**National Tertiary Education Union (NTEU)**
**Submission to Productivity Commission**
**Inquiry into**
**Public Support for Science and Innovation**

## Introduction

The NTEU represents the professional and industrial issues of over 28,000 staff employed at Australian universities. Our membership comprises academic, research, administrative, technical and other general staff employed at Australian universities.

NTEU welcomes this opportunity to provide initial comment on the Productivity Commission's Inquiry into Public Support for Science and Innovation and looks forward to making further contributions as the process unfolds.

As drivers of a knowledge-based economy, Australia's public universities provide education and training for skilled graduates and create wealth and employment across a range of industries through the production, dissemination and advancement of knowledge.

This submission concentrates on science and innovation taking place within Australia's higher education sector. It highlights the roles played by universities both in the production of research and as educators of future researchers. While these are different functions, they are very much interrelated and mutually essential to the effective functioning of Australia's innovation system.

Part A outlines the type and nature of the research undertaken by Australia's universities and points out the unique role that this research plays in Australia's science and innovation system as a whole. This section also demonstrates the very different and complementary roles played by higher education and business in Australia's overall Research and Development (R&D) effort.

Part B looks at the specific role universities play as educators of future researchers, the importance of research staff employed in universities, and the factors working against the effective functioning of research capability in Australian universities. It is argued that Government funding and policy initiatives have encouraged a growing separation between the teaching and research/research education roles of universities. We argue that this poses a significant threat to universities' ability to adequately fulfil their role in facilitating knowledge transfer and development, and building the future innovation and research capacity needed to sustain Australia's economic and social capacity, particularly in the context of an ageing academic workforce and the increasing difficulties associated with recruiting and retaining high quality research staff.

The final section provides a summary of the data and analysis presented within this submission and suggests a number of potential recommendations and ways forward to ensure that the Australian university sector is able to continue to contribute to Australia's innovation system and the economic and social prosperity of Australia as a whole.

## PART A
## THE ROLE OF UNIVERSITIES IN AUSTRALIAN SCIENCE AND INNOVATION

### I. Australia's Research and Development Performance

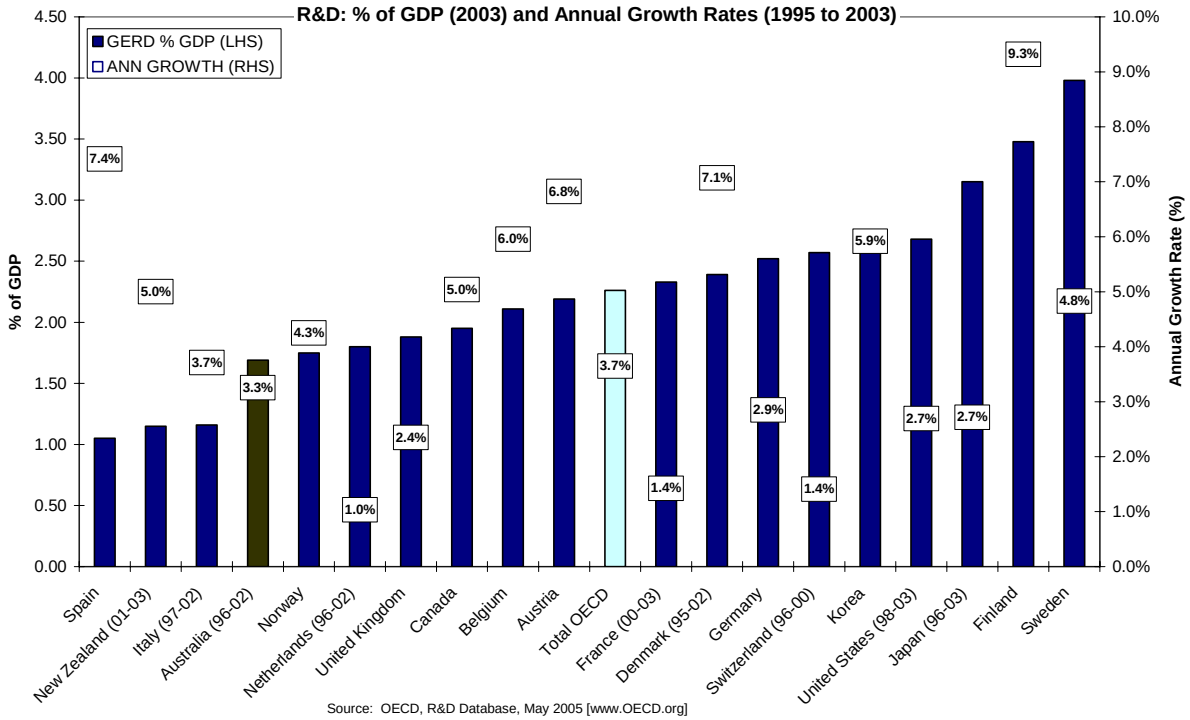
It is impossible to consider the role of Australia's higher education sector in science and innovation without first providing an overview of Australia's overall performance relative to comparable overseas countries. While the NTEU understands that the Productivity Commission's (PC) inquiry is related specifically to science and innovation, the only internationally comparable data relates to research and development (R&D) expenditure more broadly.

As has been well documented, Australia's performance in relation to investment in Research and Development (R&D) lags behind that of comparable OECD countries. Figure 1 shows that Australia's R&D intensity, Gross Expenditure on R&D (GERD) as a proportion of GDP, is well below the total OECD average. In 2002, Australian GERD accounted for 1.69% of GDP (refer to Table 1) compared to an OECD average of 2.26%. Of equal concern to the relatively low level of GERD is the fact that the average growth rate in GERD for Australia at 3.3% per annum was also below the OECD average of 3.7% per annum. Indeed the only country which could be considered to have performed more poorly than Australia over the period appears to be the Netherlands.

NTEU is concerned that Australia's relatively poor performance in R&D overall is a matter of great concern for Australia's future economic and social prosperity, but believes that the Commonwealth Government can play a critical role by developing the appropriate policy response.

Australia's higher education sector, led by our public universities, can play an important part in this process as educators of Australia's future researchers and important source of R&D in their own right.

**Figure 1**




Source: OECD, R&D Database, May 2005 [www.OECD.org]

In order to gain a better understanding of Australia's overall poor performance in relation to GERD, Table 1 shows the composition of GERD by sector. Relative to OECD averages, it shows that Australian expenditure in general Government R&D is well ahead of the OECD average, 0.34% of GDP compared to 0.25%. Australia's higher education sector performs slightly above the OECD average, 0.47% of GDP compared to 0.42%. While this is encouraging, it should be noted that this lags well behind other countries which have far stronger overall GERD, especially Denmark, Switzerland, Finland and Sweden. The primary reason for Australia's overall GERD lagging behind the rest of the OECD is attributable to the fact that business sector R&D only accounted for 0.82% of GDP compared to an OECD average of 1.52%.

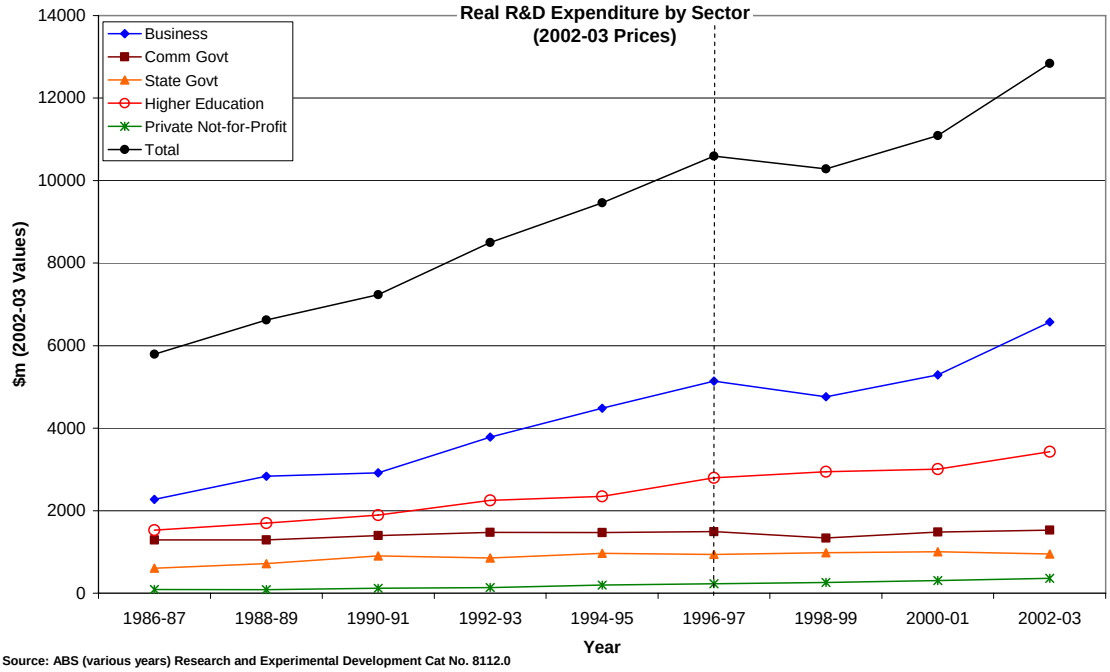
**Table 1: GERD by Sector (% of GDP) 2003 (unless otherwise stated)**

| Country | Business | Higher Education | Government | Private Non-Profit | Total |
|---|---|---|---|---|---|
| **Spain** | 0.57 | 0.32 | 0.16 | 0.00 | 1.05 |
| **New Zealand (2001)** | 0.47 | 0.33 | 0.36 | 0.00 | 1.15 |
| **Italy (2002)** | 0.56 | 0.38 | 0.20 | 0.01 | 1.16 |
| **Australia (2002)** | **0.82** | **0.47** | **0.34** | **0.05** | **1.69** |
| **Norway** | 1.01 | 0.48 | 0.26 | 0.00 | 1.75 |
| **Netherlands (2002)** | 1.02 | 0.52 | 0.25 | 0.01 | 1.80 |
| **United Kingdom** | 1.24 | 0.40 | 0.18 | 0.06 | 1.88 |
| **Canada** | 1.03 | 0.70 | 0.21 | 0.01 | 1.95 |
| **Belgium (2001)** | 1.56 | 0.39 | 0.14 | 0.02 | 2.11 |
| **Austria** | 1.46 | 0.59 | 0.12 | 0.01 | 2.19 |
| **Total OECD** | **1.52** | **0.42** | **0.25** | **0.07** | **2.26** |
| **France (2002)** | 1.45 | 0.45 | 0.40 | 0.03 | 2.33 |
| **Denmark (2001)** | 1.65 | 0.55 | 0.18 | 0.01 | 2.39 |
| **Germany** | 1.76 | 0.42 | 0.34 | 0.00 | 2.52 |
| **Switzerland (2000)** | 1.90 | 0.59 | 0.03 | 0.05 | 2.57 |
| **Korea** | 2.00 | 0.27 | 0.33 | 0.03 | 2.63 |
| **United States** | 1.85 | 0.45 | 0.24 | 0.14 | 2.68 |
| **Japan** | 2.36 | 0.43 | 0.29 | 0.06 | 3.15 |
| **Finland** | 2.45 | 0.67 | 0.34 | 0.02 | 3.48 |
| **Sweden** | 2.95 | 0.88 | 0.14 | 0.02 | 3.98 |

**Source: OECD, R&D Database, May 2005 [www.OECD.org]**

The influence of the business sector in determining Australian GERD is clearly demonstrated in Figure 2, which shows that the fall in real GERD in 1998-99 is almost solely attributable to fall in business sector R&D expenditure after 1996-97. It is interesting to note that it was in 1996 that the current Government decided to reduce the R&D tax concession from 150% to 125%.

