SUBMISSION TO HOUSE OF REPRESENTATIVES COMMITTEE ON INDUSTRY, SCIENCE AND INNOVATION

INQUIRY INTO

RESEARCH TRAINING AND RESEARCH WORKFORCE ISSUES IN AUSTRALIAN UNIVERSITIES

DEPARTMENT OF INNOVATION, INDUSTRY, SCIENCE AND RESEARCH

CONTENTS

INTRODUCTION

The innovation, industry, science and research portfolio takes a national leadership role in research and research training. The Department develops policies and delivers programs, in partnership with stakeholders, to provide lasting economic benefits ensuring Australia's competitive future.

PART A: AUSTRALIAN UNIVERSITIES' CONTRIBUTION TO RESEARCH TRAINING IN AUSTRALIA

1. Current Government support for research training

The Australian Government invests a significant amount directly into research training – over $700 million annually from the innovation, industry, science and research portfolio alone – in recognition of the contribution of research training students to the prosperity of the national research and innovation system. This investment is delivered by Australia's higher education sector.

The arrangements for the Australian research training system have their origins in the previous Government's 1999 White Paper, *Knowledge and Innovation: A policy statement on research and research training*. The policy statement introduced the program known today as the Research Training Scheme (RTS), and retained the Australian Postgraduate Awards (APAs) and International Postgraduate Research Scholarships (IPRS).

The Government has set in train a number of measures that may inform research training policy and associated funding arrangements in the future, including the Excellence in Research for Australia initiative, the Review of the National Innovation System and university compacts.

Australian Government programs and support

In 2008, research training in Australia continues to be supported primarily by the RTS, APAs and IPRS (all within the Innovation, Industry, Science and Research portfolio) as shown in Table 1. These programs are supplemented by the Commercialisation Training Scheme (CTS) which was introduced in 2007.

Table 1: RTS, APA and IPRS total funding 2002 – 2006 (actual year prices)

	2002	2003	2004	2005	2006	2007	2008
RTS Funding	$516,224,000	$528,473,205	$540,797,000	$552,153,000	$562,644,000	$573,897,000	$585,375,000
APA Funding	$85,079,000	$87,296,997	$89,297,996	$91,180,000	$93,121,000	$95,346,000	$97,767,000
IPRS Funding	$16,914,000	$17,301,996	$17,742,000	$18,037,006	$18,459,000	$18,828,000	$19,204,000
CTS Funding	-	-	-	-	-	$5,300,000	$5,406,000

These are known as 'block grant' programs where funds are allocated to universities using program-specific formulae that reward the performance of universities[1] in attracting research income, disseminating research results in mainly peer-reviewed publications and through the successful completion of research degrees by students.

[1] Institutions eligible to receive research block grants are those listed under Table A and Table B of the *Higher Education Support Act 2003*. This includes all Australian universities, as well as two self-accrediting higher education providers – Melbourne College of Divinity and Batchelor Institute of Indigenous Tertiary Education. For the purpose of this submission, eligible higher education providers are referred to collectively as universities.

In most cases, the formulae use data that are averaged over the two most recent years for which they are available. Appendix A details how grants are calculated and Appendix B details the 2008 grant amounts allocated to each university.

Other government support for research training within the portfolio includes the APA (Industry) scholarships administered by the Australian Research Council (ARC). Publicly funded research agencies, such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), play a key role in the training of research students in collaboration with the higher education sector as do Cooperative Research Centres (CRCs). Institutional Grant Scheme funding, which is provided by the Australian Government to maintain and strengthen Australia's knowledge base and research capabilities, is also used by some universities to support research training activities.

In other portfolios, research training is supported through competitively funded research programs and by dedicated mechanisms such as the National Health and Medical Research Council scholarships, the Endeavour program, the Australian Development Scholarships and Australian Leadership Awards provided by AusAID (see Appendix C for further detail).

Research Training Scheme

The RTS provides block grants, on a calendar year basis, to eligible universities to support research training for domestic students undertaking PhD and Masters degrees by research. RTS students are entitled to a maximum of four years full-time equivalent study if undertaking an eligible PhD degree by research and a maximum of two years full-time equivalent study if undertaking a Masters degree by research. RTS students study in a fully-subsidised place during this period, with no HECS-type liability accrued and no tuition fees to pay.

