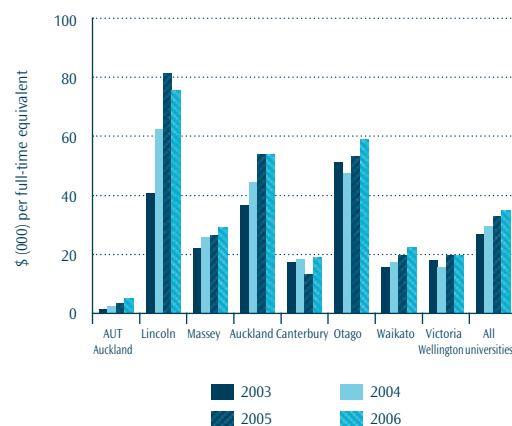
Figure 12.10// Reported research outputs of selected universities per academic staff

The inflation-adjusted amount of external research contract income per academic staff member continued to rise in the university sector in 2005. The largest increase was at Auckland University of Technology, although this was off a low base, and the largest decrease took place at Lincoln University.

Inflation-adjusted external research contract income for 2005:

| | \$ (000) per academic | |
|-----------------------------------|-----------------------|---------------------|
| All universities | 34.8 | (up 6.1% on 2004) |
| Auckland University of Technology | 5.1 | (up 54% on 2004) |
| Lincoln University | 75.4 | (down 7.2% on 2004) |
| Massey University | 29.0 | (up 9.5% on 2004) |
| University of Auckland | 53.8 | (down 0.2% on 2004) |
| University of Canterbury | 18.9 | (up 43% on 2004) |
| University of Otago | 58.7 | (up 10% on 2004) |
| University of Waikato | 22.1 | (up 12% on 2004) |
| Victoria University of Wellington | 19.5 | (up 0.1% on 2004) |

Notes: 1. The Performance-Based Research Fund definition of external research income has been used to calculate this ratio, 2. academic staff are calculated on a full-time equivalent basis, 3. the Consumers Price Index has been used to deflate the external research income data into 2005 dollars, and 4. This data treats the colleges of education as being merged with the universities for the entire time period.



Source: Ministry of Education and Tertiary Education Commission.

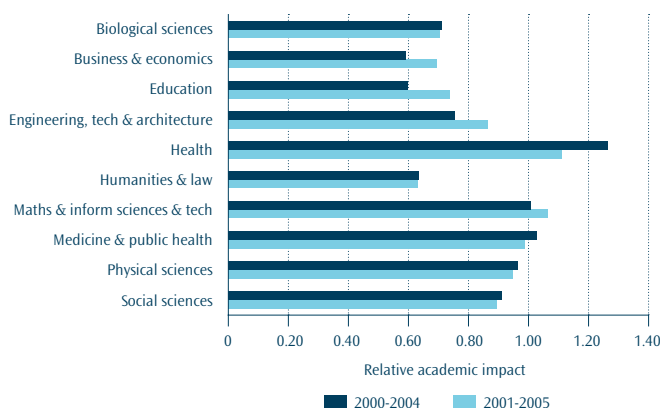
ACADEMIC IMPACT OF UNIVERSITY RESEARCH¹

Figure 12.11// Academic impact of university research

The relative academic impact of university research increased in 4 out of the 10 broad subject areas for the period 2001 to 2005. Despite a slight decrease in the relative academic impact for publications in the area of health over the period from 2001 to 2005, health research continued to have the greatest relative academic impact.

The relative academic impact of university research for the period 2001-2005:

| | | |
|---|------|---------------------|
| Biological sciences | 0.70 | (0.71 in 2000-2004) |
| Business and economics | 0.69 | (0.59 in 2000-2004) |
| Education | 0.74 | (0.60 in 2000-2004) |
| Engineering, technology and architecture | 0.87 | (0.75 in 2000-2004) |
| Health | 1.11 | (1.26 in 2000-2004) |
| Humanities and law | 0.63 | (0.64 in 2000-2004) |
| Mathematical and information science and technology | 1.07 | (1.01 in 2000-2004) |
| Medicine and public health | 0.99 | (1.03 in 2000-2004) |
| Physical sciences | 0.95 | (0.97 in 2000-2004) |
| Social science and other cultural/social sciences | 0.89 | (0.91 in 2000-2004) |



Source: Thomson Scientific.

1. (a) Measured by the number of New Zealand university citations per publication relative to the number of world citations per publication.
 (b) These subject areas are based on Performance-Based Research Fund panels. For a full description of the narrow subject areas within these subject areas see Smart and Weusten (2007) Table 1. Māori knowledge and development and creative arts have been omitted from the analysis.
 (c) All publications listed in the Thomson Scientific dataset in each five-year period, along with the citations associated with those publications in the same five-year period, are used to generate the relative impact measure.

