

Commentary

 on issues of higher education and research

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Welcome to this, the first issue of *Commentary*.

The purpose of *Commentary* is to contribute to debate on higher education and research policy in New Zealand. In this first issue we begin with a discussion of the characteristics of leading research universities around the world, why they matter, and what the benefits are likely to be of encouraging such institutions to flourish in New Zealand.

It's August 2007 and we find ourselves, once again, in the midst of reform in the New Zealand tertiary education sector. One key driver of the current reforms is, quite rightly, that of 'distinctive contributions' – determining the unique and important contribution each type of tertiary institution can make to New Zealand.

During the 1990s, public policy in New Zealand, and in many other western countries, was focused on increasing participation rates in tertiary education. At the same time, government funding per student declined in real terms (typically it was not inflation adjusted at all) and so institutions were further motivated to increase enrolments in order to maintain their revenue streams. As a result, New Zealand achieved among the highest entry rates in the OECD to all forms of higher education. Concurrent changes in government policy allowed institutions to move into areas other than their traditional type of provision. Thus, for example, institutions outside the university sector began to engage in significant degree teaching, including at postgraduate level, despite the fact that they did not provide the research-rich environments for degree

teaching mandated by the Education Act.¹ This led to a blurring of what had been the distinctive roles of our institutes of technology and polytechnics, universities and other tertiary institutions.

Overseas, more differentiated tertiary education systems are commonplace. Research universities are an important component of these systems. These institutions, many of which are well-known the world over (such as Harvard, Yale, MIT, Oxford, Cambridge, Melbourne, and the Australia National University), make a significant contribution to their regional and national economies. For example, Harvard's annual economic impact in terms of job creation, new ideas, and as the stimulus for new companies and investment is estimated to be worth more than US\$3.4 billion to the Boston Area economy.²

The Government's acknowledgement (through the reforms) that not all institutions are, or should be, the same is a critical and ultimately enabling first step towards the positioning of one or more New Zealand research universities as institutions of international quality and status. However, as we explore here, consideration of the

factors that are common to such institutions reveals that there are several other necessary conditions for their development.

What do we mean when we talk about a world-class research university?

This is an obvious question, but coming up with a precise answer is not easy. We all know Harvard, Oxford or Cambridge when we see them, but after that things become less clear. However, the research universities generally understood to be the best in the world have a number of characteristics in common. These include:

- **First and foremost, top quality staff.** The leading universities have among their faculty large numbers of people who are international thought leaders – those who hold Nobel Prizes, Fields Medals and fellowships of the top scholarly academies. Harvard, for example, has had 30 Nobel Laureates on its staff. In its entire history New Zealand has had just three Nobel Laureates, not one of them resident in this country in the two or three decades prior to winning the Prize.

1 New Zealand Vice-Chancellors' Committee (2006). The Distinctive Contribution of Universities. Available on-line www.nzvcc.ac.nz

2 Appleseed (2004). Innovation and Opportunity: Harvard University's impact on the Boston Area Economy. Available on-line: www.community.harvard.edu/economic-impact/

- **Second, a highly selected student population.** Top research universities overseas do everything they can to attract the very best students, including offering very generous fee and boarding scholarships, and accommodation. The bright young things they attract not only bring lustre to the institution through their achievements, but are more likely to go on to graduate school and become the thought leaders of the future.

- **Third, a strong research culture.** This typically includes a high proportion of postgraduate students (often as high as 50%, compared to the 10-15% more common in New Zealand), a large number of postdoctoral fellows and other full-time research staff, excellent research facilities, a massive portfolio of patents and other protected inventions, and research parks or similar ventures which help to commercialise university research and create new industries. For example, the Cambridge Science Park in the UK has 70 hi-tech companies with 5,000 employees. The world's largest science park, a joint venture between North Carolina State, Duke and the University of North Carolina at Chapel Hill, covers 7,000 acres and has 39,000 employees in 145 organisations.

- **Fourth, a high level of private support through philanthropy.** In the United States, the top five universities in philanthropic terms – Harvard, Yale, Stanford, Princeton and the University of Texas system – together had, in 2006, US\$87 billion of endowment funds.³ This reflects, of course, not only the wealth that exists in the United States, but also the long history of private giving in support of universities.

- **Fifth, a strong emphasis on thinking and acting as international institutions.** Leading research universities do not confine themselves, their staff and or their students to issues and experiences within national boundaries. They are global institutions, welcoming outstanding visitors, staff and students from around the world, bringing in new ideas and focusing on teaching and research of international relevance. In doing so, they assess the quality of all they do by global standards.⁴

- **And sixth, a high degree of autonomy and academic freedom,** albeit with appropriate accountability for the use of public and private funds. While responsible to their many stakeholders and those who fund and invest in them, they operate in an environment that supports and encourages intellectual enquiry and entrepreneurial behaviour.

