Submission to the Productivity Commission's research study on public support for science and innovation in Australia

August 2006

Introduction

The Group of Eight (Go8) welcomes the opportunity to make this submission to the Productivity Commission's study of public support for science and innovation in Australia. The study is timely, occurring just over a decade since the then Industry Commission's comprehensive examination of the economic returns from public investment in research and development in Australia, three years since the *Mapping Australian Science and Innovation* project undertaken by the Department of Education Science and Training and midway through the budgeted life of the Government's science and innovation package - *Backing Australia's Ability*.[1]

The study takes place at a time when Australia, like many countries, is grappling with the challenges posed by issues such as demographic and environmental change, the threat of terrorism and the burgeoning global knowledge-based economy. The study represents an excellent opportunity for an independent appraisal of the state of Australia's science and innovation systems; to review the international literature and evidence about the relationship between public support for science and innovation and productivity; to try to better understand the complex processes by which research and research training produces outcomes of value to society; to consider the value of the substantial investment the government makes in these areas on behalf of all Australians; and to assess what reforms might be required to enhance the capacity of our science and innovation systems (and in particular our universities) to deliver benefits into the future.

This submission sets out the key issues, from the perspective of the Go8, arising from the terms of reference for the study, the Issues Paper released by the Commission on 12 April 2006 and discussions Go8 representatives have had with Commission officials in recent months. The submission suggests various avenues of enquiry that might be pursued by the Commission as the study continues. It does this by:

1. Providing brief background information on the defining characteristics of Go8 universities.
2. Placing the study in its national and global economic policy contexts.
3. Outlining the diverse ways by which Australia's research-intensive universities contribute to positive economic, social, cultural and environmental outcomes.
4. Discussing the environment in which Australia's universities currently operate – highlighting existing and future barriers to the improved quality, efficiency and productivity.

Key themes underpinning this submission

A number of key inter-related themes underpin the information provided in the submission. They include:

- The contribution that Australia's research-intensive universities make to the economy and society more broadly through the yielding of new knowledge, discoveries and understanding.

[1] Industry Commission (1995), *Research and Development*, Report No. 44, Commonwealth of Australia, Canberra; Department of Education Science and Training (2003), *Mapping Australian Science and Innovation Report*, Canberra; For information on *Backing Australia's Ability* see http://backingaus.innovation.gov.au/.

- The crucial role that Australia's research-intensive universities play in the science and innovation systems in terms of providing access to, understanding of, and the capacity to apply the 99 per cent of research that occurs outside of Australia.
- The importance to innovation and productivity of the human capital role of Australia's research-intensive universities.
- The highly unpredictable, complex, multifaceted and often non-linear nature of the university research/knowledge transfer process and the difficulties this poses for quantifying the value of public investment in such activities.
- The importance of and need for diversity in Australia's higher education system to ensure quality, strength and dynamism.
- The need to make research quality the key driver of public research funding.
- The need for recognition of the contribution made to innovation by research and training in the non-sciences (social sciences, arts and humanities), particularly in the increasingly important services sector of the Australian economy.
- The need for research funding and program design to maximise the amount of time researchers have available for their research and related activities and to minimise the amount of time they must spend seeking funding and complying with regulations.
- The link between international perceptions of the quality of Australia's higher education systems (both in research and training) and the desirability of Australia as a destination for international students.
- The need for an economically robust and readily understandable outcomes-based mechanism for assessing the returns to public support for science and innovation in Australia.

1. Characteristics of the Go8 universities

Like leading research-intensive universities around the world Go8 universities are characterised by the strong emphasis they place on:

- Excellence in research and research training performed in a global context.
- Substantial time devoted to advanced hands-on undergraduate and post-graduate training in handling scientific theory and research methods linked to cutting-edge research.
- Hosting of major research infrastructure and instrumentation.
- Significant time spent by academic staff carrying out peer-review quality-assurance activities as an integral part of internationally-engaged research (journal refereeing, grant application refereeing etc).
- Concerted efforts to develop new and improved research instruments, tools and methods.
- Strategic efforts to commercialise useful knowledge and intellectual property.
- Other 'third stream' activities aimed at disseminating knowledge and expertise for community benefit.

In 2005 Go8 universities:

- Were all ranked in the top 100 universities in the world in the 2005 Times Higher Education Supplement University Rankings and in the top 250 in the 2005 Shanghai Jio Tong University Institute of Higher Education Rankings.
- Enrolled 275,000 undergraduate and postgraduate students, including 55,000 international students.
- Awarded 71,338 degrees including 6,650 postgraduate research degrees.
- Earned revenues of $6.76 billion including $898 million in tuition fees from international students.
- Spent $6.68 billion on recurrent and capital expenditure.