**Figure 2**




Source: ABS (various years) Research and Experimental Development Cat No. 8112.0

The data presented above demonstrates not only that Australia's relatively low ranking GERD within the OECD is primarily due to low levels of business R&D, but also shows Australia's relatively low rate of growth in GERD since the mid 1990's. This low growth rate has been affected by the decrease in real business R&D in 1989-88 as shown in Figure 2. As a consequence, it would be too easy to see the solution to Australia's relatively poor GERD performance in solely concentrating on business R&D and ignoring the other sectors. NTEU believes that this would be a mistake, especially given that higher education is the second largest source of R&D in the Australian economy. NTEU argues that higher education cannot be ignored in any review of public support for R&D because:

- the type of research undertaken by Australia's universities differs fundamentally to that undertaken by the business sector,
- the fields of research activity undertaken also differ between business and higher education, and
- it is vital to support research at Australian universities to ensure that they are in a position to continue their critical role as employers and educators of future researchers.

## II. Nature of Research Undertaken by Australia's Universities.

Before exploring Australian universities' role as educators and employers of Australian researchers, it is worth considering the nature of research undertaken at Australian universities and how this not only differs from that undertaken by the business sector, but also how it should be seen as complementary and supportive of research undertaken by other sectors of the economy.

### Research by Type of Activity

The Australian Bureau of Statistics breaks down R&D expenditure by the following types of research activity:

- pure basic,
- strategic basic,

- applied, and
- experimental.

Tables 2 and 3 show a breakdown of the share of these different types of research for the following sectors of the economy in 2002-03:

- Business
- Commonwealth government
- State/Territory governments
- Higher Education, and
- Private Not-for-Profit.

**Table 2: Share of R&D Expenditure by Type of Research by Sector 2002-03**

| Sector | Pure Basic | Strategic Basic | Applied | Experimental | Total |
|---|---|---|---|---|---|
| | % | % | % | % | % |
| **Business** | 4.0% | 18.3% | 35.2% | 85.5% | 48.8% |
| **Comm Govt** | 8.0% | 24.7% | 15.7% | 5.8% | 12.5% |
| **State/Ter Govt** | 4.3% | 6.9% | 14.8% | 2.5% | 7.8% |
| **Higher Education** | 78.6% | 42.2% | 31.8% | 5.5% | 28.0% |
| **Private Non-profit** | 5.1% | 7.9% | 2.5% | 0.8% | 2.9% |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

Source: ABS (2006) *Research and Experimental Development* 2002-03 Cat No. 8112.0

**Table 3: Share of R&D Expenditure by Sector by Type of Research 2002-03**

| Sector | Pure Basic | Strategic Basic | Applied | Experimental | Total |
|---|---|---|---|---|---|
| | % | % | % | % | % |
| **Business** | 0.8% | 5.8% | 25.8% | 67.6% | 100.0% |
| **Comm Govt** | 6.5% | 30.8% | 45.0% | 17.8% | 100.0% |
| **State/Ter Govt** | 5.6% | 13.8% | 68.2% | 12.3% | 100.0% |
| **Higher Education** | 28.4% | 23.4% | 40.6% | 7.6% | 100.0% |
| **Private Non-profit** | 17.4% | 41.8% | 30.5% | 10.4% | 100.0% |
| **Total** | 10.1% | 15.5% | 35.7% | 38.6% | 100.0% |

Source: ABS (2006) *Research and Experimental Development* 2002-03 Cat No. 8112.0

When looked at together, the data in Tables 2 and 3 show that higher education accounted for 78.6% of all the pure basic research undertaken in Australia in 2002-03 and that pure basic research accounted for 28.6% of all the research undertaken by the higher education sector. At the end of the research activity spectrum, higher education only accounts for 5.5% of experimental research[1] activity and 7.6% of all higher education research expenditures. Higher education research accounts for the largest share of strategic basic research (42.2%) but in terms of its total expenditure spends the largest share on applied research.

By contrast the business sector only accounted for 4.0% of pure basic research undertaken in Australia and spent less than 1% of all the R&D undertaken by the business sector. On the other hand the business sector accounted for 85.5% of all experimental research undertaken in Australia in 2002-03 and experimental research constituted two-thirds (67.6%) of all research undertaken by the business sector. For the business sector, the second most important type of research undertaken is

[1] The ABS defines *Experimental development as* systematic work, using existing knowledge gained from research or practical experience that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. (ABS Cat No. 1297.0 1998)

applied research, with very few of its resources dedicated to pure basic or strategic basic research.

The research efforts of government research agencies and the private Not-For-Profit sectors on the other hand are concentrated in applied research and to a lesser extent in strategic basic research.

**Research Activity by Research Field**

Tables 4 and 5 show (for 2002-03) the break down of R&D expenditure for each sector by the following fields of research:

- Mathematical and Physical sciences
- Chemical sciences,
- Earth sciences,
- Biological sciences,
- Information, Computing and Communications,
- Engineering and Technology,
- Agricultural, Veterinary and Environmental sciences,
- Medical and Health sciences, and
- Other research fields (humanities, arts and social sciences)

In examining research expenditure by research field, the data in Table 4 shows that the higher education sector undertakes the highest proportion of total research in each of the following disciplines; humanities, arts and social sciences (79.4% of total), medical and health sciences (51.6%), maths and physics (45.3%) and biological sciences (41.5%). However higher education is also an important contributor to the chemical sciences (second to business), earth sciences (second to the Commonwealth government) and agricultural, veterinary and environmental sciences (behind the State and Territory governments). Business accounts for more than 80% of all research undertaken in information, computing and communications (81.3%) and engineering and technology (80.2%) and is also the leader in chemical sciences (42.2%). Business also makes important contributions to earth sciences (24.3% of total) and medical and health sciences (23.4%).

**Table 4: R&D Expenditure by Field by Sector 2002-03**

| Field of Research | Higher Ed | Business | Comm Govt | State/Ter Govt | Priv Non-Profit | Total |
|---|---|---|---|---|---|---|
| **Math & Physics** | 45.3% | 17.7% | 34.3% | 2.2% | 0.6% | **100%** |
| **Chem Sci** | 32.0% | 42.0% | 21.6% | 3.5% | 0.8% | **100%** |
| **Earth Sci** | 24.2% | 24.3% | 43.3% | 8.2% | 0.0% | **100%** |
| **Bio Sci** | 41.5% | 21.3% | 16.4% | 10.3% | 10.6% | **100%** |
| **Info/Comp/Comm** | 8.1% | 81.3% | 9.3% | 0.9% | 0.3% | **100%** |
| **Eng / Tech** | 9.2% | 80.2% | 9.7% | 0.8% | 0.0% | **100%** |
| **Ag/Vet/Environ** | 19.6% | 16.7% | 20.3% | 43.2% | 0.2% | **100%** |
| **Med / Health** | 51.6% | 23.4% | 1.6% | 10.3% | 13.2% | **100%** |
| **Other** | 79.4% | 7.7% | 7.3% | 3.9% | 1.6% | **100%** |
| **TOTAL** | **28.0%** | **48.8%** | **12.5%** | **7.8%** | **2.9%** | **100%** |

Source: ABS (2006) *Research and Experimental Development* 2002-03 Cat No. 8112.0

In terms of the total expenditures dedicated to different fields of research, Table 5 shows that the higher education sector spends over a third (34.7%) of its total R&D expenditure on medical and health sciences, 27.4% on the humanities, arts and social sciences, 16.5% on biological sciences and 15.0% on engineering and technology. For business however, almost 80% of its total expenditure is

concentrated in two fields, namely engineering and technology (55.2%) and information, computing and communications (24.5%). It is also interesting to note that nearly 95% of the Private Not-For-Profit sector R&D expenditure goes to medical and health sciences (64.9%) and biological sciences (30.7%).

**Table 5: R&D Expenditure by Sector by Field 2002-03**

| Field of Research | Higher Ed | Business | Comm Govt | State/Ter Govt | Priv Non-Profit | Total |
|---|---|---|---|---|---|---|
| **Math & Physics** | 7.8% | 1.3% | 10.1% | 1.0% | 0.7% | **3.90%** |
| **Chem Sci** | 6.2% | 3.5% | 7.3% | 1.9% | 1.2% | **4.40%** |
| **Earth Sci** | 4.6% | 1.9% | 14.1% | 4.3% | 0.0% | **4.30%** |
| **Bio Sci** | 16.5% | 3.6% | 11.2% | 11.2% | 30.7% | **8.90%** |
| **Info/Comp/Comm** | 5.8% | 24.5% | 11.4% | 1.8% | 1.4% | **16.00%** |
| **Eng / Tech** | 15.0% | 55.2% | 27.2% | 3.5% | 0.4% | **36.60%** |
| **Ag/Vet/Environ** | 9.4% | 3.4% | 16.9% | 57.2% | 0.6% | **10.80%** |
| **Med / Health** | 34.7% | 6.7% | 1.8% | 19.1% | 64.9% | **15.10%** |
| **Other** | 27.4% | 1.5% | 5.7% | 4.9% | 5.4% | **9.70%** |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

Source: ABS (2006) *Research and Experimental Development* 2002-03 Cat No. 8112.0

In summary the evidence in the preceding sections clearly demonstrates that R&D expenditures in:

- Business;
  - is predominantly experimental in nature,
  - heavily concentrated in engineering and information, computing and communications fields, and
  - makes an important contribution to experimental research in the fields of medical, health chemical and biological sciences.