The objectives of the RTS are to:

- enhance the quality of research training provision in Australia;
- improve the responsiveness of universities to the needs of their research students;
- encourage universities to develop their own research training profiles;
- ensure the relevance of research degree programs to labour market requirements; and
- improve the efficiency and effectiveness of research training.

Figure 1: Research Training Scheme Funding 2001-2008 (actual year prices)

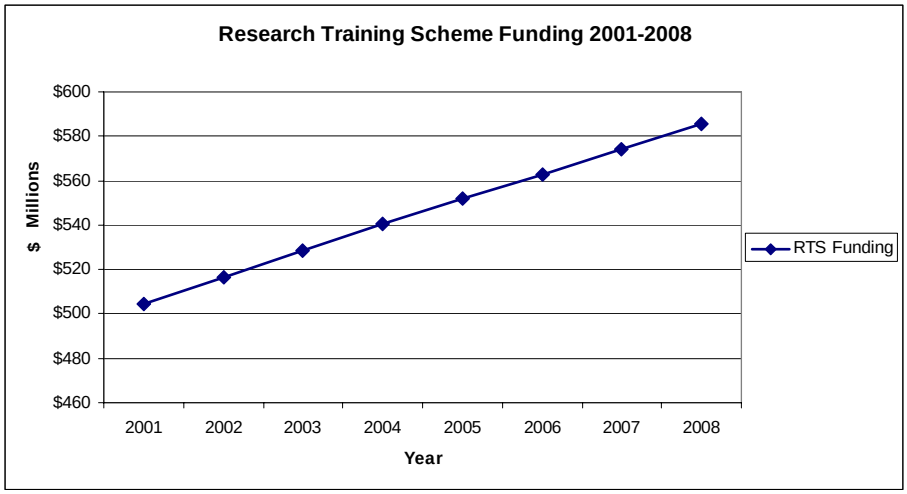
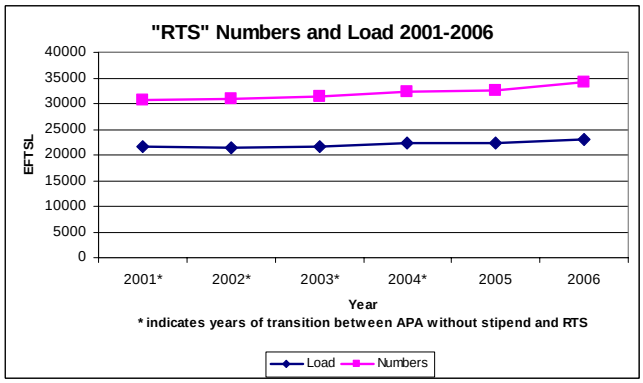


Figure 1 shows that RTS funding has increased marginally per annum due to indexation. There has been no increase in the RTS base funding over this period.

In 2006 (the latest year for which research student data is available), 34,165 actual students and 22,916 (Equivalent Full-Time Student Load (EFTSL)) places were supported by the RTS (Figure 2).

Figure 2: RTS Load 2001-2006[2]



Australian Postgraduate Awards

The objectives of the APA program are to:

- support postgraduate research training in the higher education sector; and
- provide financial support to domestic postgraduate students of exceptional research promise who undertake their higher degree by research at an eligible Australian university.

APAs help support the living costs of Australia's best and brightest domestic PhD and Masters by research students during their studies. In 2008, a full-time APA is worth $20,007 (tax-free). A part-time APA is $10,710 and, although tax liable, is adjusted to take taxation into account. APAs are available for a period of two years for a Masters by research student or three years, with a possible extension of six months, for a PhD student.

[2] Department of Education, Science and Training, *2006 Higher education statistics*.