(d) A relative impact score of less than one indicates that the academic impact of the publications was below the world average in that subject area. A relative impact score above one indicates that the academic impact of the publications was above the world average.
 (e) There are important caveats surrounding the use of bibliometrics. See Smart and Weusten (2007) for a full discussion of the caveats that apply to the use of this dataset.

THE IMPACT OF NEW ZEALAND'S TERTIARY EDUCATION SECTOR'S RESEARCH

In a recent report by the Ministry of Education Smart and Weusten (2007) examined the academic impact of university research, measured by citations per publication, in 10 broad subject areas. This new study complements the recent report by examining the research performance of selected tertiary education institutions. Specifically, this study examines the share of world publications and citations achieved by the eight universities² and one polytechnic (Unitec New Zealand), between 1981 and 2005.³

The increased focus on research that has come from the introduction of the Performance-Based Research Fund is expected to result in a stimulation of research activity and hence output. In addition, if the quality of research has increased, 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 Performance-Based Research Fund.

Given the time period of this analysis (1981-2005), it is too early to identify any impacts of the Performance-Based Research Fund, because of the lags associated with the research and publication process. Rather, this analysis establishes baseline data that can be updated over future time periods.

The structure of this commentary is as follows. First, the bibliometric dataset used in this study is described and caveats that apply to the use and interpretation of this data are presented. Then, the measures used in this study are explained. This is followed by a presentation of the results of the analysis for each of the nine institutions in this study. Finally, some conclusions are presented.

Bibliometric data

The source of the indexed publication counts and citations data used in this study is a unified bibliometric database from Thomson Scientific – a United States science and research organisation. This database contains the number of publications and the citations attracted by those publications in around 10,000 journals, which are selected for their quality and impact.

The types of research publications included in the database are articles, notes, reviews and proceedings papers. Other types of

items such as editorials, letters, corrections and abstracts have been omitted. A publication was assigned to an institution if at least one author was from that institution. If there were two authors from the same institution, the citations and papers were counted only once. However, where there are joint authors from different universities the publication is counted in the totals of each university.

The coverage of the bibliometric database across subject disciplines varies, with better coverage of research output in some subject disciplines than others. For example, the coverage of the biological and medical sciences is comprehensive, but the coverage of the humanities and social sciences is not as extensive. Therefore, institutions that have a medical school attached to them, or that have a focus on the sciences, will have a greater proportion of their research output captured by the Thomson Scientific database.

In addition, the journals selected in the Thomson Scientific database are based mainly in North America and Europe, which means that high-impact/quality research that is published in local journals will be less likely to be captured in the database. Also, although some subject disciplines, such as biological sciences, do disseminate most of their original research through journals, other subject disciplines, such as the humanities and social sciences, also publish newly created knowledge via books and book chapters. Therefore, the bibliometric database used in this study is by no means capturing all of the research produced by the tertiary education institutions. For a fuller discussion of the caveats that apply to the use of bibliometrics, refer to Smart and Weusten (2007).

Nevertheless, despite these caveats and limitations, bibliometric analyses of this type are still useful in identifying trends in research behaviour, especially over extended time periods.

Relative measures

The two measures of institutional research performance used in this article are:

- the share of world indexed publications produced in five-year overlapping time periods by the institution, and
- the share of world citations attached to those publications produced in the five-year overlapping time periods by the institution.⁴

2. Note that the dataset used in this study treats the universities as having merged with the colleges of education for the entire 1981-2005 time period. Also, Wellington Polytechnic's publications and citations are treated as part of Massey University's research output.

3. These were the tertiary education institutions with sufficient volume of publications in the Thomson Scientific database to include in the study.

4. The citations measured in this analysis are counted only 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.

These two measures are relative in nature, in that they express the number of indexed publications and citations as a percentage of the world total. The reason for using relative measures of performance is that rates of publication and citation have been naturally rising throughout the world over time. Therefore, it is necessary to discount for this inflation in numbers by expressing the measures as a percentage of the world totals.

An institution's share of world citations and indexed publications may increase for a number of reasons. There may be an increase in research productivity by existing staff, compared with the rest of the world. Or there may be an increase in the total number of research staff at an institution, boosting output. Similarly, a rise in the share of world citations may result from an increase in the academic impact of research or from a rise in the number of staff at the institution.

It is important to note that in interpreting these measures, it is **not** valid to compare the share of world indexed publications and citations of the various institutions to one another. Apart from the issue of the institutions being of different sizes, the University of Auckland and the University of Otago feature prominently in these measures as a result of having medical schools attached to them. Therefore, the performance of each institution should only be compared with its own past performance.