- Higher Education;
  - accounts for the bulk of pure basic research undertaken in Australia,
  - is spread across pure basic, strategic basic and applied research activities,
  - is most important in humanities, arts and social sciences, medical and health sciences, maths and physics and biological sciences, and
  - makes significant contributions to chemical, earth, agricultural, veterinary and environmental sciences.

## III. Effective Partnerships between universities and business

As shown above, research undertaken by the higher education sector does not "crowd-out" business sector research, rather it is complementary and supportive. Increasing R&D undertaken by Australian universities therefore has the potential to raise the level of business sector R&D if the appropriate policy framework is developed to encourage mutually beneficial collaborative partnerships.

Policies aimed at encouraging collaborative research should exploit each sector's relative comparative advantage. Business has a clear advantage in experimental research in a limited number of fields and in the commercialisation of research findings, whereas universities have strengths across a broader range of research types and fields. It also needs to be understood that the two sectors have different motivations for undertaking research. While universities' research is largely curiosity driven research aimed at advancing knowledge within the broad context of national

research priorities, business sector research is driven more by the incentive for commercial returns. Given the appropriate policy framework, it should be possible to take advantage of the synergies that exist between the two sectors, as the Business-Higher Education Round Table (BHERT) recognised in 1999, when it observed:

> *Access to the world's basic research is often required by Australian industry and this is facilitated by Australia's participation in the global basic research community as a valued contributor.*[2]

These conclusions are supported by work undertaken by Joshua Gans[3] of the Melbourne University Business School and others, which emphasises the importance of the linkages between basic, applied and experimental research; linkages that ultimately lead to the economic benefits of improved productivity and economic growth. Specifically in relation to the role played by universities it is noted that:

> *A strong university sector provides an important conduit through which basic, fundamental research results serve to catalyse the emergence of innovation-oriented domestic clusters*. [Gans and Stern (June 2003) p 26]

In order to maximise the benefits to be gained from encouraging collaborative partnerships between universities and business, any policy framework developed to exploit these synergies must understand and respect the different advantages each sector has, as well as the different motives and research cultures of each. In order to exploit these advantages, policies should ensure that the distribution of economic incentives do not provide a disincentive to participation by either party[4]. Universities should be encouraged to exploit their advantages in pure basic curiosity driven research and business their advantage in bringing research findings to market through commercialisation. To provide both parties an incentive to participate in these partnerships, it is therefore important that any financial rewards be shared between business partners, universities and university researchers.

With respect to research undertaken by universities, the policy framework should explicitly acknowledge and take into account:

- the importance of academic freedom and institutional autonomy in relation to research undertaken by Australian university staff,
- the critical nexus between universities teaching and research/research education, and
- in relation to the potential commercialisation of research outcomes, intellectual property guidelines that:
  - understand the importance to university staff of being able to publish their research results to allow them to participate in the academic discourse.

[2] BHERT (1999) 'The Case for Additional Investment in Basic Research in Australia', Position Paper No.3, p.5.

[3] See in particular Joshua Gans and Scott Stern (June 2003) *Assessing Australia's Innovative Capacity in the 21st Century* (http://www.mbs.edu/home/jgans/tech/) and Joshua Gans and Richard Hayes (December 2005) *Assessing Australia's Innovative Capacity: 2005 Update* (http://www.mbs.edu/home/jgans/papers/Aus-Innovation%20Index-2005.pdf)

[4] NTEU believes that the *National Principles of Intellectual Property Management for Publicly Funded Research*, [http://www.arc.gov.au/grant_programs/national_ip.htm] provide a sound basis for publicly funded research.

## IV. Australian Universities as Research Educators

As will be discussed in more detail in Section B, Australia is facing a potential crisis in its research workforce in the coming years. Therefore, the role of Australian universities in educating future researchers is critical. In this section we provide a brief overview of trends in higher degree research (HDR) student numbers, research funding per HDR student and the role HDR students play in the overall research effort of the higher education sector.

### HDR Student Numbers

Table 6 shows the student load (full time equivalent students) for higher degree research (HDR) students, (Doctorate and Masters) and all student load for the period 1995 to 2004. As the data shows the total student load for HDR students increased by 31.7% over the period compared to 40.8% for all students. As a consequence the proportion of HDR students to all students decreased from 5.4% of total load in 1995 to 5.1% in 2004. Interestingly, there has been a large shift in the composition of HDR students away from research Masters degrees (which fell) and into Doctorate programs, which increased by 56.8%. Doctorate students require greater resources to educate than research Masters students, given the relative length of the candidature together with the requirement that PhD students undertake original ground-breaking research.

**Table 6: Australian University Student Load (Full Time Equivalent) 1995 to 2004**

| | Doctorate by Research | Masters by Research | Sub-Total HDR | ALL STUDENT LOAD | HDR as % of ALL |
|---|---|---|---|---|---|
| **1995** | 17,403 | 7,706 | 25,109 | 462,087 | **5.4%** |
| **1996** | 18,441 | 7,316 | 25,757 | 487,977 | **5.3%** |
| **1997** | 19,500 | 7,408 | 26,908 | 514,727 | **5.2%** |
| **1998** | 20,214 | 7,106 | 27,320 | 528,838 | **5.2%** |
| **1999** | 21,643 | 6,958 | 28,601 | 544,143 | **5.3%** |
| **2000** | 22,591 | 6,613 | 29,204 | 557,763 | **5.2%** |
| **2001** | 23,480 | 6,425 | 29,905 | 588,202 | **5.1%** |
| **2002** | 24,315 | 6,166 | 30,481 | 626,749 | **4.9%** |
| **2003** | 25,771 | 5,931 | 31,702 | 661,206 | **4.8%** |
| **2004** | 27,294 | 5,780 | 33,074 | 650,849 | **5.1%** |
| **Change** | **9,891** | **-1,926** | **7,965** | **188,762** | |
| **Change %** | **56.8%** | **-25.0%** | **31.7%** | **40.8%** | |

Source: DEST Selected Higher Education Statistics

**Table 7: Higher Degree Research and Total Students by Field of Education 2004**

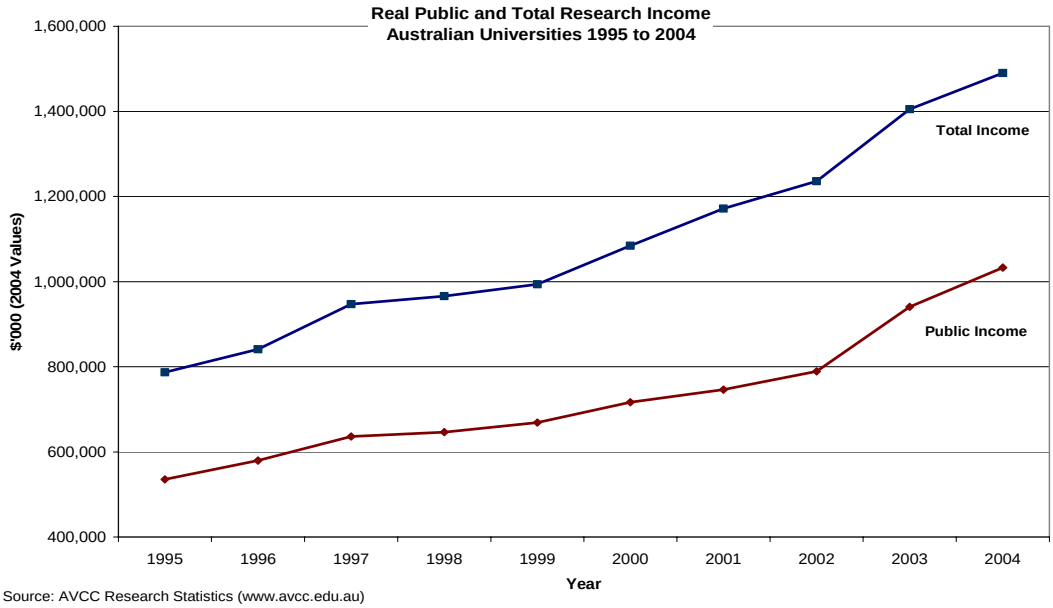
| | HDR Students | | All Students |
|---|---|---|---|
| Field of Education | Share HDR | Share of All Students in Field | Share |
| **Natural and Physical Sciences** | 17.5% | 11.2% | 7.8% |
| **Information Technology** | 3.5% | 2.3% | 7.7% |
| **Engineering and Related Technologies** | 11.2% | 8.1% | 6.9% |
| **Architecture and Building** | 1.5% | 3.8% | 2.0% |
| **Agriculture, Environmental and Related** | 4.2% | 10.9% | 2.0% |
| **Health** | 13.4% | 6.2% | 10.9% |
| ***Sub-Total Science / Engineering / Health*** | ***51.4%*** | ***6.9%*** | ***37.3%*** |
| **Education** | 9.6% | 4.9% | 9.7% |
| **Management and Commerce** | 7.9% | 1.4% | 28.3% |
| **Society and Culture** | 24.9% | 5.8% | 21.5% |
| **Creative Arts** | 6.3% | 5.0% | 6.3% |
| **Food, Hospitality and Personal Services** | 0.0% | 0.0% | 0.0% |
| **Mixed Field Programs** | 0.0% | 0.0% | 0.2% |
| **Non-award** | 0.0% | 0.0% | 2.5% |
| **Total Other** | ***48.6%*** | ***3.6%*** | ***68.6%*** |
| **TOTAL** | **100.0%** | **5.1%** | **100.0%** |

Source: DEST Selected Higher Education Statistics

Table 7 shows the breakdown of HDR and all student enrolments by field of education for 2004. In terms of absolute numbers the most important fields of education for HDR students were society and culture (24.9%) followed by the natural and physical sciences (17.5%), health (13.4%) and engineering (11.2%). This compares to all students where, together with society and culture, enrolments are dominated by management and commerce. Science, engineering and health related disciplines in total account for 37.1% of all student enrolments but over half (51.7%) of all HDR enrolments.