- Expended $2.2 billion on research activities—producing in excess of 23,000 research publications, disclosing 490 inventions and filing 374 Australian and US patent applications (2004).
- Employed 37,664 full-time equivalent staff paying in excess of $3.5 billion in staff salaries and benefits.
- Paid $177 million in payroll tax to state and territory governments and received $143 million in funding from this sphere of government.[2]

Based on average salaries and tax rates for 2005 the Go8 conservatively estimates that employees of member universities paid tax on income earned from the universities of around $730 million per annum. Further, the Go8 estimates that students graduating with undergraduate qualifications from member universities in 2005 can collectively expect net (after tax) lifetime monetary gains of around $15.6 billion compared to not having chosen to obtain a university qualification.[3] While the private returns to students from investment in higher education are substantial, the broader economic benefits are significant—and include the additional taxation paid on the increased earnings.

A large proportion of what has historically been called ‘basic’, ‘fundamental’, or ‘discovery’ research occurs in Go8 universities, which together win around 70 per cent of national competitive research funding. However, our experience is that in practice, research is most commonly a combination of basic and applied. A research endeavour characterised as ‘basic’ will often generate applications at many points through the discovery process. It is not a simple linear model. The importance of this relationship was recognised by the then Industry Commission in its 1995 study:

> *The role of basic research is not directly to generate commercial products, but rather to provide essential support for, and raise the return on, more applied research. This is a much more diffuse role, but also a critically important one in successful innovation. It occurs through:*
> - *training researchers, many of whom will work for industry and government;*
> - *creating a store of ‘background’ knowledge, which improves the effectiveness of technological search activities;*
> - *enabling membership of ‘networks’ yielding access to the large body of knowledge generated worldwide; and*
> - *developing new research techniques and instrumentation.*[4]

2. Placing the study in its national and global economic policy contexts

Australia has experienced a remarkable period of sustained economic growth—now in its 15th year. While this strong economic performance may well continue for several more years, some serious policy challenges loom on the horizon, principally because of Australia’s rapidly ageing population. In the midst of a prolonged global resources boom, signs are already emerging that Australia’s workforce is stretched to capacity and that labour shortages are impacting on productivity.[5]

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[2] Statistics derived from a range of sources including university annual reports for 2005 and returns to the National Survey of Research Commercialisation.

[3] Estimate based on the methodology applied in: Borland, J. (July 2002), *New Estimates of the Private Rates of Return to University Education Australia*, Melbourne Institute Working Paper No 14/02, Melbourne Institute of Applied Economics and Social Research, The University of Melbourne, Melbourne.

[4] Industry Commission, op.cit., Overview p.5.

[5] See for example, Department of Education Science and Training (July 2006), *Audit of Science, Engineering & Technology Skills*, Summary Report, Commonwealth of Australia, Canberra.

According to the Government's 2002 Intergenerational Report, without major policy reform and improved productivity across the economy, demographic change over the next four decades will see Australia's rate of economic growth average only 2.25 per cent per year, a full 1.5 per cent lower than the average growth rate experienced during the 1990s, as well as the last 40 years. The implications of such a dramatic long term decline in economic growth are far reaching. For example, the report predicts that without significant policy adjustments, the current generation will impose a tax burden equivalent to five per cent of GDP by 2041-42 ($87 billion in 2002 dollars) on the next generation.[6]

In broad terms, the Australian Treasury sees the solution to the economic challenges posed by the ageing population as requiring policy attention in two main areas—the continuation of pro-competition reforms and the lifting of performance in education, training and the development of an innovation culture.[7] However, the economic agencies of many comparable countries appear to be placing the human capital dimension of the productivity equation higher on their policy agendas. Further, despite the existence of many cross-country econometric studies that find a positive relationship between investment in R&D and productivity,[8] our Treasury appears to be taking a relatively cautious view of the relationship:

> *Although R&D spending is related to economic growth, correlation does not necessarily imply causation. And it is innovation in the economy that drives productivity improvements and economic growth, to which R&D is only one input.*[9]

Nevertheless, even with the additional funding injected through the *Backing Australia's Ability* program since 2001, Australia's overall levels of investment in R&D remain relatively low compared with international benchmarks.[10] Despite Treasury's apparent cautiousness about the relationship between R&D and productivity and the inconclusive work recently undertaken on the issue by the Productivity Commission itself,[11] it is undeniable that developed and developing countries around the world are vigorously seeking to improve their science and innovation systems. As our Treasury has itself recently confirmed, many OECD countries have introduced new or revised national plans for science, technology and innovation policy, and a growing number have established targets for increased R&D spending.[12] Many of these plans strongly emphasise the need to target available public resources to support research of the highest quality—just as the Australian Government is exploring through the development of improved methods for assessing research quality and impact under the Research Quality Framework.