Figure 3: Australian Postgraduate Awards Scheme Funding 2001-2008 (actual year prices)

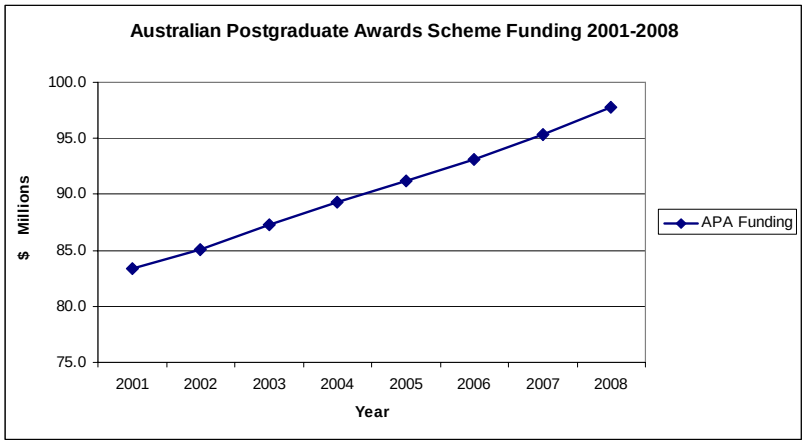
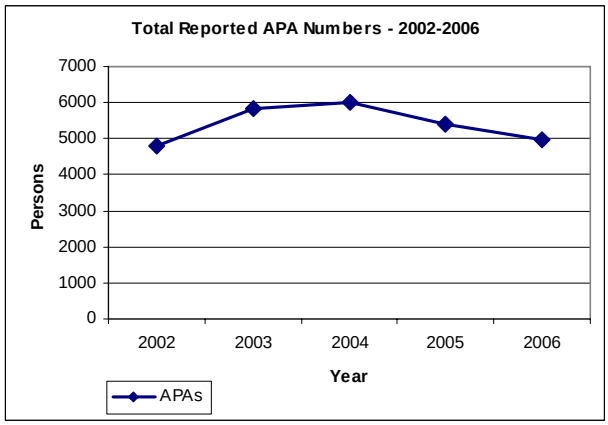


Figure 3 shows that APA funding has increased marginally per annum due to indexation and also a small annual increase to the base funding from 2006 as an outcome of the previous Government's *Backing Australia's Future* package.

There were 1,584 new APAs allocated to universities in 2008. As part of the Education Revolution, the Australian Government has committed to double the number of APAs by 2012. The first allocation of new APAs under this initiative will commence in 2009.

Figure 4 shows that in 2006, there were 4,985 APA holders in total[3].

Figure 4: Total Reported APA Numbers – 2002-2006



International Postgraduate Research Scholarships

The IPRS program enables international students to undertake a postgraduate research qualification in Australia and gain experience with leading Australian researchers. The scholarship covers tuition fees and health cover costs for scholarship holders, and health cover costs for their dependents.

[3] Department of Education, Science and Training, *2006 Higher education statistics*. Note that total APA student figures vary from year to year depending on factors such as the proportion of part time and full time students and the number of students who have suspended their studies etc. The Department of Education, Employment and Workplace Relations (DEEWR) has identified anomalies in the reporting of APA students for 2006 and is currently revising this data.

The main objectives of the IPRS program are to attract top quality international postgraduate students to areas of research strength in Australian universities and to support Australia's research effort. IPRS are open to international students of all countries (except New Zealand) and are available for a period of two years for a Masters by Research or three years for a PhD.

Figure 5: International Postgraduate Research Scholarships Funding 2001-2008 (actual year prices)

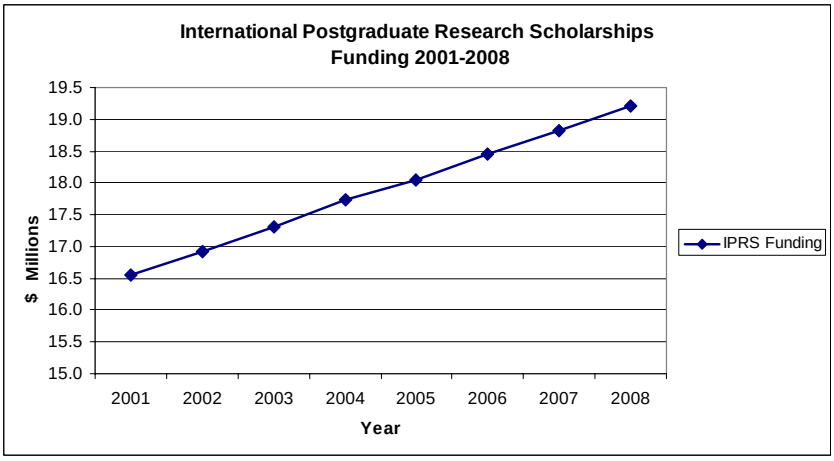
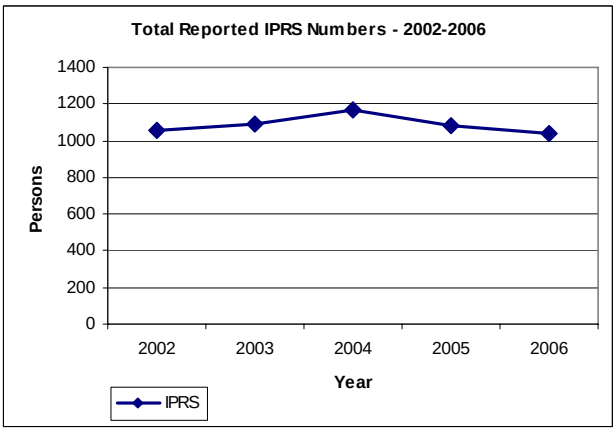