Also, the world share of citations at each institution cannot be simply added to arrive at a sector total, as publications that are jointly authored by researchers at different institutions would be counted twice and would inflate the share.

The impact of tertiary education research

Auckland University of Technology

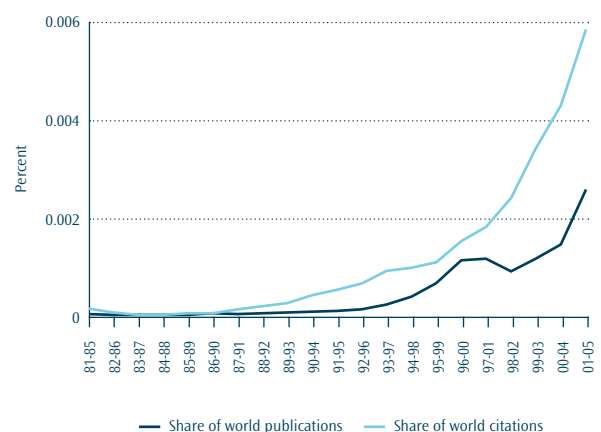
The Auckland University of Technology is New Zealand's newest university, having attained university status at the start of 2000. Previously, as the Auckland Institute of Technology, it was a polytechnic. The Auckland University of Technology began offering degrees in 1989, following the passing of the Education Act 1989, which removed the monopoly that universities had on the teaching of degrees. These two events, the beginning of degree teaching and the change of status to a university, would appear to have had a major impact on the research performance of this institution.

As can be seen in Figure 12.12, the Auckland University of Technology's share of world indexed publications and citations has been rising

from the late 1980s. This period of growth coincides with the commencement of degree teaching at the institution in 1989.

The change of status from a polytechnic to a university in 2000 has coincided with an exponential rise in the share of world citations. The Auckland University of Technology's share of world citations increased from 0.001 percent in 1995-1999 (the last period with publications before becoming a university) to 0.005 percent in 2001-2005. This pattern of exponential growth from a low base of performance is to be expected as the research culture matures and develops.

Figure 12.12 // Share of world indexed publications and citations by the Auckland University of Technology



Source: Thomson Scientific.

Lincoln University

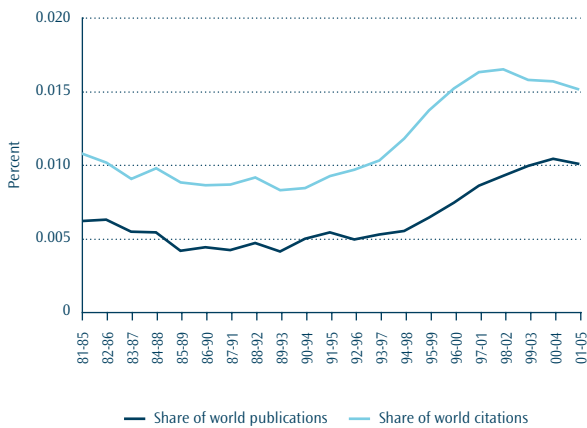
Lincoln University is New Zealand's smallest university and specialises in the land-based sciences. Lincoln began degree teaching in 1896 when it became a college of the University of New Zealand. But between 1961 and 1990 it operated as a college of the University of Canterbury and was known as Lincoln College.

The change in status in 1990 would appear to have had a substantial impact on Lincoln's performance. Before becoming an autonomous university, Lincoln's share of world indexed publications and citations had been declining, albeit slowly. In 1981-1986, the share of world indexed publications and citations was 0.01 percent. By 1989-1993,

the share of world indexed publications had decreased to 0.004 percent and the share of world citations to 0.008 percent.

However, in the years following Lincoln becoming a stand-alone university, its share of world indexed publications and citations has increased substantially. Lincoln University's share of world citations peaked at 0.016 percent in 1998-2002, while the volume of indexed publications peaked a little later at 0.01 percent in 2001-2004. Following these peaks, there has been a slight decline in both of these measures.

Figure 12.13 // Share of world indexed publications and citations by Lincoln University



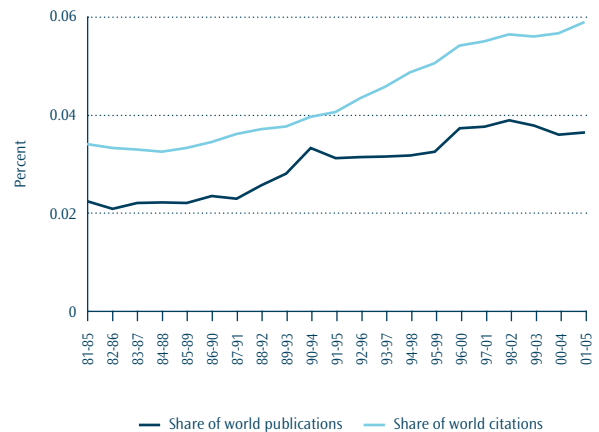
Source: Thomson Scientific.