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[6] Commonwealth of Australia (2002), *Budget Paper No. 5 Intergenerational Report*, Canberra, 2002-2003 budget papers.
[7] Henry, K. (9 August 2004), *Policy Strategies for Future Growth*, Treasury, Canberra, p.6.
[8] See for example: Porter M.E, and Stern S (1999), *The New Challenges to America's Prosperity: Findings from the Innovation Index*, Council on Competitiveness Publications Office, Washington DC; the work of Gans J and Hayes R, *Assessing Australia's innovation capacity*: *2005 update* (Report 02/06), IPRIA; DEST, *Mapping Australian Science and Innovation Report* (2003), Canberra, pp.45-49; Dowrick, S, (August 2003), *A Review of the evidence on science, R&D and productivity*, prepared for the Department of Education Science and Training, Commonwealth of Australia, Canberra.
[9] Davis, G. and Tunny, G. (2005), *International Comparisons of Research and Development*, Online Treasury Paper.
[10] In this regard it is noted that BAA has had a significant positive impact on higher education expenditure on research and experimental development: Australia Bureau of Statistics (July 2006), *Research and Experimental Development, Higher Education Organisations Australia, 2004 (Reissue),* Catalogue 8111.0, Canberra.
[11] Shanks, S. and Zeng, S. (April 2006), *Econometric Modelling of R&D and Australia's Productivity,* Productivity Commission Staff Working Paper, Canberra.
[12] Davis and Tunny, op.cit.

Given these international trends it is the Go8's view that Australia can ill afford to contemplate a strategy of passive absorption of ideas and knowledge, or to expect to continue to fill labour shortages for highly skilled workers from overseas. Indeed, it has been predicted that increasing international demand for science and technology skills could result in a net outflow of highly skilled Australians in the future.[13]

3. The diverse ways by which Australia's research-intensive universities contribute to positive economic, social, cultural and environmental outcomes

3.1 Conduits for understanding and benefiting from the global science and innovation effort

Once estimates for non-OECD economies like China are taken into account, Australia accounts for one percent of identified global expenditure on research and development.[14] This relatively small contribution does not mean, however, that a passive 'early adopter' approach, based on exploiting the global pool of public good knowledge is a viable strategy for Australia to consider. The 'absorptive capacity' to understand and exploit global research advances is a critical factor in generating a return on publicly supported research. Such a capacity depends on the existence of a research and research training base capable of equipping people with the knowledge, skills and experience necessary to apply discoveries developed elsewhere.

Research-intensive universities are characteristically engaged in research efforts that loop through those of other nations, exploiting the synergies between what our researchers know and can do, and what overseas researchers know and can do. Further, access to global science and innovation resources (such as cutting edge and highly costly major research facilities) is often only granted on a peer-review basis and, not infrequently, as part of peer-based collaborative research arrangements. In a sense, international engagement in research can be seen as similar to the economic principle that free trade makes all nations better off by allowing comparative advantages to be exploited more effectively. However, it is a nation's willingness and ability to contribute to the global pool of knowledge that provides the basis for accessing and using the knowledge and data in this global pool.

When considering the potential that exists to tap into the global pool of R&D it is the relative *sizes* of national R&D efforts that matter, not the more familiar relative *intensities* (as measured by R&D per head or R&D/GDP). Relative size in R&D is graphed in Figure 1 using the OECD's estimates of both OECD and identified non-OECD economy R&D expenditure by sector of performance.