Figure 5 shows that IPRS funding has increased marginally per annum due to indexation and also a small annual increase to the base funding from 2004 when an additional 30 new scholarships were funded through the 2003-04 Budget.

330 new scholarships are awarded each year and in 2006 there were a total of 1,040 IPRS recipients (Figure 6).

Figure 6: Total Reported IPRS Numbers – 2002-2006[4]



Commercialisation Training Scheme

The CTS enables universities to provide high quality research commercialisation training for domestic PhD and Masters by research students to equip them with the skills, knowledge and experience necessary to bring research-based ideas, inventions and innovations to market. CTS students are exempt from payment of student contribution amounts and tuition fees for units undertaken as part of CTS

[4] Department of Education, Science and Training, *2006 Higher education statistics*. Note that total IPRS numbers for 2002 and 2003 are estimates.

training and are awarded a Graduate Certificate on successful completion. 40 out of 42 eligible universities elected to participate in the CTS in 2007 and around 250 CTS students are expected to be supported each year. CTS student data for 2007 will be available in the second half of 2008.

Australian Postgraduate Awards (Industry) (APA(I))

APA(I)s are living stipends for HDR students administered by the ARC. Under the *Linkage Projects* scheme, the ARC offers APA(I)s to support industry-oriented research training students. 295 new APA(I)s were awarded in 2007.

The *Linkage Projects* scheme supports collaborative research and development projects between higher education organisations and other organisations, including within industry, to enable the application of advanced knowledge to problems. Proposals for funding under *Linkage Projects* must involve a collaborating organisation from outside the higher education sector. The collaborating organisation must make a significant contribution (equal to, or greater than, the ARC funding), in cash and/or in kind, to the project.

On 26 March 2008, the Government announced that eligibility for APA(I)s would be opened up to allow further internationalisation of the national innovation system. Unlike the APAs which are restricted to domestic students, APA(I)s will now be awarded to the highest calibre postgraduate students irrespective of nationality.

The role of CSIRO and other publicly funded research agencies in the training of research students

While all research students in Australia obtain their degree through an Australian university, students sometimes undertake a portion of their training in industry, independent medical research institutes, or publicly funded research agencies such as CSIRO. In 2006-07, for example, in collaboration with university colleagues, CSIRO staff supervised, co-supervised and/or sponsored over 700 postgraduate research students, including more than 130 supervised in collaboration with Cooperative Research Centres (CRCs).

CRC Program

A key feature of the CRC Program is its role in engaging industry in CRC education programs to produce industry-ready graduates via the requirement for all CRCs to have a PhD training program. Some CRCs have initiatives that foster the development of Australia's future science capacity throughout all levels of our education system. A 2007 publication by the CRC Association highlights specific examples of training programs that have been developed by CRCs. These go beyond PhDs and encompass all levels of higher education, vocational education and training, secondary and even primary education. Some CRCs also provide education programs aimed at the general community.[5]

In addition, the CRC Association (a representative body of 57 CRCs) runs an annual conference where CRCs have an opportunity to come together to discuss best practice, including in the provision of their education and training programs.