Massey University

Massey University is one of New Zealand's largest universities. It has two major satellite campuses and Massey is also a major extramural provider. Overall, it has exhibited a general upward trend in its share of world indexed publications and citations. As can be seen in Figure 12.14, there has been a steady rise in Massey University's share of world citations, with an especially strong period of growth between 1985-1989 and 1996-2000. During this period, Massey's share of world citations increased from 0.032 percent to 0.054 percent. More modest growth in Massey's world share of citations between 1996-2000 and 2000-2004 has been followed by a slight upturn in share in the most recent time period, 2001-2005.

Massey University's share of world indexed publications has also exhibited an upwards trend over time, although there is more volatility in this output measure than was the case with citations. Massey's share of world indexed publications peaked at 0.039 percent in 1998-2002 but has since declined slightly to 0.036 percent in 2001-2005.

Figure 12.14 // Share of world indexed publications and citations by Massey University



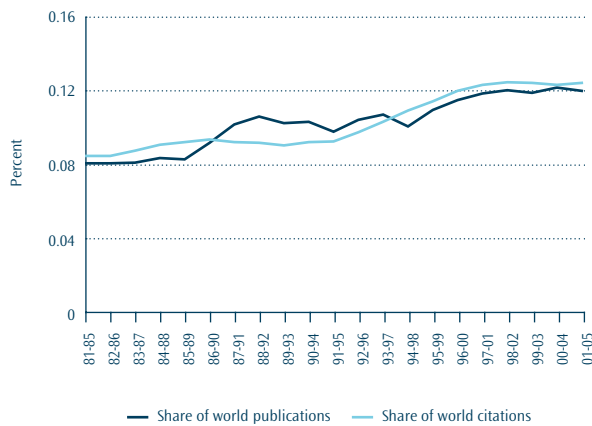
Source: Thomson Scientific.

University of Auckland

The University of Auckland is New Zealand's largest university. It also has a medical school, which boosts the number of research outputs captured in the Thomson Scientific database. As a result, the University of Auckland has one of the largest shares of world indexed publications and citations of the New Zealand institutions in this study.

Overall, the share of world indexed publications and citations has been rising at the University of Auckland over time. In 1981-1985, the University of Auckland's share of world indexed publications was 0.079 percent and the share of world citations was 0.084 percent. By 2001-2005, these had increased to 0.119 and 0.123 percent, respectively. As can be seen in Figure 12.15 the share of world indexed publications and world citations has remained relatively constant since the 1997-2001 period.

Figure 12.15 // Share of world indexed publications and citations by the University of Auckland



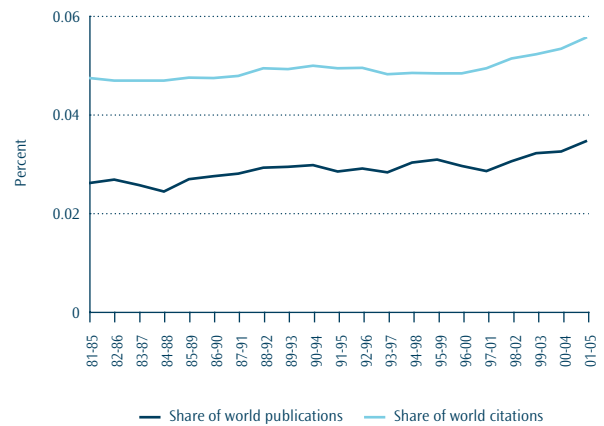
Source: Thomson Scientific.

University of Canterbury

There would appear to be two distinct phases to the performance of the University of Canterbury. Between 1981-1985 and 1997-2001, Canterbury's share of world indexed publications and citations remained within a fairly narrow range of 0.025 to 0.030 percent and 0.046 to 0.050 percent, respectively.

However, since 1997-2001 Canterbury's share of world indexed publications and citations has been growing significantly. By 2001-2005, Canterbury's share of world indexed publications had reached 0.036 percent while the share of world citations had reached 0.056 percent.

Figure 12.16 // Share of world indexed publications and citations by the University of Canterbury



Source: Thomson Scientific.