## Public Funding of University Research and Research Education

**Figure 3**

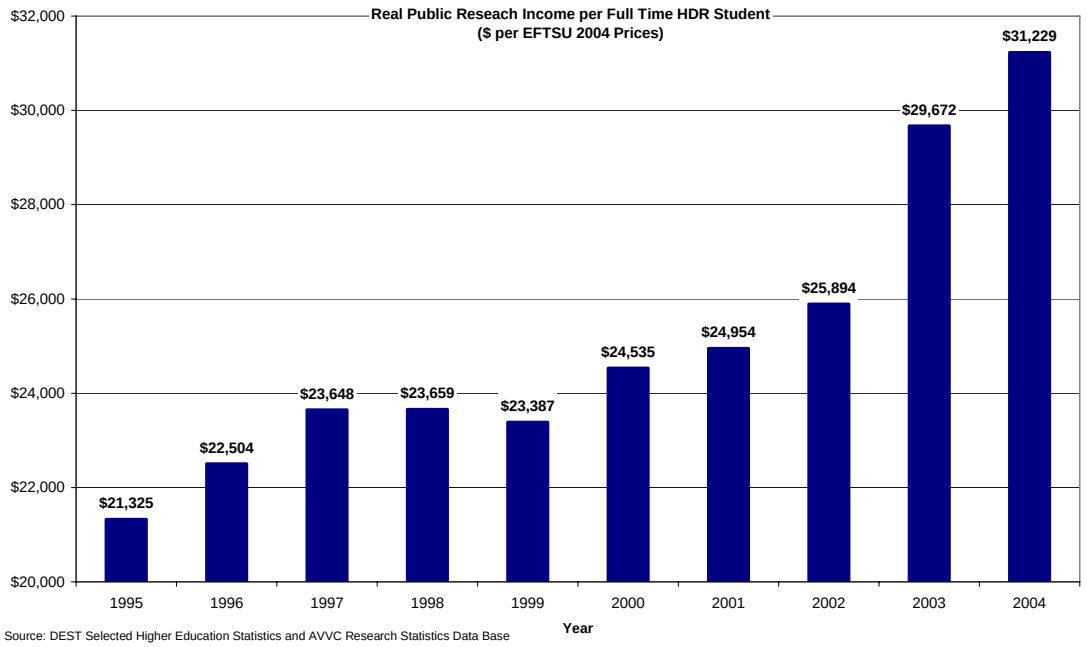



Source: AVCC Research Statistics (www.avcc.edu.au)

Trying to analyse the resources universities have available to them to undertake their research education role is complicated because it is comprised of a number of funding sources, including competitive research grants together with general operating grants. In addition, there have been so many changes to programs used by government to support universities' research effort and student support over the last decade it is impossible to get time-series data that clearly distinguishes between teaching and research responsibilities. Therefore as a proxy, the NTEU is using research income to indicate changes in the level of resources available over time. Figure 3 shows both total and public sector research income as defined and compiled by the Australian Vice Chancellors' Committee (AVCC) in real 2004 values[5]. The data show that both public and total funding have increased steadily over time, with a marked acceleration in public (and therefore total) funding after 2001.

Figure 4 shows the level of real public sector research income (as per Figure 3) per HDR full time equivalent student. Again the data shows that the level of real public funding per HDR student remained reasonably constant at between $23,000 and $24,000 from 1996 to 1999 then rising to about $26,000 by 2002 and increasing considerably in 2003 and 2004. The increases in public sector support for research at Australian universities reflect policy initiatives undertaken by the government through their Backing Australia's Ability (BAA) policies, phases I and II. An analysis of BAA funding shows that it peaks in 2005-06, and plateaus thereafter. Therefore, all other things being equal, NTEU anticipates that both the absolute level of public sector research income that universities receive will soon plateau and eventually begin to tail off. So the substantial increases in real public sector funding to support university research (as depicted in Figures 3 and 4) are not anticipated to continue beyond 2005/06.

**Figure 4**




Source: DEST Selected Higher Education Statistics and AVVC Research Statistics Data Base

[5] December Qtr CPI has been used to deflate the values.

## The role of HDR students in university research

While HDR students are essentially enrolled at universities for a research education, they also contribute greatly to the sector's, and more broadly the Australian economy's research effort. Table 8 provides a breakdown of the human resources Australia's higher education sector devotes to research through academic staff, support staff and HDR students. The data shows that in 2002 HDR students accounted for 60.4% of the total human resources involved in research. This varies significantly between different fields of study as shown in Table 8. The data also shows that academic staff accounted for 25.8% of all human resources. This reflects the fact that most academic staff also have teaching and other responsibilities.

**Table 8**
**Higher Education Human Resources in Research by Research Field of Study 2002 (person years)**

| | Researchers | | Supporting | Total | Academics | Post Grads |
|---|---|---|---|---|---|---|
| **Research field** | **Academics** | **Postgraduate** | **staff** | | **% Total** | **% Total** |
| Mathematical sciences | 303 | 416 | 81 | 800 | 37.9% | 52.0% |
| Physical sciences | 447 | 607 | 332 | 1385 | 32.3% | 43.8% |
| Chemical sciences | 495 | 1073 | 287 | 1854 | 26.7% | 57.9% |
| Earth sciences | 460 | 851 | 238 | 1549 | 29.7% | 54.9% |
| Biological sciences | 1272 | 2666 | 847 | 4785 | 26.6% | 55.7% |
| Information, computing, communications | 563 | 1319 | 286 | 2168 | 26.0% | 60.8% |
| Engineering and technology | 1367 | 3110 | 699 | 5177 | 26.4% | 60.1% |
| Agricultural, veterinary, environ science | 801 | 1756 | 558 | 3115 | 25.7% | 56.4% |
| Medical and health sciences | 2934 | 4570 | 1938 | 9441 | 31.1% | 48.4% |
| ***Total Science / Engineering / Med*** | ***8642*** | ***16368*** | ***5266*** | ***30274*** | ***28.5%*** | ***54.1%*** |
| Education | 550 | 2324 | 210 | 3084 | 17.8% | 75.4% |
| Economics | 374 | 657 | 146 | 1176 | 31.8% | 55.9% |
| Commerce, management, tourism | 677 | 1580 | 204 | 2461 | 27.5% | 64.2% |
| Studies in human society | 455 | 1626 | 229 | 2310 | 19.7% | 70.4% |
| Behavioural and cognitive sciences | 456 | 1522 | 229 | 2207 | 20.7% | 69.0% |
| Other research fields | 1665 | 5887 | 548 | 8100 | 20.6% | 72.7% |
| ***Total Other*** | ***4177*** | ***13596*** | ***1566*** | ***19338*** | ***21.6%*** | ***70.3%*** |
| **Total** | **12819** | **29964** | **6832** | **49612** | **25.8%** | **60.4%** |

Source: ABS Research and Experimental Development Higher Education Institutions 2002 Cat No. 8111.0

The data presented in Table 8 demonstrates the importance of universities growing their capacity in relation to research education. As the largest providers of research education, Australia's public universities are responsible for ensuring that such education is of a high international standard and quality. In order to meet this responsibility it is essential that universities have the capacity and resources to be actively engaged in research.

Income support available to HDR students has been a matter of concern for sometime. HDR students are generally not eligible to apply for Austudy support unless they happen to be under 21 years of age. The main form of income support for Australian HDR students is through Australian Postgraduate Award (APA) scholarships. The Commonwealth awards about 1550 new APA scholarships each year, and at any one time there are approximately 4500 students in receipt of APA scholarships. Some other HDR students will be in receipt of university scholarships and others scholarships funded through ARC or NHMRC grants. However, given that there are over 33,000 HDR students enrolled at Australian universities, there is little doubt that the vast majority of HDR students will not be in receipt of any education specific income support

Therefore, when considering the question of public support for science and innovation, the NTEU would urge the Productivity Commission to also examine nature of income support available to HDR students, and consider whether there are a sufficient number of scholarships available to attract the best students into research education programs and meet Australia's future demand for researchers, especially

given the rapidly aging academic workforce as discussed in the following part of this submission.

In this respect the NTEU agrees with the recommendations of the Council of Australian Postgraduate Associations (CAPA) in their submission to the Senate Inquiry into Student Income Support[6] which included:

- extending Austudy/Abstudy eligibility to all postgraduate students, and
- in relation to APA scholarships that:
  - for PhD students, the length of scholarship should be extended to cover the full length of students' candidature and not limited to three years,
  - taxation should not be applied to scholarships for part-time students,
  - the number of APA's available must be raised significantly, and
  - the stipend amount must be increased by at least 10%.

[6] Council of Australian Postgraduate Associations (CAPA) (June 2004) Submission to Senate Employment, Workplace Relations and Education References Committee ***Inquiry into Student Income Support Measures***. (http://www.capa.edu.au/frameset.html?/submissions/index.html)

## PART B
## Challenges Facing Australian University Research Capacity / Capability

As drivers of a knowledge-based economy, universities provide training for skilled graduates and create wealth and employment across a range of industries through the production, dissemination and advancement of knowledge.

As discussed in Part A, as well as educating future researchers, who have the potential to be employed both within and outside the higher education sector, universities are significant contributors to knowledge production and advancement, and play an important and distinct role in research and development. These functions are very much interrelated and mutually essential to the effective functioning of Australia's innovation system.

In addition to their research and research education roles, universities are also expected to fulfil other core activities such as the education and teaching of undergraduate and postgraduate course work students and community service.

Universities however, face a number of challenges and impediments to fulfilling these multiple roles. In this part we address a number of the specific, but interrelated challenges that currently confront universities, in particular:

- changes to the funding mix to support university research and research education and their general teaching responsibilities,
- difficulties associated with recruiting and retaining high quality research staff.
- an ageing academic workforce, and

Given the focus of the Productivity Commission's inquiry, this part of the NTEU submission looks at these challenges from the perspective of universities' ability to sustain an adequate research capacity and capability, without which they will be unable to adequately fulfil their role in facilitating knowledge transfer and building the future innovation and research capacity needed to sustain Australia's economic and social capacity.

### I. Meeting Teaching and Research Responsibilities

Teaching, research and research education, together with community service, are the core responsibilities of all Australian public universities. In order for universities to be able to fulfil community expectations in regard to these core functions, it is important that they are not seen as separate and distinct missions, but rather as mutually reinforcing and interconnected. A nexus between research and teaching is one of the defining characteristics of a university education and is the basis on which universities engage with their communities. The reality is that universities are increasingly being asked, as a result of government policy and funding changes, to separate and prioritise these functions.