The New Zealand 'challenge'

Perhaps not surprisingly, given this list, the most difficult thing about building an international research university is that it is an extremely expensive business, and there must be few developed countries in which it is more difficult than New Zealand.

For example, it is very difficult to see how one can build international quality universities and a sophisticated knowledge economy by proportionately reducing investment in degree and post-graduate education while increasing substantially the amount of money spent on low level courses which do not add to the vocational opportunities of students and make little or no impact in the business sector. Yet, that is essentially what has happened in the tertiary sector in New Zealand in recent years, as the graph below shows.⁵

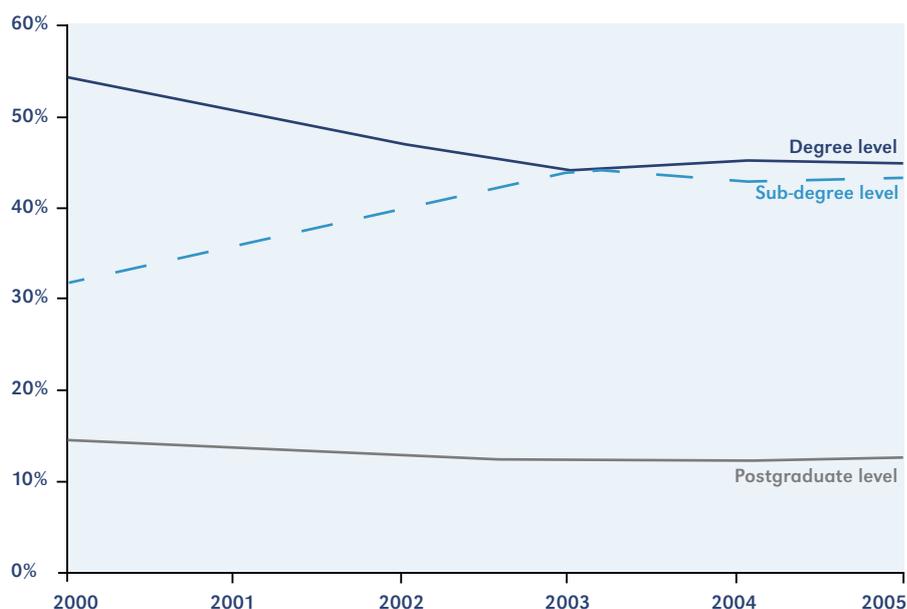
We are already seeing some evidence within

the present Government of a desire to realign its investment in tertiary education in a more sensible and productive fashion. This is to be applauded. However, small incremental change will not achieve the results Government and industry are seeking, nor that which the New Zealand economy so desperately needs. We need a dramatic shift in thinking that encourages and enables research and innovation of the highest quality to thrive.

The challenge New Zealand must address is that the most successful tertiary institutions in the world, those against which our best universities ought to be benchmarking themselves, operate with levels of public investment that we in New Zealand struggle to comprehend. To cite just one example, federal and state funding in the United States public universities is estimated at US\$12,000 per student – approximately twice that of New Zealand in equivalent purchasing terms. And that doesn't take into account the additional impact of the substantial endowments that many US universities enjoy.

It is not just the US that eclipses us in terms of public investment. The United Kingdom invests in universities at a rate that is well above our own (US\$7,400 per full time student in 2004, compared with US\$5,500 in New Zealand – a difference of 35 per cent adjusted for purchasing power parity). Per equivalent full-time student, Australia also invests 25 per cent more in its

Proportion of student component funding ⁵



3 2006 NACUBO Endowment Study. National Association of College and University Business Officers, Washington D.C. 2007.

4 Professor Donald Markwell, Deputy Vice-Chancellor (Education), The University of Western Australia. ABC Radio National interview, 14 October 2006. Transcript available on-line: www.abc.net.au/rn/saturdayextra/stories/2006/1763354.htm

5 New Zealand Vice-Chancellors' Committee (2006). An Investment Approach to Public Support of New Zealand's Universities. Available on-line: www.nzvcc.ac.nz