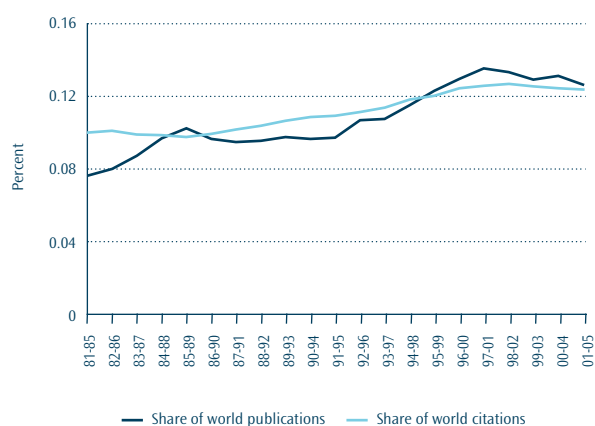
University of Otago

Like the University of Auckland, Otago has a medical school attached to it which boosts the number of publications captured by the Thomson Scientific database. Hence, Otago has one of the highest shares of world indexed publications and citations in this study.

Interestingly, the pattern of performance at Otago displays a similar pattern to that of the University of Auckland, in that, overall, there is an upward trend in the share of world indexed publications and citations. Otago's share of world indexed publications increased from 0.070 percent in 1981-1985 to a peak of 0.134 percent in 1997-2001. Since then, this share has decreased slightly to reach 0.125 percent in 2001-2005.

Otago's share of world citations increased from a low of 0.096 percent in 1985-1989 to a peak of 0.125 percent in 1998-2002. Since then the share of world citations has declined very slightly to 0.122 percent in 2001-2005.

Figure 12.17 // Share of world indexed publications and citations by the University of Otago



Source: Thomson Scientific.

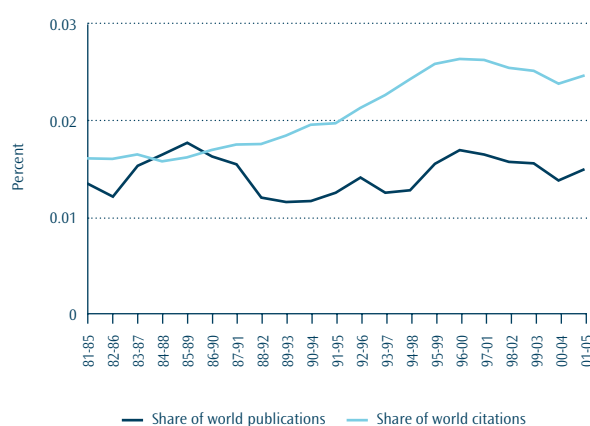
University of Waikato

The University of Waikato displays an unusual pattern compared with the other institutions in this study. Although Waikato's share of world citations has generally been rising between 1981 and 2005, the share of world indexed publications has not exhibited the same overall trend. This would suggest that the research published by the university is having an increased impact over time.

Waikato's share of world citations increased from a low of 0.016 percent in 1984-1988 to a high of 0.026 percent in 1996-2000. Since then, Waikato's share of world citations declined slightly to 0.023 percent, followed by a noticeable increase in the most recent five-year overlapping time period, 2001-2005.

Waikato's share of world indexed publications displays a more cyclical pattern. Waikato's world share peaked quite early at 0.018 percent in 1985-1989. There was another lower peak in share of world indexed publications in 1996-2000, before the share fell to 0.014 percent in 2000-2004. As was the case with Waikato's share of world citations, there has been a noticeable upturn in the share of world indexed publications in the most recent time period, 2001-2005.

Figure 12.18 // Share of world indexed publications and citations by the University of Waikato



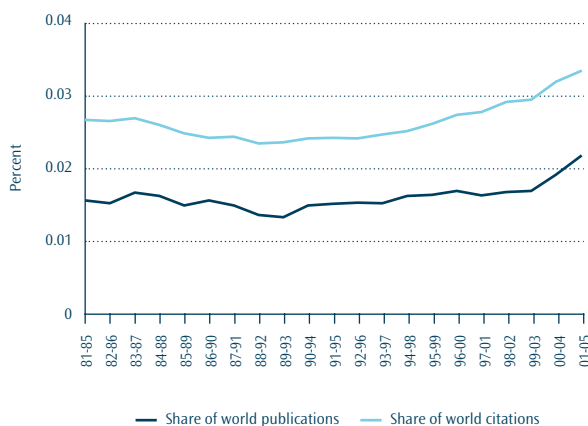
Source: Thomson Scientific.

Victoria University of Wellington

As can be seen in Figure 12.19, Victoria University of Wellington displays two main patterns of behaviour – a slow decline in the share of world indexed publications and citations between 1981-1985 and 1989-1993, followed by a rise in world share that gathers pace from 1999-2003 onwards.