The current government has made it clear that it would like to see more specialisation and diversity in the higher education sector and has not ruled out the possibility of teaching-only universities. Australia's public universities are already a highly diverse set of institutions that differ markedly in both their teaching and research profiles. NTEU fears that the government may be content to limit the number of "research" universities, with the remainder being essentially teaching institutions with perhaps one or two areas of research specialisation. This was confirmed in a recent speech, where the Federal Minister for Education stated:

> *The need for diversity is obvious. We are a country of 20 million people with 37 public universities and three private universities including the new Carnegie Mellon campus in Adelaide. We have neither the population nor sufficient high-quality academic staff to maintain 37 comprehensive universities which are all undertaking teaching, scholarship and research across a broad range of disciplines.*

and

> *There is obviously a place for fully comprehensive, generic universities which meet the skills needs of the nation and of their regions across a broad range of disciplines. There is a place for perhaps a dozen universities like that, particularly in the major metropolitan cities and some distinct regions.* [7]

There are a number of critical reasons why teaching needs to be informed by research at Australian universities. For example, there is a strong argument that to complete the later stages of an Honours Bachelor degree, students need access to research infrastructure and research active staff. The introduction of teaching-only or teaching-intensive institutions would provide serious limitations in regard to student choice about the type of institution they attend or the subject areas that they pursue. Furthermore, postgraduate courses offer greater choice for students to continue their studies. In addition, the research conducted by both postgraduate students and academic staff plays an important role in developing undergraduate disciplines and in contributing to Australia's research effort. These principles have been upheld by recently announced changes to *National Protocols for Higher Education Approval Processes*[8] for higher education. While allowing for the establishment of more specialised "universities", the *Protocols* insist that an institution which wishes to use the name university must be engaged in both teaching and research across a specified number of discipline areas.

Data on the composition of Australian universities' academic labour force demonstrates the importance of the teaching and research responsibilities of these institutions. The data presented in Table 9 shows that in 2004, of all academic staff, some 70% had both teaching and research responsibilities. While the total number of academic staff increased by 12.4% between 1995 and 2004, this was largely due to a rise in the number of research-only staff numbers, which increased by 32.8% compared to a relatively small increase in the number of research and teaching staff which only rose by 5.6% over the same period. As a consequence, the share of research-only staff as a proportion of the academic staff sub-total increased from 24.9% in 1995 to 29.5% in 2004.

[7] Ms Julie Bishop Minister for Education 24 July 2006 *Speech to Curtin Institute Public Policy Forum* http://www.dest.gov.au/Ministers/Media/Bishop/2006/07/B0010240706.asp

[8] MCEETYA (7 July 2006) *Draft National Protocols for Higher Education Approval Processes* http://www.mceetya.edu.au/mceetya/default.asp?id=13681

**Table 9**
**Research and Teaching Staff Employed at Australian Universities**

| Year | Research Only | Teaching & Research | Sub Total | Res Only % Sub Total | ALL Staff | Res & T&R % ALL |
|---|---|---|---|---|---|---|
| **1995** | 8,539 | 25,702 | 34,241 | 24.9% | 77,430 | 44.2% |
| **1996** | 8,601 | 26,354 | 34,955 | 24.6% | 78,766 | 44.4% |
| **1997** | 8,705 | 25,914 | 34,619 | 25.1% | 77,316 | 44.8% |
| **1998** | 8,488 | 25,636 | 34,124 | 24.9% | 76,272 | 44.7% |
| **1999** | 8,684 | 25,356 | 34,040 | 25.5% | 76,037 | 44.8% |
| **2000** | 8,840 | 25,583 | 34,423 | 25.7% | 76,878 | 44.8% |
| **2001** | 9,132 | 25,711 | 34,843 | 26.2% | 78,205 | 44.6% |
| **2002** | 9,829 | 25,916 | 35,745 | 27.5% | 81,144 | 44.1% |
| **2003** | 10,633 | 26,304 | 36,937 | 28.8% | 84,435 | 43.7% |
| **2004** | 11,339 | 27,151 | 38,490 | 29.5% | 87,658 | 43.9% |
| **Change no.** | 2,800 | 1,449 | 4,249 | | 10,228 | |
| **Change%** | 32.8% | 5.6% | 12.4% | | 13.2% | |

Source: DEST Selected Higher Education Statistics

NTEU believes that this change in the composition of academic staff, toward more research-only staff, reflects changes in the mix of public funding for research and teaching. This funding mix, which will be discussed in further detail below, presents a number of serious challenges to Australian universities. In particular:

- how to adequately staff their teaching responsibilities and provide those staff with the capacity to continue to undertake research,
- attracting, retaining and providing career paths for dedicated research staff.

In addition to these specific challenges, universities are also confronted with a major staffing issue as a consequence of a rapidly ageing workforce.

**The teaching research funding mix**

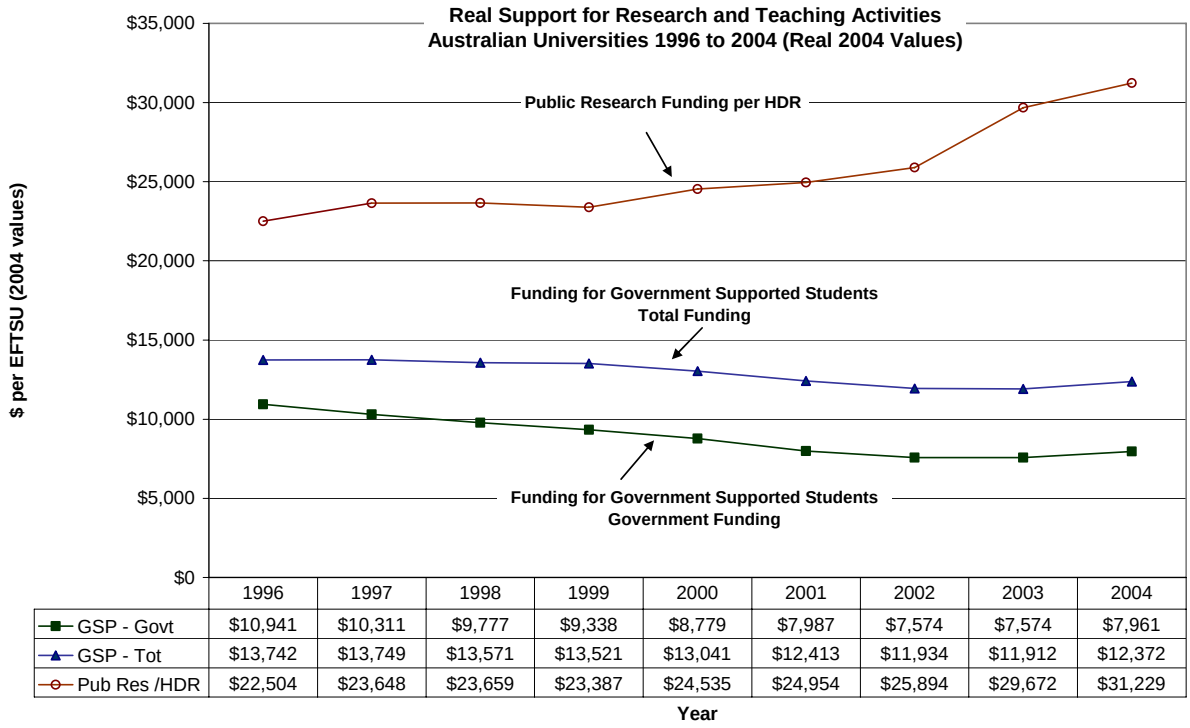
As the analysis presented in Part A demonstrated, real public funding per HDR student at Australian universities has shown a significant increase since the introduction of BAA in 2001. However, the opposite has been true in relation to universities' general teaching role in educating government supported students, with significant declines in real public funding per student in relation to both undergraduate students and postgraduate coursework students in national priority areas.

Figure 5 compares the real level of income universities receive (made up of both government operating grants and student HECS payments) to undertake their general teaching role, with the public income universities receive for research activities. In order to take account of increased teaching and research education loads, the teaching income has been divided by the total student load and research income by HDR load. While the data presented in Figure 5 are not directly comparable, and need to be interpreted with caution, they are indicative of the change in the mix of government support for university research relative to their more general teaching responsibilities.

As the data shows the real per-student income universities receive for their teaching role declined by 10% over the period 1996-2004. However, the Government's contribution actually fell from 80% to about 64% over this period, because of increases in students HECS contributions. In other words, the increase in students' contributions due to higher HECS was not sufficient to offset the overall decline in financial support for government supported university students. By contrast the level

of real public research income per HDR student increased from $22,504 per student to $31,229 or 38.8%.

**Figure 5**




| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|
| GSP - Govt | $10,941 | $10,311 | $9,777 | $9,338 | $8,779 | $7,987 | $7,574 | $7,574 | $7,961 |
| GSP - Tot | $13,742 | $13,749 | $13,571 | $13,521 | $13,041 | $12,413 | $11,934 | $11,912 | $12,372 |
| Pub Res /HDR | $22,504 | $23,648 | $23,659 | $23,387 | $24,535 | $24,954 | $25,894 | $29,672 | $31,229 |

*Source: Figure 3 and NTEU (2006) Students Pay More: Universities Get Less Update II (2006) (www.nteu.org.au/policy)*

NTEU is highly supportive of the increased public financial support for research activities, but questions what impact the reduction in real funding for the teaching of government supported students is having on the relative priorities and workloads of staff with dual teaching and research responsibilities.

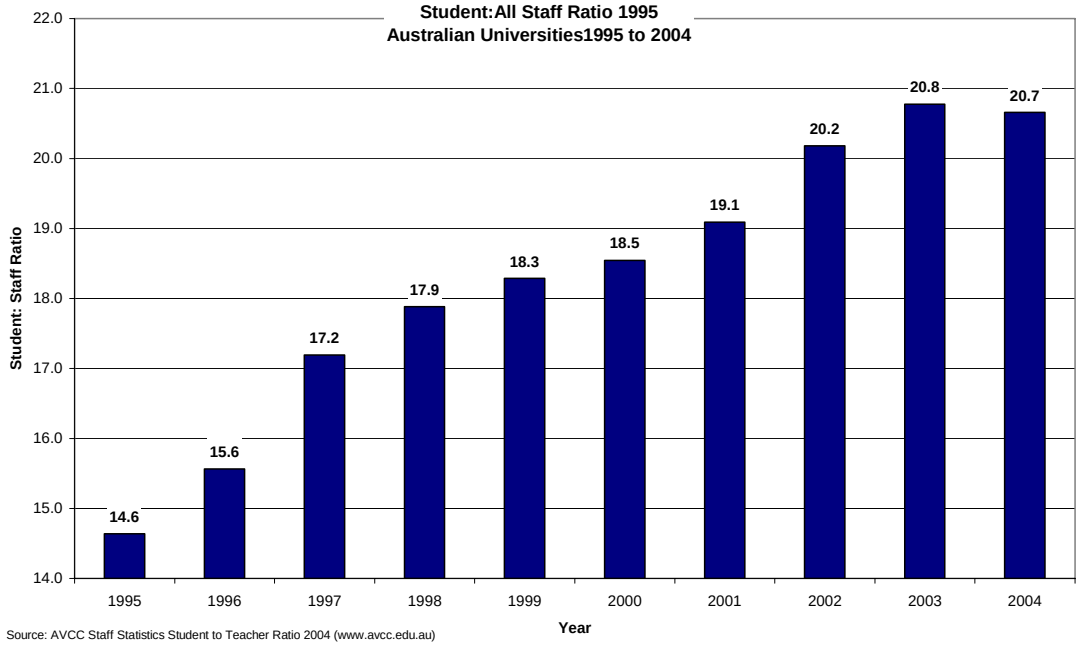
Real cuts in funding to support government supported students has resulted in a dramatic rise in the student to staff ratio at Australian universities[9]. As Figure 6 shows, the student to staff ratio increased from 14.6 to 20.7 between 1996 and 2004 – a rise of almost 42%. This means that the teaching workloads for over 70% of academic staff, who have both teaching and research responsibilities, have increased significantly. This has placed increased pressure on their research activities and resulted in extended working hours for most academic staff to well over 50 hours per week.