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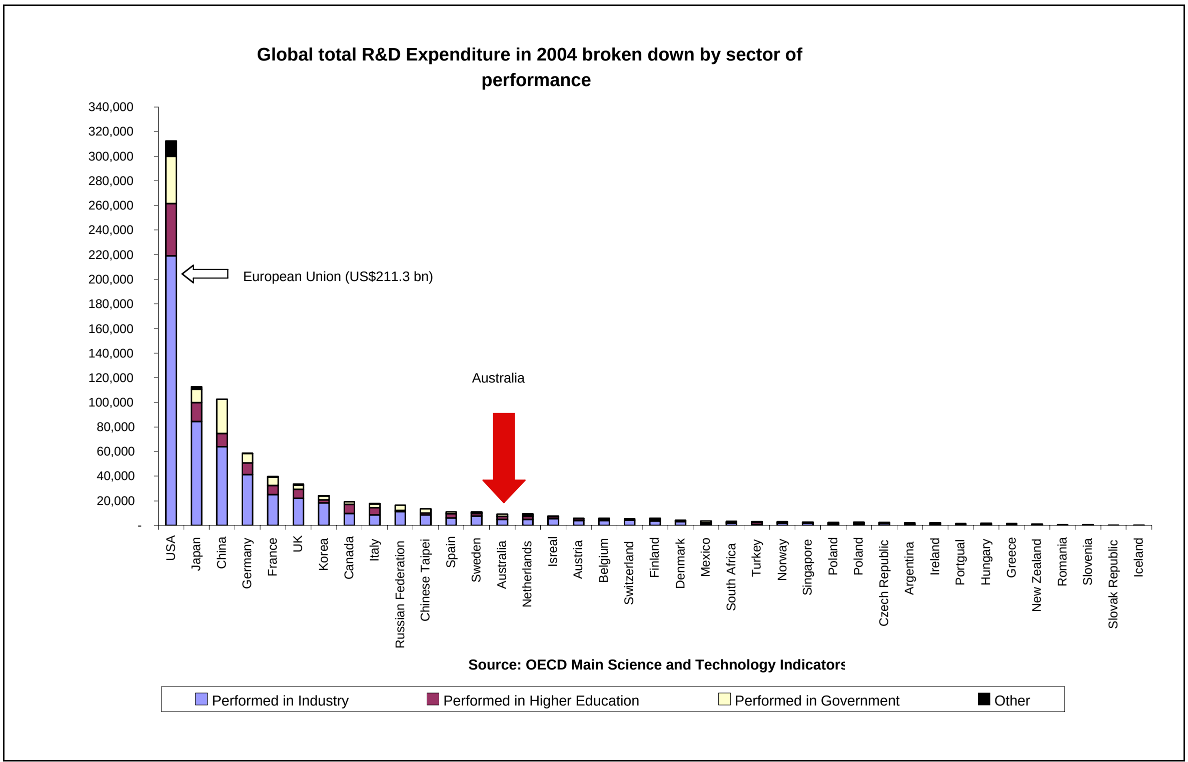
[13] Department of Education Science and Training (July 2006), *Audit of Science, Engineering & Technology Skills*, Summary Report, Commonwealth of Australia, Canberra, p.x.

[14] The more frequently noted figure of two percent reflects identified global R&D in OECD economies. This is now an outdated statistic as the OECD's own estimates are that China's R&D effort on an expenditure basis is now ranked third behind the United States and Japan.

Figure 1: The highly concentrated pattern of global R&D



Source: Calculations based on data from the OECD's Main Science and Technology Indicators (2005) Vol 2.[15]

Table 1 compares the shares of total identified global R&D in the top three national economies to the shares by performing sector. These data demonstrate the importance of higher education R&D in the global R&D effort. In total, 16 per cent of identified global R&D expenditure is performed in the higher education sector. This is greater than the 13 per cent of global R&D performed by Japan (the second ranked economy) and close to half that of the United States' share of global R&D expenditure (36 per cent of the total). The share of the global R&D effort performed in universities exceeds that performed in government organisations (15 percent). Consequently, when the R&D performed in the higher education sector worldwide is aggregated, it amounts to a substantial component of the global R&D effort. Given the relatively free flow of knowledge and data between universities in different nations this means that each nation's research-intensive universities provide a key interface through which the global R&D effort can be accessed and used.

Table 1: Country and sector based views of the global R&D effort (2004)

		R&D on a Purchasing Power Parity (PPP) basis 2004 US dollars ($m)	Percent of global total (%)
	Identified global R&D expenditure	859,562	100%
Top three national economies	United States	312,535	36%
	Japan	112,715	13%
	China	102,623	12%
	Other economies	331,689	39%
Top three sectors	Business sector	575,778	67%
	Higher Education sector	139,812	16%
	Government sector	125,280	15%
	Other	18,692	2%

Source: Calculations using data from OECD Main Science and Technology Indicators (2005) vol.2.

[15] Reported in Matthews, M. *(2006) Managing uncertainty and risk in science, innovation and preparedness: Why public policy should pay more attention to geopolitical and financial considerations*. Discussion Paper prepared by Howard Partners for the Federation of Australian Scientific and Technological Societies, Canberra.