[5] *The Impact of CRCs on the Australian Education System*, CRC Association publication, Nov 5, 2007. http://www.crca.asn.au/

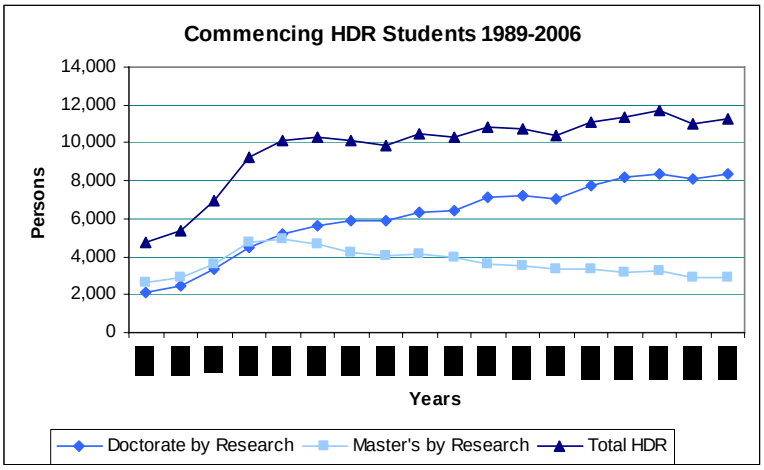
As of June 2007, CRCs have reported that there have been 4,345 new PhD students and 1,691 new Masters students supported through the CRC Program since its inception in 1991.[6]

One of the major advantages of PhD programs in CRCs is the involvement of the industry partners who provide a "real-world" perspective. In 2006-07, there were 560 non-university supervisors of CRC postgraduate students and, since the commencement of the CRC Program, more than 3,500 CRC postgraduates have taken up employment with end-users in their sector.

2. Australia's future researcher and researcher-in-training needs

The total number of PhD or Masters by research (collectively known as higher degree by research (HDR) students) commencing each year more than doubled from 4,760 in 1989 to 10,129 in 1993, and has remained at around 11,000 ever since – peaking at 11,668 in 2004 (Figure 7).

Figure 7: Commencing Higher Degree by Research Students 1989-2006[7]

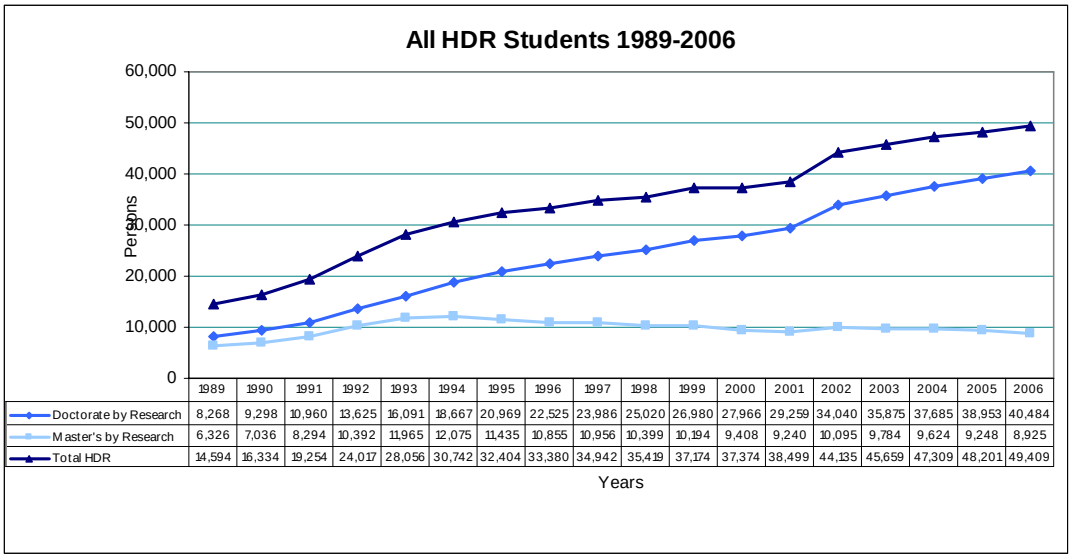


Since 1993 the Masters by research qualification has declined in popularity. The number of students commencing PhDs has increased steadily since 1989 although the number commencing Masters by research degrees has almost halved from 4,379 in 1993 to 2,361 in 2005.