Declines in public funding for teaching and research activities, are likely to impact on the research capacity of Australian universities, as the majority of academic staff are forced to allocate more time and resources to teaching. However, while public funding for teaching activities has been falling in real terms, the fact that this funding is directly related to the number and discipline profile of government supported student places each university is allocated means that there is at least some certainty attached to this funding. Conversely, while research-only staff and public funding for research are increasing, this funding is becoming increasingly uncertain and

[9] AVCC defines "The staff FTE, used for the ratio computation, comprises full-time and fractional full-time staff with work functions of "teaching" and "teaching and research" only". http://www.avcc.edu.au/documents/publications/stats/SSR-2004-data.xls#'Explanatory Note'!A1

contingent and therefore is also likely to affect the research capacity of Australian universities, both in relation to the type and nature of the research being carried out as well as the staff universities are able to attract to carry out this research.

**Figure 6**




Source: AVCC Staff Statistics Student to Teacher Ratio 2004 (www.avcc.edu.au)

## Public support for universities research activities

Universities receive research funding from two broad general sources:

- project based research grants which are essentially allocated on a competitive basis and must be allocated to specific projects, and
- block grants over which universities have some discretion which provides base-line funding for universities to support research activities more generally.

Table 10 provides a breakdown of the share of total university research income by source, namely competitive grants (largely competitive public grants through the ARC and NHMRC), industry and other private sources and other public sources. NTEU would contend that the first two categories namely competitive grants and industry grants fit into the first category, that is project based funding, while the latter, other public grants constitute base-line support funding. As the data in Table 10 shows, in 2003, over 80% of total research income was of a project based nature (competitive grants or industry and other sources). Only about 20% of total funding could be considered as base-line support research funding.

It should be noted that even some base-line support discretionary research funding is allocated is also allocated on a competitive basis. Funds allocated to universities to help develop and support research infrastructure through the Research Infrastructure Block Grants (RIBG) scheme are calculated on the basis of each university' share of Australian.Competitive Grants Income. At current funding rates the RIBG provides 20 cents for each dollar of competitive grant income. NTEU supports recommendations contained in the Government's *Evaluation of the Knowledge and Innovation Reforms* that this should be increased to bring it into line with similar programs internationally, which are funded at a rate of 40 cents for each dollar. This is to ensure that universities are not forced to draw on other income in order to leverage competitive grants. The introduction of the RQF will result in other

discretionary research funding such as the Institutional Grants Scheme (IGS) and the Research Training Scheme (RTS) also being allocated on a more competitive basis.

While the NTEU agrees that research funding should be allocated to the highest quality projects, it needs to be understood that competitive project based funding creates its own set of challenges to universities in employing research-only staff (which are becoming an increasingly important part of the academic workforce as shown above) because of the high level of uncertainty of this funding which is only guaranteed for a funding cycle typically between 1 and 5 years.

**Table 10: Share of University Research Income Received by Universities by Source 1992 to 2003**

| Year | Competitive Grants | Industry and Other | Sub-Total Comp Grants + Ind & Other | Other Public Sector | TOTAL |
|---|---|---|---|---|---|
| 1995 | 53.5% | 30.0% | 83.6% | 16.4% | 100.0% |
| 1996 | 55.5% | 29.3% | 84.8% | 15.4% | 100.0% |
| 1997 | 53.2% | 31.0% | 84.1% | 15.9% | 100.0% |
| 1998 | 53.3% | 31.2% | 84.5% | 15.5% | 100.0% |
| 1999 | 54.8% | 30.1% | 84.9% | 15.1% | 100.0% |
| 2000 | 48.8% | 33.9% | 82.7% | 17.3% | 100.0% |
| 2001 | 45.2% | 36.3% | 81.5% | 18.5% | 100.0% |
| 2002 | 44.5% | 36.2% | 80.7% | 19.3% | 100.0% |
| 2003 | 47.4% | 33.1% | 80.5% | 19.5% | 100.0% |

Source: AVCC Research Statistics (www.avcc.edu.au)

NTEU is already aware that several universities are moving to classify academic staff as being either research active or inactive based on the universities' own assessments of research produced by individual staff members. A number of universities are proposing to use these classifications to reallocate teaching workloads away from so-called research-active staff, to staff considered to be research-inactive.

These processes are being introduced under the guise of the planned introduction of a research quality and impact assessment exercise to be called the Research Quality Framework (RQF). While the NTEU strongly supports the underlying principles and rationale for the introduction of the RQF, which presents many of our members with the opportunity to have the quality of their research effort independently assessed and verified through a process of external peer review, we are concerned about the possible implications of the proposed model for the Australian university sector.

In particular, we are concerned that universities will perceive that they are best able to achieve high RQF ratings and secure funding through separating the teaching and research responsibilities of academic staff. This could result in the creation of teaching-only or teaching-intensive positions, and undermine universities general research capacity and capability.

Apart from these classification processes being highly arbitrary, they also have the potential to prejudice particular types of research, as well as particular research areas and outcomes that are easily able to be measured. NTEU members are also concerned that the RQF might cause universities to alter the nature and type of research they are prepared to support and therefore impact on intellectual freedom and free inquiry.

While universities might believe that creating a divide between teaching and research staff will be to their advantage in terms of the assessment they are likely to get under any RQF, in the longer term NTEU believes this could threaten the quality of education delivered by Australian universities. NTEU believes that teaching and research are inextricably linked and that this link is essential to both the development of high quality curricula as well as the role universities play as researchers and research educators in Australia's innovation system.

In summary, the reason the change in the public funding mix presents a major challenge to universities in fulfilling their teaching and research and research education roles, is because it is forcing them to prioritise and separate their teaching and research functions. Declining public funding for the teaching of government supported students is increasing the teaching workload for staff with teaching and research responsibilities, and thus reducing their capacity to undertake research. On the other hand, while public funding for research has been increasing in real terms, the bulk of this funding is allocated on a competitive basis. While NTEU believes that research grants should be allocated to the best projects, it is becoming apparent that the precarious nature of this funding is having implications for universities in recruiting and retaining staff.

There is a real danger that the composition of academic staff will be comprised largely of teaching-only and research-only staff, with academics that have teaching and research responsibilities becoming a minority. This presents two major challenges to universities. Firstly, how to maintain high quality knowledge production and dissemination, which the NTEU believes is dependent on ensuring that all teaching is informed by research. Secondly, how to attract and retain high quality research staff and offer researchers a genuine research career under the increasingly competitive nature of research funding. These later issues are discussed at more length in following part of this submission.

In the interests of maintaining both high quality knowledge production and dissemination, NTEU believes that it is critical that the teaching research nexus at all Australian public universities is maintained. In this respect, NTEU recommends that a research loading be added to Commonwealth Grant Scheme, which is currently allocated as a set amount of funding per student, depending upon the discipline in which the student is enrolled. This would essentially be discretionary funding that would have the advantages of:

- specifically acknowledging the nexus between teaching and research by allocating money for both teaching and research activities through Commonwealth Grants Scheme the on a per student basis,
- ensuring greater funding certainty for universities' research activities, through tying some research funding to government supported teaching loads, and
- easing the pressure on universities to separate and prioritise the teaching and research responsibilities of their academic staff.

In addition, universities need to be able to create an environment where pursuing a research dedicated career at an Australian university is more attractive proposition than is currently the case, as discussed below.

## II. Research Careers at Australian Universities

While research-only staff are becoming an increasingly important part of Australia's academic labour force, NTEU believes that the highly competitive and therefore uncertain nature of funding to support universities' research activities has

implications for those wishing to pursue a dedicated research career within the Australian university sector, as well as the nature and, potentially, the quality of the research being carried out.

While there is little data supporting these claims, NTEU has significant anecdotal evidence to suggest that there are significant difficulties in pursing a research career at a number of Australian universities and these difficulties pose significant impediments to the effective functioning of Australia innovation system. In order to gain further insight into these claims, NTEU randomly selected members employed in research positions in medicine, science, engineering, mathematics and information technology disciplines, and asked them a series of questions about their research career within the higher education sector, including their aspirations and the incentives and impediments to developing a research career in the sector. In addition to requesting members to respond to a range of issues, the NTEU also approached all of the Deputy/Pro-Vice Chancellors (D/PVC) of Research at Australian universities. We received responses from 9 D/PVCs which represents almost a quarter of all universities. A number of respondents wanted to make it clear that comments reflected their own views and not necessarily their institution's official policy position.

An overview of the issues raised and a summary of our members' and D/PVC responses is provided below. While the NTEU does not claim that the responses in anyway represent statistically significant evidence, we would argue that they are indicative of the views of our members employed in research-only positions, which as shown in Table 9 represent about 30% of all academic staff employed at Australian universities. The responses provide valuable insights into the motivations and difficulties researchers face in establishing and maintaining a dedicated research career at Australian universities.

**Nature of Employment**

Those members from whom we received responses spent between 70% and 100% of their time on research and were predominantly employed on fixed term contracts. Of the 30 respondents who provided information, only 4 were employed on a continuing basis. The large majority of members were employed from research grant funding, either through competitive research grants or industry grants or a combination of both. Only 2 respondents indicated that their positions were funded from general university funds.

Those surveyed had spent varying lengths of time as university researchers, with approximately a third of those surveyed currently on their first contract and another third indicating that they had been employed on between 2 and 5 contracts. The remaining third had been employed on over 5 contracts, 3 of whom had had more than 10 contracts. NTEU is also aware of at least one research-only member who has been on a series of one year contracts for over 40 years.