3.2 The human capital dimension of research and research training

While the role of research-intensive universities in yielding new scientific knowledge, making new discoveries, fostering innovation and producing economic benefit through technology transfer is well recognised, much of the current policy thinking tends to prioritise 'idea-centric' over 'people-centric' perspectives of the knowledge transfer process.[16] The discrete packets of intellectual property associated with some idea-centric innovations mesh with the increasing emphasis placed on measuring research outputs and outcomes according to the linear model of the research process. This focus on intellectual property-based outputs and outcomes risks moving incentive systems away from supporting the development of human capital as the principal conduit via which research universities generate wider economic, social and environmental benefits. It also risks forcing institutions and researchers to give priority to shorter-term research projects at the expense of those where outcomes are less measurable in economic terms and likely to take much longer to be realised. The Go8 encourages the Commission to explicitly focus on the human capital dimension of impacts generated by research-intensive universities. Such a move would help rebalance the emphasis between idea-centric and people-centric perspectives.

3.3 Uncertain lead times

Much of the scientific research undertaken in universities is aimed at understanding, at a fundamental level, how natural phenomena operate. This theoretical understanding then serves to underpin a wide range of useful applications. However, the potential applications of this understanding are usually not clear at the outset and it may take many years for the research to reach a state in which specific applications can be realised. Some of the greatest economic or other impacts of research have taken many years to be realised. A recent example from a Go8 university is the work by Professor Ian Frazer of the University of Queensland. His research on the human papilloma virus has led to the development of a vaccine to prevent most forms of cervical cancer. As Professor Frazer has noted many times since being named Australian of the Year in January 2006, the eventual production of the vaccine, with its marked potential for public health and economic benefits, was unknown at the initiation and through a long period of research. The potential to develop the vaccine emerged as the research progressed. Requiring researchers to specify possible applications from their research over well-defined time frames runs the risk of undermining the principal strength of such research. As soon as they are produced, the outputs of research activities join a global pool of knowledge in which ideas and people interact to produce innovation and discovery through unpredictable paths and at uneven intervals. The practical value of much knowledge in the global pool is often demonstrated concretely only when someone trying to solve a practical problem dips into it for the needed resources.

3.4 Increasing preparedness, reducing uncertainty and risk

Improved understanding generated from university research reduces the uncertainty and risk faced by private and public sector decision-makers—in so doing generating useful outcomes. For example, agricultural research has informed crop-planting strategies that, in turn, have decreased risks and increased yields. Similarly, the applied mathematics of options theory has influenced strategies and risk-management in business and finance. These impacts achieved via 'distributed decision-making capacity' throughout the economy can be pervasive and highly significant relative to more discrete 'innovations'. Articulating how research generates impacts via reduced uncertainty and risk is, therefore, particularly useful in demonstrating the practical utility of advances in theoretical understanding.

A significant proportion of publicly supported R&D is concerned with improved levels of preparedness and contingency options for handling unwanted and unexpected

[16]See for example, Allott, S. (March 2006), *From Science to Growth*, Cambridge: http://www.hughes.cam.ac.uk/City_Lecture_060306.pdf

events—reducing the likelihood of occurrence and reducing the negative impacts. This covers research on natural hazards, pests, diseases, public health, defence and counter-terrorism – classic areas that markets can be poor at handling. While 'preparedness' is an outcome that the general community has come to expect from public R&D it does not currently feature with comparable weight in considerations about how publicly funded research benefits society.[17]

3.5 The inter-weaving of economic, social and environmental benefits

It is not uncommon to find cases in which economic, social and environmental impacts are combined. Many economic impacts are also associated with social and environmental impacts. For example, the benefits of health and medical research commercialised as pharmaceuticals generate social as well as economic benefits (disease treatment and reduced burdens on home-based carers look after the chronically ill, for example). The commercialisation of new technologies to reduce greenhouse gas emissions from industry and electricity generation delivers environmental as well as economic benefits, as does the commercialisation of software packages that help farmers to manage their water—with knock-on effects for dry-land salinity and environmental flows in rivers. Applications from research carried out in the social sciences, arts and humanities produces social and cultural benefits as well as economic benefits. Consequently, it would be particularly useful if the study paid explicit attention to cases of combined impacts rather than, in the first instance, treating economic, social and environmental impacts as distinct channels of benefit.