In 2006, there were 49,409 HDR students in total enrolled in Australian universities. This number has increased from 14,594 in 1989 (Figure 8).

[6] The figures quoted above reflect the number of students commencing these courses (i.e. *supported*), not the number who have completed (which is lower due to the time delay associated with completing these courses and due to some degree of attrition).
[7] Department of Education, Science and Training, *2006 Higher education statistics*.

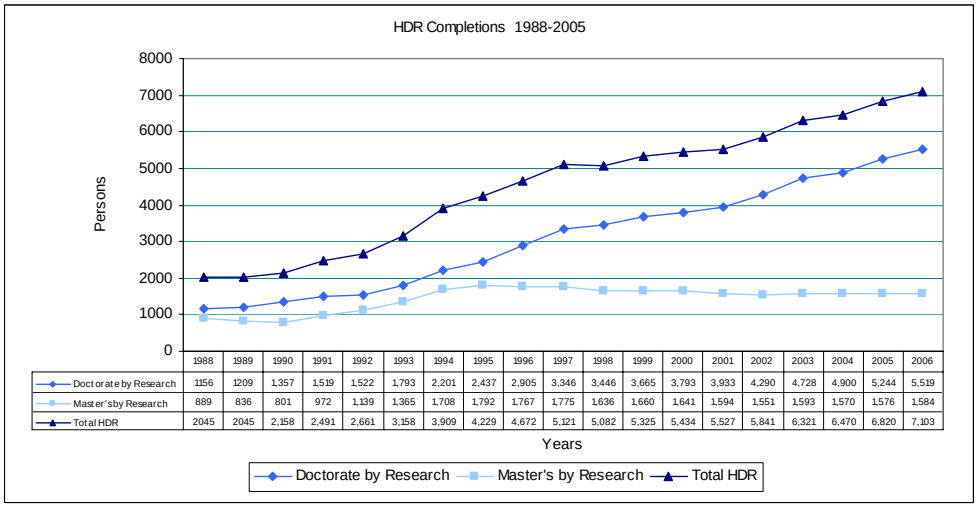
Figure 8: All HDR Students 1989-2006[8]



	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Doctorate by Research	8,268	9,298	10,960	13,625	16,091	18,667	20,969	22,525	23,986	25,020	26,980	27,966	29,259	34,040	35,875	37,685	38,953	40,484
Master's by Research	6,326	7,036	8,294	10,392	11,965	12,075	11,435	10,855	10,956	10,399	10,194	9,408	9,240	10,095	9,784	9,624	9,248	8,925
Total HDR	14,594	16,334	19,254	24,017	28,056	30,742	32,404	33,380	34,942	35,419	37,174	37,374	38,499	44,135	45,659	47,309	48,201	49,409

In 2006, there were 7,103 HDR completions; 78% of these were domestic completions and 22% were international completions. Total HDR completions have increased steadily since the early nineties. In the period 2001-2006, for example, completions increased by 29%.

Figure 9: HDR Completions 1988-2006[9]