When asked if they thought that they would have the opportunity for further employment at the expiry of their contract, responses were equally divided between those that had no idea, those who were hopeful but indicated that there was some possibility but were dependent on funding, and those who indicated that they either definitively would or definitely would not secure further employment. Despite the lack of any statistically significant quantitative data, it is apparent from the responses we received from our members that the rate of staff turnover in research-only positions at Australian universities would be well above that of other university employees and is largely dependent on research grant funding cycles.

**Incentives to work at universities**

The differing roles and functions of research and development within the university and business sectors mean that universities often recruit researchers with different motivations and interests from those who work in industry. Nearly all respondents to our survey mentioned the freedom and flexibility to pursue their research interests as a major incentive for working in the sector. Along with academic freedom, a large proportion of respondents also expressed passion for their work, intellectual stimulation and the ability to explore issues more substantively as major incentives for working in the sector. Overall, members' responses to what they considered to be incentives for working as researchers within the sector were somewhat similar, with the following selected quotes from individual members, giving a good indication of responses:

> *"The incentives for me are work flexibility, some freedom to pursue your own ideas, feel like you are making a contribution to the disease you are researching and the community as a whole"*
>
> *"The main incentive is that I enjoy the work and I feel it's where I can best make a contribution given my skills and background"*
>
> *"The biggest incentive is passion for the job and field of research, even when funding and employment opportunities are relatively few"*

The similar nature of the responses is not surprising given the analysis of the type and fields of research undertaken by universities. As was demonstrated earlier, universities account for over 80% of all pure basic research undertaken in Australia, and it is little surprise that our members clearly indicated that the incentive to pursue a research career within the higher education sector was largely driven by a desire to undertake curiosity driven research and to be able to do so in an environment governed by the principle of freedom of inquiry.

However, while all the respondents indicated that they would like to pursue a research career within the Australian university sector, a large proportion expressed reservations about the wisdom of doing so, as captured by the following responses:

> *"I'm a specialist instrumentalist, the instrumentation I need to undertake research is largely only housed within Universities in Australia. I love what I do. I believe in the value of our research endeavours. However, I have no realistic expectation of ever finding secure employment as a researcher within the sector."*
>
> *"I am doing it, if you can call it a career. If I was the sole earner I don't think that it would be secure enough although it's been 20 years of employment".*
>
> *"Yes – I have been desperately trying to pursue a career in research within the Australian university sector. However, I am becoming jaded with the experience".*

**Disincentives**

While it was clear a number of respondents had already managed to pursue a career in research, despite the insecurity, many respondents expressed increasing frustration at the lack of certainty around future employment, and saw it as a major impediment to continuing to work within the sector, claiming that it affected not only their family life, but also the quality and continuity of their research, as the following quotes demonstrate;

> *"Lack of job stability means it's difficult to pursue ones work, particularly if you have a family. One reason for this would be the limited number of available (new) lectureships in local universities".*

> *"Lack of permanent positions in research means reliance on insecure employment which in turn impacts on research performance - by last year of contract the focus is inevitably on the next position".*

> *"This year, for the first time, I am not losing sleep over the possibility that I may not be reappointed next year. I am not scouring job adverts seeking possible alternative appointments for 2007. I will return to worrying about that in 2008. But that's a problem for then. For now I can concentrate on my work, not my future".*

All respondents mentioned lack of job security and career stability as a major disincentive for working as a researcher in the university sector. Pay was another significant consideration, with many respondents feeling that it was not competitive with industry. In addition a number of respondents were also concerned about insufficient levels of funding for universities and particular projects:

> *"Disincentives include a comparatively low PAY for the education required, hours worked, and long term commitment required to have a career in research - being competitive (in order to secure funding), the lack of security and the need to compete even with those who are supposed to be nurturing your career (supervisors, collaborators etc)".*

While NTEU does not have any hard evidence, anecdotal evidence suggests that in some specialist areas of research directly associated with the mining boom, companies are currently prepared to offer university staff double their current salary as an opening gambit to try to recruit them.

In relation to a question about whether their university faced any difficulties in attracting or retaining high quality dedicated research staff, especially in sciences and associated fields, because of not being in a position able to offer competitive salaries and/or career paths compared to business, 8 out of the 9 D/PVCs responded in the affirmative, although commented that this was only in specific areas that were not listed. In terms of competing with research opportunities offered overseas, there was no consistency in responses with about half believing it was an important factor in attracting good quality candidates.

In addition to rates of pay, another issue that is often cited as a disincentive for short term contract employees is differences in access to other non-wage components of the pay and conditions. For example, it is not uncommon for staff employed on short term contracts to receive less generous employer superannuation contributions than continuing staff. Another issue raised by one of our members was that universities are not required to make provision for potential liabilities of short term staff such as parental leave or long service leave. In essence these types of liabilities are unfunded, which provides a disincentive for universities to engage staff on a continuing basis.

Administrative and teaching loads were also identified as disincentives with one D/PVC stating that:

> *"The greater problem is that of high teaching loads that deter staff from undertaking research; this is discouraging those who want to develop a research career from joining the HE sector."*

With a significant number of staff relying on research grant funding cycles, a number expressed concern that they spent an increasing proportion of their time applying for research grants in an attempt to further their own research careers. One dedicated

researcher employed in a specialist research centre commented that, working in that environment was very much like running your own small business, where it was largely left up to individuals to secure funding for their own future employment. In addition to representing a high opportunity cost of lost research time, junior or middle ranked research staff are at a major disadvantage in applying for competitive research grants where they are competing with other staff with established careers and research records. As one member commented:

> *"Disincentives are the focus on income generation through grants and consultancies. This creates a high opportunity cost in terms of time expended and also diverts effort to research deemed appropriate by external agencies. Certainly not conducive to high quality critical independent scholarly research on an ongoing basis".*

Similarly, all but one D/PVC indicated that relying on relatively short term project based research grants as the major source of funding for attracting and retaining dedicated research staff was a major issue confronting universities.

The other factor that respondents felt was influencing the nature of their research work, was the rules and priorities attached to competitive research funding. There was a diversity of opinion as to the extent of this influence, with some indicating that it was a primary determinant of their research area and others indicating that it was just a matter of 'tweaking the edges'.

> *"I am totally dependant on public funding. The priorities of funding utterly dictate the kind of work I prefer to attempt. This is perhaps less true of the academics, who can afford to 'burn' a few PhDs on speculative projects."*

> *"The main change that affects the nature of research that I carry out is the focus on applied outcomes, particularly the focus on outputs that attract IP. This stifles creativity and examination of new areas where no applied outcome can be promised. Researchers put up projects that have guaranteed outcomes. This leaves quite a bit of ground breaking research in the stalls".*

> *"Usually more senior colleagues have attracted the funding that pays me. We are always at the mercy of fashions in research funding but our field isn't so affected by that as some others".*

**Research Career Paths**

While a handful of respondents thought that their universities were or could be adopting policies and strategies to help in the recruitment, retention and or development of career paths for dedicated research staff, the majority of respondents thought that there were no such provisions made by their universities. There were however, a number of suggestions or initiatives that respondents thought had some merit, including:

> *"The university attempts to attract staff who are likely to succeed in the Grant race. That success 'secures' their career. For three years. To be fair, recently there have been initiatives to provide one year 'gap' finding for those who miss a fellowship renewal, but the bottom line is: get a grant, or get lost. We have made efforts to do our own career development (our Research Career Development Network), and this has been favourably received. This is worthwhile in several ways, but the bottom line remains: publish or perish"*

> *"My university has created strategic areas of research investment, and undertakes a number of training programs. More could be done to assist younger researchers in grant-writing in particular".*

*"There are no general provisions for ongoing dedicated research appointments (ie tenured researchers). However my university is making selective research intensive appointments in areas perceived as requiring investment or support. These tend to be at the senior level rather than junior. They are rare and contingent however".*

*"If you're not doing a fair bit of teaching your career progress will eventually be impeded but there are plenty of opportunities for research staff to do teaching if we want to. The vast majority of academic workers in my department are dedicated research staff and our teaching gets done on the side so this department is heavily focused on research and necessarily focused on research careers".*

*"Universities should provide researchers with the opportunity to have associate affiliation when they are 'temporarily unfunded'. As it is currently, once their contract has expired, those research-only staff who have not yet secured another academic job ('temporarily unfunded' academics), and yet who wish to pursue an academic career, are effectively on their own, without access to library facilities (particularly online journals and databases), without a university email address and without institutional support to apply for grants".*

While respondents generally thought that it was important for Australian universities to promote research careers, many thought that universities were not in a position to be able to so, predominantly due to funding constraints, which a number of respondents believed not only impacted on career issues, but on the research itself.

*"Currently Universities seem to be struggling with funding issues. Our department seems pretty under resourced for its teaching commitments and that just cuts into support funds available for research staff. But, I think the university environment is essential for research, so from a cultural point of view they are in the best position to provide a career path for dedicated researchers".*

*"Universities can provide the early stages of a research career (i.e. PhD) because they are value for money, however a large number of graduates end up overseas where there is better pay and facilities. I feel I am extremely fortunate to have secured a job at the institution where I undertook my PhD".*

*"I believe the sacrifices required to follow this career path are fast becoming completely disproportionate to the financial compensation, and academic freedoms, associated with such positions".*

*"Australian universities are not in a position to address the current employment and job security crisis which plague research. The universities are under resourced enough without providing a career path for researchers".*

*"From what I've seen there seems to be research funding out there (by way of grants from other organisations) but it takes a considerable amount of time to put good quality submissions together and manage research projects thoughtfully, efficiently and effectively. Many higher level researchers are juggling numerous research projects on top of full time workloads, and the quality of their research would no doubt benefit from capable project managers with skills in coordination, in addition to quantitative and qualitative research methods".*

Most D/PVCs indicated that their universities had implemented strategies with the specific aim of attracting and retaining high quality research staff which largely involved selective recruitment and/or head hunting. NTEU also believes that a number of Australia's research intensive universities are in the process of developing policies aimed at providing research dedicated staff continuing employment by attempting to provide funding to allow researchers to be employed between research grant cycles.

NTEU also asked the D/PVCs whether there were any changes to government policy in relation to publicly funded research that would make it easier for universities to offer high quality researchers careers as dedicated researchers, the responses generally suggested higher levels of government support so as to:

- allow teaching and research staff to devote a greater amount of their time to research tasks,
- improve the research infrastructure, especially in relation to building and refurbishing high capital costs in relation to specialist laboratories etc, and
- provide funding for the establishment of dedicated research chairs to act as leaders in areas of strength (as currently happens in Canada).