After dropping since 1981-1985, Victoria's share of world citations bottomed out at 0.017 percent in 1987-1991. This was followed by a steady, if unspectacular, rise in Victoria's share of world citations to 0.029 percent in 1999-2003. However, in the last two five-year overlapping time periods, Victoria's share of world citations has increased significantly to 0.033 percent in 2001-2005. The trend in Victoria's share of world publications mirrors that of the share of world citations, with an even greater increase in share evident between 1999-2003 and 2001-2005.

Figure 12.19 // Share of world indexed publications and citations by Victoria University of Wellington



Source: Thomson Scientific.

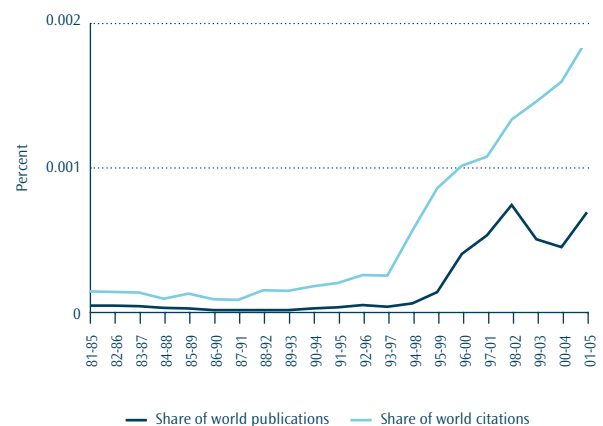
Unitec New Zealand

Unitec New Zealand is the largest polytechnic in New Zealand and has the highest number of degree students in that sub-sector. It is one of only two polytechnics that have participated in both the 2003 and 2006 Performance-Based Research Fund Quality Evaluations.

The key feature of Figure 12.20 is the dramatic increase in world share of both indexed publications and citations, albeit off a very low base, starting in 1994-1998. In 1993-1997, Unitec's share of world citations was 0.0002 percent. By 2001-2005, this had risen to 0.0019 percent.

This pattern of strong growth off a low base mirrors that of the Auckland University of Technology, which also has a relatively recent history of research production.

Figure 12.20 // Share of world indexed publications and citations by Unitec New Zealand



Source: Thomson Scientific.

Share of citations and publications

This analysis has shown that the share of world citations and world indexed publications by nine New Zealand tertiary education institutions has increased, in some cases substantially, over the period between 1981 and 2005. Those institutions that have the shortest research history, the 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 of its share of world indexed publications and citations in the years following this event.

Any evidence of an initial increase in academic impact and research output that may have resulted from the introduction of the Performance-Based Research Fund is sketchy, given the period of analysis in this study. It is likely that only the final two five-year periods, 2000-2004 and 2001-2005, would exhibit any impact of the Performance-Based Research Fund. There are some signs of a response at the University of Waikato and Victoria University of Wellington, but it is too early to tell if these improvements will be sustained and are directly related to the Performance-Based Research Fund. In all likelihood, it will take several years before any definitive conclusions can be drawn.

As the database used in this study can be updated on an annual basis, continued monitoring of performance measures, such as the ones used in this study, will be important to assess the impacts, both positive and negative, of the Performance-Based Research Fund on the research performance of New Zealand tertiary education organisations.

Reference:

- Smart, W. & Weusten, M. (2007) *(ex)Citing research: a bibliometric analysis of New Zealand university research 1981-2005*, Wellington: Tertiary Sector Performance Analysis and Reporting, Ministry of Education.

MEASURING THE QUALITY OF RESEARCH IN NEW ZEALAND'S TERTIARY EDUCATION SECTOR

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 Quality Evaluation. This was followed by a second partial quality evaluation in 2006. Although the measurement of research quality in the quality evaluations is primarily designed to facilitate the distribution of research funding, the results enable us to obtain a picture of the quality of research produced by New Zealand's tertiary education research workforce.

In particular, the data from the quality evaluations can help to identify the subject areas and tertiary education organisations that produce high-quality research. The results from the two quality evaluations have been discussed in detail by the Tertiary Education Commission (2004, 2007), so this article presents an overall summary of some of the main results of the quality evaluations.

This article is structured as follows. Firstly, the process of how quality is measured in the quality evaluations is briefly outlined. Then a summary of some of the key results of the 2006 Quality Evaluation are presented, along with a comparison with the 2003 results. Finally, some overall conclusions are presented.

Peer assessment to measure quality

The Performance-Based Research Fund quality evaluations use a system of peer assessment to measure the quality of research by Performance-Based Research Fund-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 with which they are held by their peers, and
- their contribution to the research environment.

Through a process of holistic assessment, the peer review panels rate the performance of the Performance-Based Research Fund-eligible staff in these three performance dimensions to arrive at a final quality category. In the first quality evaluation, four quality categories were awarded. An 'A' quality category was awarded to staff who were

assessed as producing research that was highly original or innovative and was esteemed by the international academic community. A 'B' quality category was awarded to staff who were assessed as producing research that was original and innovative and recognised beyond the staff member's own institution. A 'C' quality category was awarded to staff that were assessed as producing research that applied 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.