3.6 Advances in research methods and instrumentation

While the 'ends' of many areas of university research may generate practical applications over time, the 'means' used to achieve these ends often deliver their own direct benefits along the way. The research process often involves highly-focussed efforts to develop new and improved research methods, forms of research instrumentation and analytical tools. Many path-breaking technical advances have been stimulated by the ways in which the highly demanding technical challenges faced in discovery research have stimulated technological advances in research processes, instruments and equipment. Indeed, there is a well-established tradition of research scientists consciously fostering the development of trans-disciplinary technical skills in order to facilitate advances in research instrumentation.[18]

For instance, the 'Cambridge phenomenon' of university spin-off growth surrounding the University of Cambridge in the United Kingdom is one example of research instrument-based regional and national economic impacts. It would be useful if the study could consider any impediments to discovery-driven technical advance in instrumentation from this economic impact perspective. For example, the potential role of the National Collaborative Research Infrastructure Strategy (NCRIS) to provide a stimulus for the development of specialist Australian scientific instrumentation businesses could be explored.

3.7 The distinction between technological innovation and business innovation

The Commission's Issues Paper did not explicitly distinguish between technological innovation and business system innovation although it alluded to both aspects in its discussion of 'innovation'. Business innovation has very important economic, social and environmental impacts (particularly in the services sector) and may require technological

[17] For a detailed discussion of these issues see, Mathews, M. (2006), op.cit.

[18] This is evident, for example, in the way in which the Australian radio-astronomy community provided opportunities for group-based hands on graduate training in solving technical challenges in radio-astronomy, eventually contributing to advances in microprocessor design capability that have generated a wide range of commercial outcomes. See Matthews, M. and Frater, R. (2003), *Creating and Exploiting Intangible Networks: How Radiata was able to improve its odds of success in the risky process of innovating.* Detailed analytical case study prepared for the Science and Innovation Mapping System Taskforce, Australian Government Department of Education, Science and Training.

innovation linked to formal R&D – but may not. As a strategy-driven process, business innovation is strongly dependent upon insights from the social sciences and the humanities (accounting, sociology, anthropology, psychology, linguistics, law, economics and management studies etc).

Much of the research and research training strengths of research-intensive universities lie in the social sciences and the humanities. However, at present these strengths tend to be overlooked in preference to the impact of science, engineering and technology (SET) in the innovation process. Given that business strategy-driven innovation draws, in part, upon the knowledge and data generated by the social sciences and the humanities, it would be useful if the Commission could address the way in which the social sciences and the humanities inform the development of the long-term competitive strategies that improve business efficiency and, in turn, define the requirements for technological innovation.

This distinction is of clear importance to econometric analyses because productivity growth, particularly in the services sector, is influenced by the strategy-driven combination of business innovation and technological innovation—two variables that will be strongly correlated in some businesses but not in others. If the two variables are not well specified then the accuracy of the results may be compromised.

4. Impediments to the improved quality, efficiency and productivity of Australia's research-intensive universities under the current operating environment

Over the last 25 years Australia's higher education system has undergone enormous change and there is no sign that the pace of change will diminish. Research in a university context does not take place in a vacuum. The ability of institutions to provide researchers with the environment and resources required to undertake outstanding research depends upon the overall health of their operations—staffing, infrastructure, teaching and community engagement. The massive shift from elite to universal participation Australia has experienced since the 1970s has not been matched by growth in public funding for the undergraduate teaching functions of universities. Rather, public funding per student has fallen steadily for more than two decades. According to one study, Australia has in one generation gone from free tertiary education to offering amongst the most highly priced courses anywhere in the OECD.[19]

Institutions have responded by increasing class sizes, rationalising staff numbers and course offerings and seeking alternative sources of income—partly through the introduction of full-fee courses (particularly at the postgraduate level)—and largely through recruiting students from overseas. In 2005 Go8 universities received, on average, 41 per cent of their revenues from government sources, down from around 90 per cent in the early 1980s.[20] The higher education sector's success in building an export industry (estimated to be worth more than $5 billion to the Australian economy in 2005[21]) has allowed successive governments to restrict further public spending on the sector and in many cases provided universities with a supplementary source of income to sustain general operations. In 2004, with total export earnings estimated at $7.5 billion, international education was Australia's fourth largest export sector overall and the second largest services export sector.[22] However, as traditional international markets for Australian tertiary education invest heavily in the development of

[19] US-Canadian Education Policy Institute (2005), *Global Higher Education Rankings: Affordability and Accessibility in Comparative Perspective*, Washington.

[20] It is noted here that the Commission has itself predicted that by 2044-45 Australia's universities will receive on average 34 per cent of total revenues from public sources: Productivity Commission (2004), *Economic Implications of an Ageing Population*, Draft Research Report, p.9.11.

[21] The University of Queensland Social Research Centre (2005), *Final Report of the Survey of International Students' Spending in Australia*, prepared foe Australian Education International, Brisbane.