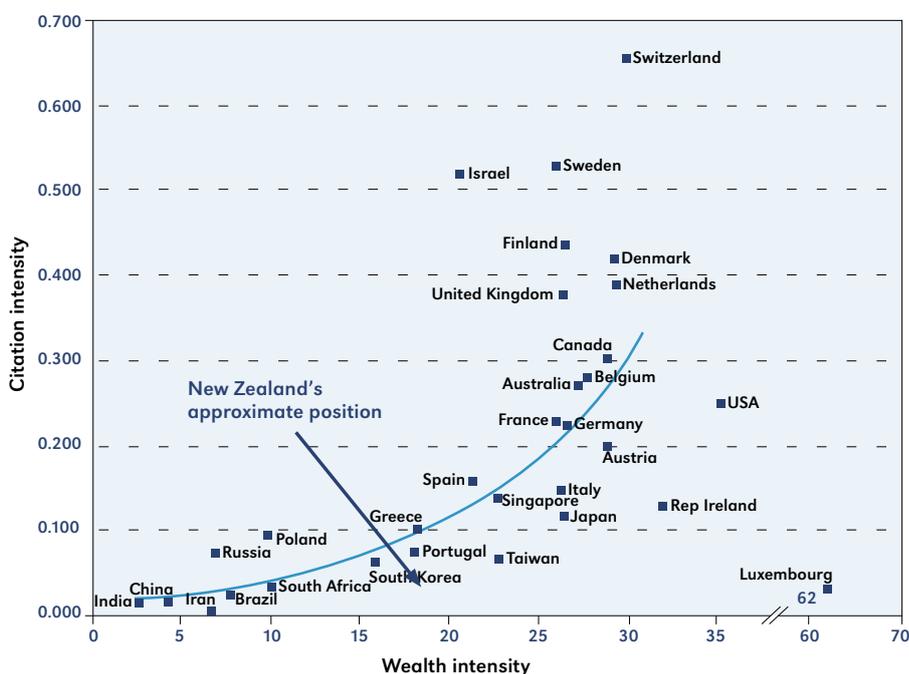
universities than New Zealand (and nearly twice as much in its eight leading research universities). Note that this differential was prior to Australia's recently announced 2007 federal budget, which brought increased funding of nearly A\$7 billion into the sector. According to Australia's Minister for Education, Science and Training, the stated aim of this increase in investment is to 'allow more world-class universities to emerge and encourage greater excellence, diversity and specialisation in the sector'.⁶

Faced with such comparisons, fingers are often pointed at New Zealand's relative lack of wealth, with the implication that we can't be expected to fund tertiary education to the same level as 'wealthier' countries. The reality is that New Zealand's public expenditure on tertiary education is not low by world standards – as the table below shows it is among the highest (as a proportion of GDP) in the OECD. What is unusual about New Zealand is the pattern of public expenditure. Such expenditure comprises both financial investment in the tertiary institutions and financial support of students. New Zealand is unusual in expending a very low proportion of its tertiary funding on institutions (just 56% vs the OECD average of 83%) and a very high proportion on financial support to students (44% of the total expenditure vs an OECD average of only 17%).⁵ It is this unusual pattern of expenditure on students rather than on institutions, and the increasing investment in recent years on sub-degree (and typically non-vocational) courses, that has led to the very low level of investment in our universities.

So what do world-class research universities do?

A publication three years ago in the prestigious scientific journal 'Nature' looked at the relationship between wealth intensity, as measured by GDP per capita, and the intensity of research as measured by the ratio of citations of research papers to the national GDP. In other words, high citation intensity was indicative of a country, and in most cases would be indicative of a few institutions, that were producing a large number of research outcomes of high impact relative to the size of the country.

Intensity of research and wealth intensity show a positive relationship, and the relationship is very strong. At the bottom of the graph are countries like India, China, Russia and Brazil with very low research intensity and low wealth intensity. At the top of the graph are Switzerland, Sweden, Israel, Denmark, the UK, the US, Australia and Canada, all countries which have a very strong research culture and strong economies.⁹ The smaller countries among this group are often those against which New Zealand is compared in terms of aspirations for our future.



Investment in tertiary education	New Zealand	Australia	Canada	United Kingdom	United States	OECD Average
Public expenditure as a percentage of GDP ⁷	1.7%	1.2%	2.0%	1.1%	1.4%	1.3%
Distribution of public expenditure:						
– Direct expenditure on institutions ⁸	56%	65%	79%	76%	82%	83%
– Financial support to students	44%	35%	19%	24%	18%	17%
– Other	-	-	2%	-	-	-
Public expenditure as a percentage of GDP:						
– Direct expenditure on institutions	0.9%	0.8%	1.6%	0.8%	1.2%	1.1%
– Financial aid to students	0.8%	0.4%	0.4%	0.3%	0.2%	0.2%

6 Budget Information 2007 – At a Glance (2007). Available on-line: www.dest.gov.au/portfolio_department/dest_information/publications_resources/resources/budget_information/

7 Public expenditure on tertiary educational institutions plus student support (including subsidies for living costs).

8 Includes financial support of students which is directly attributable to educational institutions.

9 Adapted by permission from Macmillan Publishers Ltd: Nature, King, David A. 'The scientific impact of nations: What different countries get for their research spending'. Volume 430, 15 July 2004. Copyright (2004).