Another respondent made specific mention of the problems faced in retaining mid career researchers. The view was expressed that while early high quality PhD graduates had opportunities to enter a research career through post-doctoral fellowships, and experienced researchers with an established track record were in a position to attract competitive research grants, it was the people in between who had difficulty finding dedicated research positions who were normally required to maintain their attachment to research by applying for traditional teaching and research positions.

**Impact of the RQF**

Most respondents were unsure about how the RQF would affect universities' ability to attract and retain high quality research staff. A number of respondents saw the measuring of research quality as a good thing, but thought that the RQF would create a significant divide between research and teaching staff and institutions. A number also commented on additional administrative burdens that would adversely affect the quality of research being carried out. A number of respondents also thought that most researchers were already aware of which institutions were the most attractive for research staff and that the RQF would not change this, except to limit opportunities in smaller institutions and for early career researchers. While no overall theme was apparent from our members' responses, the following quotes provide a broad overview of the major concerns expressed by our members.

> *"The foreshadowed additional administrative burden will be the straw that breaks the camel's back for a few, but mostly it will just be yet another burdensome administrative impost on the researchers."*
>
> *"Based on my experience in the UK, basically a white-line was drawn in the sand and universities to the north of this line were labelled research intensive, and those to the south of the line, teaching universities. This would be a very dangerous thing if it were to happen in Australia."*
>
> *"I foresee many smaller universities becoming primarily teaching institutions."*
>
> *"The RAE has already stimulated my institution to begin appointments of senior research intensive academics at the Professor and Associate Professor level. This however risks the potential for other institutions to copy such a strategy resulting in wasteful churning of senior scholars through senior positions combined with a stagnant investment at the junior researcher level. If this were to occur it would be highly inefficient way to achieve higher research output and quality in Australian universities. It would potentially create periodic and cyclical inefficiencies and instabilities in the academic research labour market."*
>
> *'My experience of the RQF in the UK was that it was a monumental waste of everyone's time, that just produced reams of paper to reiterate what everybody knew: some groups get grants, others don't. It did not change who were winners, except to exaggerate the divide between the haves and the have nots."*

*"I think it's a good idea in the main. Of course people will know how to "play the game" and so the RQF will become less meaningful, but I think that assessing your work is a good thing, and striving to produce good work is a good thing."*

In relation to the RQF, the responses we received from D/PVCs either indicted that it was "*too early to know*" or that they anticipated that the RQF would make the task of securing research funding even more competitive and therefore uncertain. Another D/PVC noted that, even at this early stage, it was apparent that the introduction of the RQF was resulting in some institutions attempting to "*poach the best research staff*".

**Overview of Responses**

From those we surveyed, we can infer that researchers working in universities are generally highly motivated individuals who are motivated by passion and commitment to their research projects rather than by financial reward. By and large, universities provide them with an environment that gives them the freedom to pursue and explore their ideas, but that this freedom is being curtailed by a number of factors, perhaps most significantly lack of employment security. This lack of security seems to be a problematic factor not only on a personal and financial level, in terms of the pay and conditions associated with working in short term contract positions, but also on an intellectual level as the need to secure funding increasingly encroaches on the type and fields of research that is being carried out.

The comments of two of the respondents summarise these issues quite neatly;

*"The system of employing the vast majority of research staff on relatively poorly paid, short term contracts is manifestly detrimental to the kind of work attempted, and the kind of people prepared to stay here and do it. It avoids the opposite problem of entrenched deadwood, but at the cost of entrenching mediocrity (the truly talented will go where they have the money to answer important questions, not the ones you can get an answer from in 18 months using 2nd rate help). This is not to suggest that we do not train excellent researchers, just that those who are really excellent will leave, with only a few returning for family/lifestyle reasons. It would be counterproductive to hand out research jobs for life, but a system where the expectation is that you are likely to be renewed each 5 years (like the Wellcome Trust) is far better. Of course there would be fewer positions, but it would reduce the business of postdocs having to move wherever there is money. This is a terrible waste: you build up expertise in a field, but because only 20% of grants get funded, the chances are you'll have to move on and start all over again in another lab once your three years is up".*

*"Most in the scientific community do research work out of love, rather than any kind of financial reward. I for one am very happy with my pay levels. However, I am starting to feel that the personal sacrifices I need to make to stay within this career are fast outstripping the intellectual rewards provided in return. The loss of job stability places me under a great deal of stress, and unfortunately dramatically reduces my current job satisfaction within the university environment. Sadly, this last point is probably my biggest disincentive for staying within the University sector".*

It is clear that the Government's commitment to increase research funding, relative to funding for support of teaching, will result in the need for universities to employ more dedicated research staff if they are to fulfil their responsibilities. However, the competitive nature of this funding makes it difficult for universities to offer research dedicated staff genuine careers. Thus, the NTEU recommends that the balance between competitive and base-line research support funding needs to re-examined in order to encourage universities to offer structured career paths for young, dedicated

researchers and attempt to make working at Australian public universities in this capacity, an attractive proposition.

## III. The Ageing of the Academic Workforce

Another critical challenge that Australia's universities are going to have to face in the very near future, and which exacerbates and complicates the issues raised in the preceding sections, is the ageing of the academic workforce. While this is part of a more general trend regarding the ageing of the workforce overall, recent research by Professor Graeme Hugo has shown that the academic workforce in Australia is older than almost any other group of workers.[10]

Table 11 shows that there are more academics over 55 years of age than there are in the workforce as a whole. This age group is also over represented in the professional workforce, with only Doctors having a slightly higher proportion of its profession in this category. Academics also have comparatively low levels of staff under 40 compared to the rest of the workforce, particularly those staff involved in teaching, with only 33.8% of all lecturers and tutors under the age of 40, significantly less than even Doctors, who most closely mirror the age profile of the academic workforce. While this suggests that research staff may be slightly younger than the teaching cohort, the ageing of the academic workforce generally and teaching staff in particular, has significant implications for universities as a whole as well as for both teaching and research and research-only staff.

**Table 11: Australia: Percentage of the Workforce by Age Groups, 2001**

| | All academics | Lecturers and tutors | All workforce | All professionals | Doctors | IT Professionals |
|---|---|---|---|---|---|---|
| **55 years and over** | 15.7% | 19.0% | 11.5% | 11.1% | 20.1% | 3.6% |
| **45 years and over** | 44.5% | 51.2% | 33.4% | 36.3% | 45.2% | 18.7% |
| Under 40 years | 40.8 | 33.8 | 53.8 | 49.3 | 39.5 | 67.7 |

**Source: ABS 2001 Census referenced (from Hugo 2005).**

There are significant implications for universities in recruiting new staff. As Hugo points out:

> *International competition for highly skilled professionals including academics has never been more competitive. Australia must compete not only for potential academic staff from other countries but also for Australian graduates who are increasingly examining options in foreign universities.*[11]

However, there are also significant challenges ahead for universities in terms of succession and continuity with a substantial loss of older, experienced staff through retirement. Hugo suggests that the substantial increase in teaching loads that has occurred over the last decade may well have been possible because of the experience of the teaching staff over this period. He warns that large scale replacements of this expertise with recent graduates could present significant difficulties.[12] This is particularly significant for teaching and research staff who are already struggling to find time to undertake the research component of their work.

[10] Hugo, Graham, "Academia's Own Demographic Time-Bomb", *Australian Universities Review*, Vol 48, No.1, 2005, pp16-23
[11] *ibid*, p.21.
[12] *ibid*, p.21

New staff, taking on increasing teaching loads without the resources and experience of older staff, are likely to feel this pressure even more.

Given that Australian universities are to be faced with such a significant recruitment crisis, NTEU endorses the recommendations made by Hugo, that in order for universities to continue to produce, let alone enhance, high quality knowledge production, dissemination and advancement, they will need to adopt a range of innovative human resource strategies, including;

- New blood programmes,
- Early recognition of new talent,
- Family friendly policies,
- 'Bringing them back' programmes to repatriate former staff and students of the university,
- Developing joint international exchanges in teaching and research,
- Incentives to keep 'high flyers' in the university,
- Gradual retirement programs for selected staff, and
- Accelerated promotion for key staff. [13]

NTEU believes that it would be to the Productivity Commission's advantage to request information from universities as to whether they are developing specific policies in relation to this issue, and in doing so make an assessment as to what constitutes best practice.

[13] *ibid*, p.22.

## PART C

## Overview and the Way Forward

### Overview

The capability of the university sector to produce research, in particular basic research, is crucial to Australia's innovation capacity. It not only forms a basis for encouraging research collaboration but is also the foundation for further innovation.

The research produced at Australian universities is crucial to Australia's innovation effort, particularly in terms of its contribution to Australia's basic research effort, but also as educators of future researchers for all industries. It is for this reason that it is crucial that the teaching research nexus is maintained and universities are able to continue to produce high quality graduates. NTEU believes that the separation of teaching and research functions within Australia's universities will only serve to weaken the quality of both teaching and research.

In addition, if universities are unable to provide career paths for researchers, as well as teaching and research staff, Australia's innovation will suffer, both through the basic research effort as well as through an inability to produce capable graduates to work in applied, experimental and strategic research endeavours.

Given the age profile of the academic workforce, it is already likely that universities will have difficulties in recruiting the number of new staff required to replace the large proportion of academics that are likely to retire in the next decade. Without adequate career paths for university researchers, this recruitment task will become even more difficult, particularly if the conditions of employment impinge on those very factors that attract people to a research career in the first place.

### The Way Forward

Throughout this submission, NTEU has made a number of suggestions as to which issues we believe to be important to facilitating universities' capacity to fulfil their distinct and important role as part of Australia's innovation system. In summary the NTEU recommends that when examining public support for science and innovation, the Productivity Commission take into account:

- the distinct role that universities play in Australia's innovation system, both in terms of the types and fields of research that they undertake and in their role as educators of Australia's future researchers,
- that research undertaken by Australian universities should be seen as complementary to and supportive of business sector research, and
  - that policies and programs be developed to increase the number of effective partnerships between the two sectors,
  - that these policies are sensitive to the different motivations and cultures of research within these sectors and address the potentially difficult intellectual property issues that arise from collaborative research,
- that public support for universities teaching responsibilities be addressed to ensure that the critical nexus between teaching and research is maintained and that those academic staff who are employed to undertake both teaching and research have the capacity to do so in the future,
- income support measures for HDR students,
- that the nature of public support for university research, which is largely competitive in nature, be re-examined to allow universities to offer dedicated research staff genuine career paths, and
- that urgent consideration be given to how universities will meet the looming crisis of their rapidly ageing academic workforce.