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.

There were a number of differences between the 2003 and 2006 Quality Evaluations. 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.

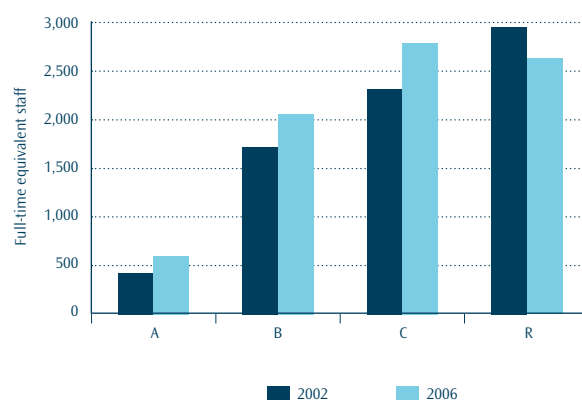
After consultation with the sector following the first quality evaluation, two new quality categories were introduced to measure the performance of new and emerging researchers, 'C(NE)' and 'R(NE)'. This allowed new and emerging staff, who may not have had the chance to produce a track record of research, but have nevertheless produced recent research of high quality, the opportunity to attract funding for their institution.

Higher research quality

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, 600 staff were awarded an 'A' quality category in the 2006 Quality Evaluation, up by 41 percent on the 424 awarded in 2003. There were also 2,064 staff awarded a 'B' quality category (an increase of 20 percent from 2003), 2,786 staff awarded a 'C' quality category (up by 20 percent from 2003) and 2,629 staff awarded an 'R' quality category (down by 11 percent from 2003). The average quality score increased by 14 percent, from 2.59 in 2003 to 2.96 in 2006.

In 2006, 33 tertiary education organisations participated in the quality evaluation, compared to 22 in 2003. In total there were 8,671 Performance-Based Research Fund-eligible staff in the 2006 Quality Evaluation, compared to 8,018 in the 2003 Quality Evaluation.

Figure 12.21 // Performance-Based Research Fund-eligible staff by quality category

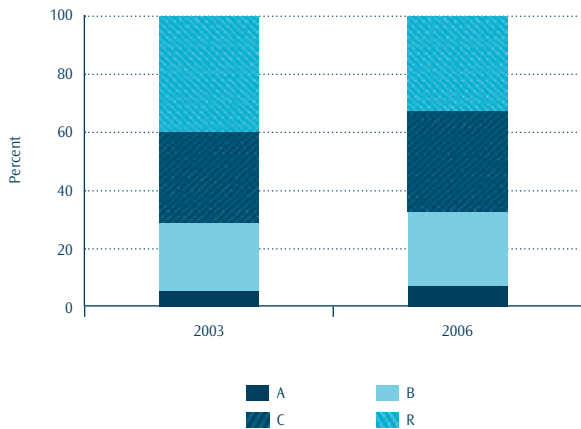


Source: Tertiary Education Commission.

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.

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 is presented as a proportion of total staff in Figure 12.22. The proportion of Performance-Based Research Fund-eligible staff awarded an 'A' quality category 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 12.22 // Distribution of Performance-Based Research Fund-eligible staff by quality category



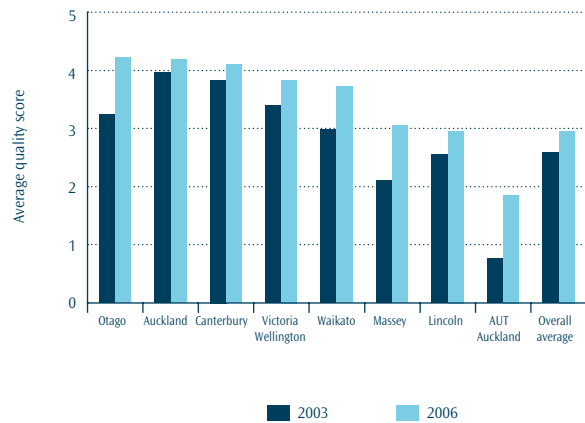
Source: Tertiary Education Commission.

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 who were allocated 'A' and 'B' quality categories. In 2006, 98 percent of staff awarded an 'A' or 'B' quality category were from universities, compared to 99 percent in 2003. In addition, the eight universities received the highest average quality scores in the 2006 Quality Evaluation. The average quality scores of the eight universities in the 2006 and 2003 Quality Evaluation are presented in Figure 12.23.

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 the 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.