New Zealand is not shown on the graph – tellingly, we do not feature in the group of countries that account for more than 98 per cent of the world’s highly cited papers (although similarly populated countries like Singapore and Ireland do, along with much smaller Luxembourg).

Our position can, however, be estimated – we lie approximately two thirds of the way down the graph with relatively low research intensity and wealth intensity, in a similar position to Greece, Portugal, and South Korea.

The point about this is that there is a positive, and probably self-reinforcing, relationship between investment in research excellence and the creation of wealth. Countries wishing to develop a strong industrial base, particularly new industries which rely on the prior creation of new knowledge, must invest heavily in research and development.

If we need a reminder about the importance of knowledge creation, it is worth noting that Microsoft Corporation, the world’s largest commercial enterprise, did not exist 32 years ago. And as Gray Davis, the then Governor of California, pointed out in 2000:

Fifty years ago, there was no Silicon Valley; 30 years ago there was no bio-tech industry; 10 years ago there was no internet. Who knows what new enterprises will be created or what medical breakthroughs will result because of our (research) institutes? But this we do know, breakthroughs will occur.

The US has good reason to be confident of such breakthroughs – the relationship between university research and economic growth is well documented. Studies into the impact of education on US economic growth between 1929 and 1969 found that more than half of the economic growth could be

attributed to growth in education.¹⁰ More recently, the US Committee for Economic Development found that total R&D (of which ‘the most important American institutions conducting basic research are the nation’s 200 major research universities’) accounted for 12 to 25 per cent of the annual growth in productivity since the end of the Second World War.¹¹ There are many reasons why the same relationship could, and should, be found in New Zealand.

A 2004 literature review of the economic and social impact of higher education research funding found that developing ‘leading edge research centres and educational institutions are critical long-term economic growth strategies for states and metropolitan areas’.¹²

Access to facilities, instrumentation, associated techniques and university expertise has been found to be of considerable importance to the realisation of important spin-off relationships between universities and industry. Indeed, it is often an important determinant of the choice of location for a company.

Varga (1997) found that access to knowledge transfer from universities is a strong influence on company location in the biotechnology sector. ‘Furthermore, it was evidenced that a university scientist having been awarded a Nobel Prize significantly increases the probability that biotechnology firms locate near the university.’¹³

Becoming world-class in New Zealand

A critical mass of leading staff and outstanding students in a university, enabled by adequate investment and an international reputation for teaching and research, produces research outputs, an atmosphere of intellectual excitement,

and productive relationships with industry which cannot be replicated elsewhere. To cite just one example of what is possible, a November 2006 study by the Ministry of Research, Science and Technology found that of 16 New Zealand-developed drugs currently in clinical trials approved by the US Food and Drug Administration, 13 had been developed by our universities – and 12 of them by The University of Auckland!¹⁴

To reach this goal, and achieve the characteristics shared by world-class research universities, vision, commitment, and a desire for change are required. These will assist New Zealand’s leading universities to provide a learning environment of the highest quality, to lead the advancement of knowledge creation, intellectual discovery and innovation within New Zealand, and to take our place with world-class research universities on the global stage.

Vision, commitment and a desire for change will, however, not be sufficient. Increased levels of public and private investment will also be required, along with a particular commitment to the stated aim of the current reforms – differentiation. Both Australia and the US concentrate research excellence (and investment) in those institutions most likely to produce results for economic and social development. We need the same willingness in New Zealand to recognise and fund excellence in a selective and strategic fashion. Only then will the current tertiary reforms be successful.

10 Denison, E (1974). Accounting for United States Economic Growth, 1929 – 1969. Washington DC, Brookings Institution

11 Committee for Economic Development (1998). America’s Basic Research: Prosperity through Discovery, p3. Available on-line: www.ced.org/docs/report/report_basic.pdf.

12 Lynch, T and Aydin, N (2004). Literature Review of the Economic and Social Impact of Higher Education Research Funding. p8. Available on-line: www.cefa.fsu.edu/sus_2004.pdf

13 Varga, A (1997). Regional Effects of University Research: A Survey. p19. Available on-line: www.rri.wvu.edu/wpapers/pdffiles/surveyattila.pdf

14 MoRST Biotech roadmap – Available on-line: www.morst.govt.nz/current-work/roadmaps/biotech/



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Commentary is produced on an occasional basis by the Office of the Vice-Chancellor at The University of Auckland, and brings together some of the research-based evidence relevant to current issues in higher education and research.

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