[22] Department of Education, Science and Training (2005), *Annual Report 2004-05*, Canberra, p.113.

their own higher education systems, there is no certainty that this revenue stream will be sustainable in an increasingly globalised higher education market. In this broader funding context, the Go8 draws the attention of the Commission to the following impediments to the efficient functioning and improved performance of Australia's research-intensive universities and the sector as a whole.

4.1 Overall R&D investment levels

While *Backing Australia's Ability* has delivered strong growth in levels of higher education R&D over the last five years, Australia's overall investment in R&D remains well below the OECD average. While this is partly due to the distinctive structure of the Australian economy, it raises issues such as whether investment is sufficient to allow for the levels of international engagement necessary to leverage knowledge and technologies developed overseas. Another important issue here is whether the structural mix of Australia's economy is appropriately diverse given trends in comparable nations toward much higher tech and knowledge-based industries.

4.2 Inadequate indexation of university operating grants

For ten years university operating grants have been indexed at a rate well below increases in labour and capital costs that have occurred across the rest of the economy. The impact of this inadequate indexation on the sector has been well documented elsewhere.[23] The absence of more realistic indexation of university operating grants threatens the ability of all Australian universities to offer internationally competitive rewards and conditions for staff and to provide internationally competitive facilities and infrastructure both for teaching and research.

4.3 Part funding of competitive research projects

Institutions that succeed in winning competitive grants through the ARC, NHMRC and other schemes must find funding from other sources to match or 'leverage' the funding available under the competitive schemes. In 2003-04 this cost supplementation was estimated at $450 million for the whole sector with the Go8 share estimated at 70 per cent or $330 million.[24] The extent to which universities must supplement competitive grants with funds from other sources is reflected in the most recent ABS figures.[25]

4.4 One size fits all approach to university funding

Under current regulatory and funding settings all Australian universities are treated the same when they patently are not and all are funded to undertake research when many do not.[26] Funding should be directed to support excellent research and research training and be focussed on areas where the market failure is greatest and the economic, social and environmental returns on the investment are likely to be significant.

4.5 Regulatory burdens impact on institutional and researcher productivity

Heavy regulation and increasing reliance on competitive funding schemes restrain the productivity of researchers and the management of institutions. Significant resources are required to employ non-academic staff in order to comply with and manage complicated regulatory and funding requirements. Significant researcher 'down time' is required to prepare funding applications and deal with other regulations. Significant researcher 'dead time' occurs as researchers wait to hear about the success or failure of grant applications. For

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[23] See for example, Group of Eight (December 2004), *Position Paper on the Indexation of University Grants*.
[24] Fell C et al, for the Department of Education Science and Training (2004), *Evaluation of Knowledge and Innovation Reforms Consultation Report*, p.xii.
[25] ABS op.cit., The amount of HERD sourced from general university funds and competitive grants in 2004 was $2,964.6 million and $739.6 million respectively.
[26] For a recent analysis of the relative research performance of most Australian universities see Valadkhani, A. & Worthington, A. (July 2006), *Ranking and Clustering Australian University Research Performance*, 1998-2002, Journal of Higher Education Policy and Management, Vol 28, No.2, pp.189-210.

some graduates and current researchers this uncertainty detracts significantly from the attractiveness of research as a career option. While the Go8 strongly supports competitive funding as a mechanism for focussing available resources on high quality research, program design must also taken into account the need to the maximise productivity of researchers by maximising the time they have available to undertake research and related activities.

4.6 Support for university research commercialisation activities

Universities currently receive public funding to support their teaching and research activities. Very limited dedicated funding is available, however, to support the research commercialisation activities of universities—even though governments increasingly expect universities to improve their performance in this area. The Go8 has addressed, in detail, particular obstacles to the commercialisation of research in a number of publications which are drawn to the Commission's attention.[27] Three key points are emphasised here. First, the management of investment risk is a critical factor for universities when considering the pros and cons of potential sources of private income. Many of these sources (for example full fee course provision to domestic and international students, consultancy and contract research, private investment) carry less financial risk, promise faster and higher rates of return-on-investment and are more closely aligned to their core competencies than the commercialisation of intellectual property per se. Risk management is particularly important given that universities remain responsible for the prudent allocation of significant amounts of public funding. Second, access to capital, particularly at the proof-of-concept stage of the research commercialisation process remains a significant obstacle to improve performance. Tax incentives or direct public investment to address this market failure may be warranted on public goods grounds.[28] Third, consideration of the potential for economic returns from the commercialisation of university-generated intellectual property needs to recognise that even the world's best performing universities in this area only generate between 3 and 5 per cent of their total revenues from research commercialisation activities.[29]