Figure 12.23 // Average Performance-Based Research Fund quality scores by university

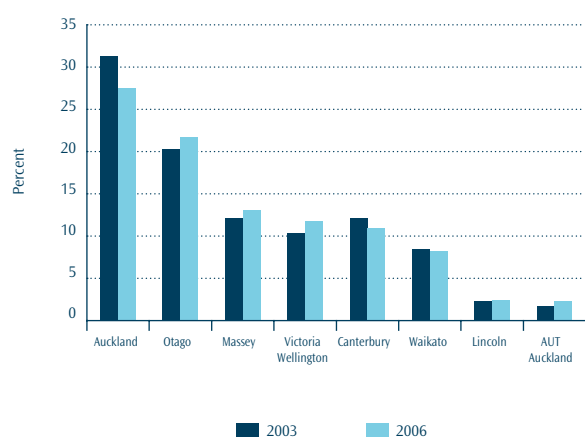


Source: Tertiary Education Commission.

However, determining the degree of improvement in quality between the 2003 and 2006 Quality Evaluations 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 12.24 presents the share of total staff awarded 'A' and 'B' quality categories by the eight universities in the 2003 and 2006 Quality Evaluations.

Figure 12.24 // Share of the total number of ‘A’ and ‘B’ Performance-Based Research Fund-eligible staff by university



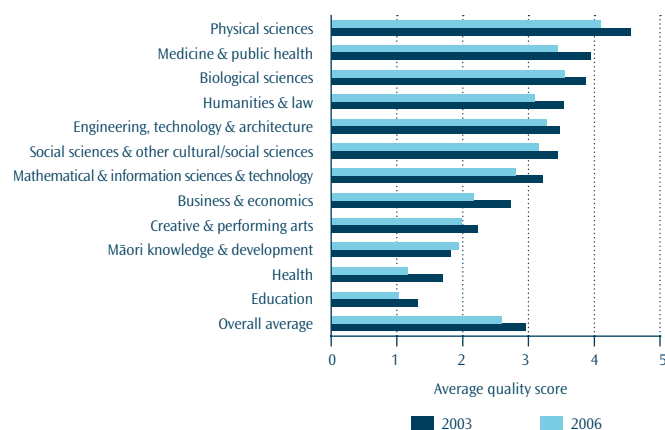
Source: Tertiary Education Commission.

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. Figure 12.25 presents the average quality scores in 2003 and 2006 by broad subject panel for all Performance-Based Research Fund-eligible staff. 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.

As can be seen in Figure 12.25, the average quality score increased in all subject panels, with the exception of Māori knowledge and development. 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).

Figure 12.25 // Average Performance-Based Research Fund quality scores by subject panel

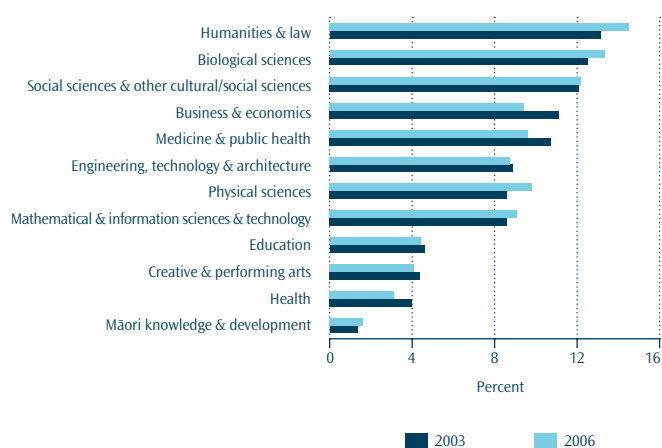


Source: Tertiary Education Commission.

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 determine how these changed between 2003 and 2006.

As can be seen in Figure 12.26, 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 12.26 // Share of the total number of 'A' and 'B' Performance-Based Research Fund-eligible staff by subject panel



Source: Tertiary Education Commission.

More research on quality to come

Overall, the results of the 2006 Quality Evaluation indicate that the quality of research at New Zealand tertiary education organisations 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. Further research will be required to attempt to control for these changes and hence get a clearer picture of changes in the quality of research.

Also, given the long-term nature of the research process and the relatively short period of time between the 2003 and 2006 Quality Evaluations, it will perhaps be of more relevance to compare the quality of research in the next quality evaluation (expected to take place in 2012) with that achieved in 2006.

References:

- Tertiary Education Commission (2004) *Performance-Based Research Fund: evaluating research excellence – the 2003 assessment*, Wellington: Tertiary Education Commission.
- Tertiary Education Commission (2007) *Performance-Based Research Fund: evaluating research excellence – the 2006 assessment*, Wellington: Tertiary Education Commission.