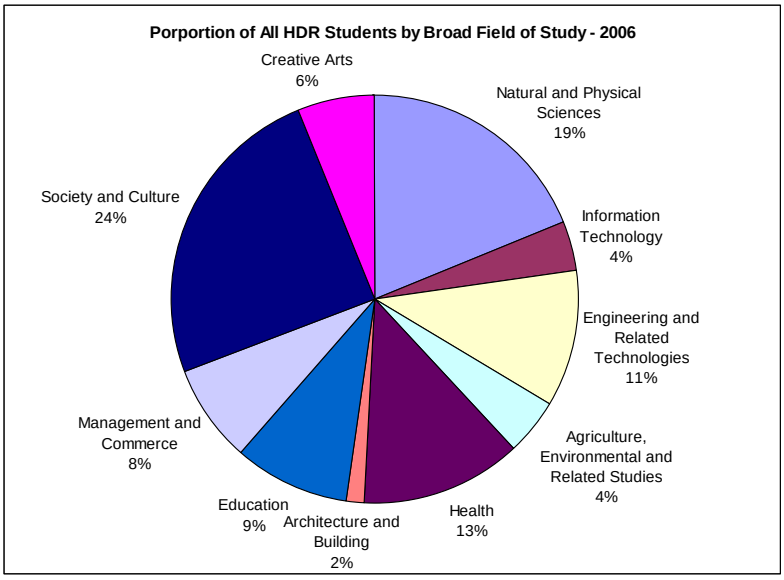


	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Doctorate by Research	1156	1209	1,357	1,519	1,522	1,793	2,201	2,437	2,905	3,346	3,446	3,665	3,793	3,933	4,290	4,728	4,900	5,244	5,519
Master'sby Research	889	836	801	972	1,139	1,365	1,708	1,792	1,767	1,775	1,636	1,660	1,641	1,594	1,551	1,593	1,570	1,576	1,584
Total HDR	2045	2045	2,158	2,491	2,661	3,158	3,909	4,229	4,672	5,121	5,082	5,325	5,434	5,527	5,841	6,321	6,470	6,820	7,103

The largest proportion of HDR students (24%) are in the Society and Culture broad field of education, followed by Natural and Physical Sciences (19%), Health (13%), Engineering and Related Technologies (11%) and Education (9%).

[8] *Ibid.*
[9] *Ibid.*

Figure 10: Proportion of All HDR Students by Broad Field of Study[10]



In 2006, the former Department of Education, Science and Training undertook an audit of Australia's science, engineering and technology (SET) skills. The report identified skills needs in Australia's non-health SET skill supply and found that the proportion of domestic students in SET study across all education and training sectors had remained static or declined over the past decade. The audit concluded that Australia was heading for a cumulative shortfall of 19,000 scientists and 51,000 engineers and engineering tradespeople by 2013.

The audit also took other skills research and reports into consideration however cautioned that analysis of historical data can mask present and emerging skills shortages:

> A comparison of projections of demands for skills…suggests that the present supply of non health related SET skills from domestic and overseas sources appears adequate to meet Australian industry and research SET skill needs. However, labour demand projections are based on historical data, and may not reflect recent, planned, or potential development in the resources sector, infrastructure development and renewal or defence material needs.[11]

Skilled migration can help address skill shortages. Australia currently performs well in attracting highly skilled migrants and enjoys a net gain despite increased emigration of highly skilled Australians over recent years. It is estimated that there are 1.5 million highly skilled overseas-born people living in Australia and that 120,000 tertiary-educated Australian-born people are living overseas[12] .

The largest and fastest growing visa category in Australia is the Skilled Stream, which accounted for 65% (about 78,000) of the visas granted under the Migration Program in 2004-05.[13] In 2000, Australia ranked as second in the OECD to Luxembourg in highly skilled immigration, with the number of highly-skilled migrants

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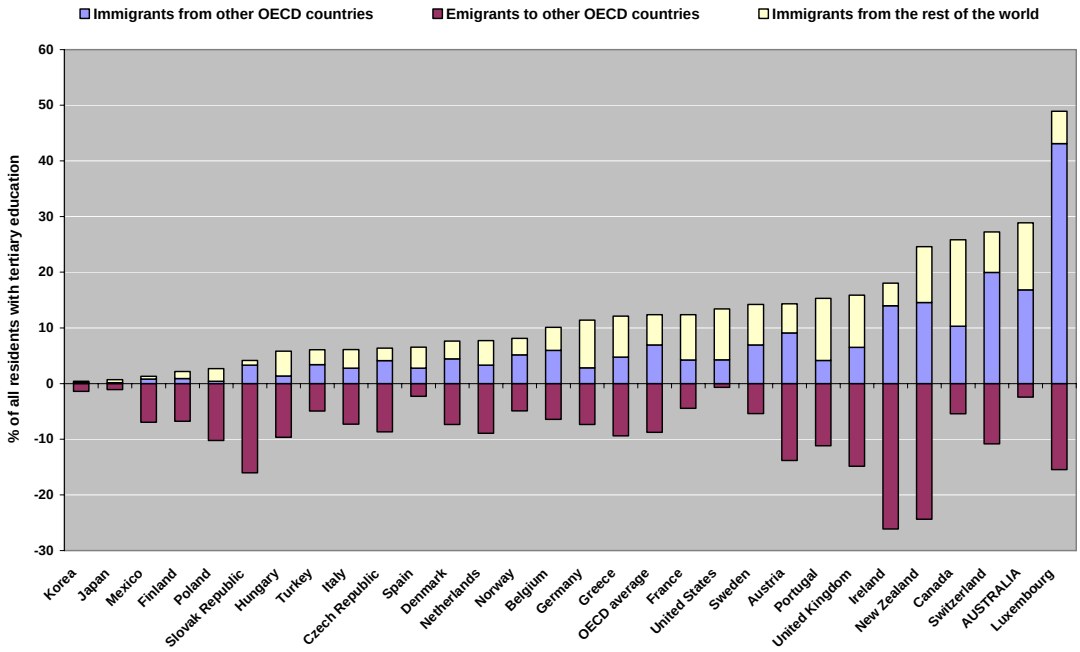
[10] *Ibid.*
[11] Department of Education, Science and Training, *Audit of science, engineering & technology skills: Summary Report*, July 2006.
[12] Productivity Commission, *Economic Impacts of Migration and Population Growth: Productivity Commission Research Report,* 24 April 2006.
[13] *Ibid*.