4.7 The rapid ageing of the Australian academic workforce

Recent studies have confirmed that Australia's universities face major workforce planning challenges over the next 5-10 years in particular as large numbers of their most experienced and skilled academic staff reach retirement age. In its *Workforce Tomorrow* report released in November 2005 the Department of Workplace Relations found that the education sector has recorded the highest increase in the proportion of workers over 45 over the last ten years —with one in two people employed in the education sector now over aged over 45.[30] Further, demographer Graeme Hugo has estimated that Australia's universities will have lost between 20 and 33 per cent of their staff to retirement in the period 2000 to 2010.[31] If not managed well, these trends have the capacity to impact negatively on the overall efficiency and productivity of Australia's universities. Go8 universities are responding to the critical need to equip the next generation researchers, supervisers and teachers with the management,

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[27] See for example, Group of Eight (August 2002) *Submission to the House of Representatives Standing Committee on Science and Innovation Inquiry into Business Commitment to R&D in Australia*, Canberra; Group of Eight (May 2005), *Submission to the House of Representatives Standing Committee on Science and Innovation Inquiry into Pathways to Technological Innovation*; Group of Eight (September 2005), *Report on outcomes of 8 July 2005 Tech Transfer Workshop*.

[28] See for example, Group of Eight (August 2002) op.cit.; Group of Eight (September 2005) op. cit.; House of Representatives Standing Committee on Science and Innovation (June 2006) *Report on Pathways to Technological Innovation*, Canberra, p.xxiv and pp.157-2004.

[29] Australian Centre for Innovation, Howard Partners Carisgold (2003), *Best Practice Processes for University Research Commercialisation,* report completed for DEST, p.4.

[30] The Department of Employment and Workplace Relations (2005), *Workforce Tomorrow: Adapting to a more diverse Australian labour market*, Canberra, p.11.

[31] Hugo, G. (2005) *Demographic Trends in Australia's Academic Workforce*, Journal of Higher Education Policy and Management, Melbourne, Vo.27, No.3, pp.327-343.

financial and other skills needed to fill the gaps that will be left by their retiring colleagues. However, funding constraints have resulted in unattractive salaries and conditions of employment compared to other sectors in the economy—with the resulting loss of academics and potential academics to the private sector and overseas.

4.8 Variable levels of interest, support and engagement from state and territory governments

While Australia's universities receive the majority of their public funding from the Federal sources, the level of support (financial and non-financial) provided by state and territory governments can have a significant bearing on the ability of institutions to prosper and contribute to their local communities. Across Australia a variety of models of engagement are in place between state and territory governments and metropolitan and regional universities delivering variable results.

Conclusion

Over the next decade the Go8 fully expects the globalisation of the higher education sector to continue at a rapid pace. There will be increasing competition between institutions for students, top researchers and public and private sector research funding. This competition should be good for students, purchasers of research services, the productivity of Australia's universities and the economy as a whole. Competitor nations can also be expected, however, to continue to invest heavily in their higher education systems to generate new ideas and knowledge and to develop the skills and knowledge of their workforces. Given these international trends Australia can not afford to risk a science and innovation strategy based on the passive absorption of ideas and knowledge, or to expect to be able to continue to fill labour shortages from international sources indefinitely.

Australia's current approach to addressing the challenges to economic growth posed largely by the rapid ageing of our population is focussed heavily on getting Australia's macro and microeconomic policy settings right—to pursue productivity improvements through greater competition across all sectors of the economy. In order to benefit fully from the global public good world of knowledge, however, pro-competition reforms will need to be complemented by policies targeted at ensuring Australia has a technological capable workforce and public and private sectors engaged in cutting edge R&D.

Through their research, training and knowledge transfer activities Australia's research-intensive universities give Australia a domestic capacity to address scientific and other challenges of direct relevance to all Australians. Through the relatively small but significant contribution their researchers make to the global pool of knowledge, Australia's research intensive-universities provide Australia with access to and the capacity to understand and apply the 99 per cent of research that occurs elsewhere—for great economic, social, cultural and environmental benefit. It is crucial therefore that the funding, regulatory and administrative frameworks that make up the environment in which Australia's research-intensive universities operate, allow them to remain internationally competitive into the future.

The Go8 considers the Commission's study of public support for science and innovation a very important one for the future of Australia's higher education system and the prosperity of the economy as a whole. We look forward to continuing engagement with the Commission as the study progresses.

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