from both OECD and non-OECD countries corresponding to 28.9% of total highly skilled workers in Australia (Figure 11).

Figure 11: Highly skilled migrants as a percentage of total highly skilled workers – by OECD country, 2000[14]



3. The benefits of research training to Australia

Research training is the skilling of HDR students. Research training is fundamental to ensuring Australia's continued supply of qualified and skilled researchers, independent and original thinkers, wealth creators, opinion shapers and leaders. A well-educated and well-trained population is essential for the social and economic wellbeing of countries and individuals.[15]

Research qualifications form the pinnacle of the Australian education system, and research students contribute positively to the Australian economy in many ways including:

- forming a substantial research workforce within universities and the research sector;[16]
- contributing to the production of research and innovation;
- replenishing the research sector by becoming the next generation of academics and business innovators; and
- upon completing their degrees, becoming highly skilled, dynamic and productive members of the labour force.

Measuring Benefits: Rates of Return to Higher Degrees by Research

[14] Department of Education, Science and Training, *Australian Science and Technology at a Glance 2006*.
[15] OECD, *Education At A Glance 2007*
[16] Research students comprise 60% of the human resources devoted to research and development in the Australian higher education sector (Australian Bureau of Statistics Research and Experimental Development, *Higher Education Organisations 2004*).

The rate of return is the benefit to an individual or society of obtaining further education, relative to the costs of obtaining it. The formulae for calculating both social and private rates of return are the same (see below), although the costs and benefits included differ between the two.

The costs to the individual are usually foregone earnings and tuition fees where applicable; the costs to the government are training costs (tuition fees, infrastructure costs) and foregone taxes. The benefits to both the individual and the government are usually a function of earnings: in the individual's case the increase in earnings counts, in the government's case, the increase in taxes.

The composition of costs and benefits[17]

The cost elements are the following:

1. Forgone earnings

Foregone earnings are the value of earnings that would have been obtained if the individual had worked, at the lower level of education, instead of making the investment in education.

2. Training costs

Two forms of educational expenditure are taken into account in the analysis:
- Public expenditures on education (for infrastructure, teachers' wages, as well as subsidies, etc.).
- Private expenditures (tuition, other fees, etc.).

3. Additional tax payments resulting from an education-induced increase in taxable income.

These costs can be grouped as follows:

Private costs:

Foregone earnings + direct private expenditures + increased future taxes

Public costs:

Lost tax receipts during the training + public expenditures

In the calculation of private rates of return, private costs are included; and in the calculation of public rates of return, public costs are included.

The benefits associated with the individual's decision to invest in training are:

1. Increased earnings levels arising from a higher level of education
2. A higher probability of being employed associated with higher education.
3. For the public sector, additional tax receipts.

These can be grouped as follows:

Private benefits:

Increases in earnings+ higher probability of being employed

Public benefits:

Additional tax receipts

[17] Diagram from OECD *Education at a Glance 2007*.

In calculating the private rates of return, private benefits are included. In calculating the public rates of return, public benefits are included.

The Returns to Higher Degrees by Research

Relatively few studies have isolated postgraduate degrees from other forms of higher education and even fewer have disaggregated to the level of HDR. In addition, the relatively high degree costs and Government subsidies for HDRs means that when calculating returns based on income tax alone, HDR holders must earn disproportionately high salaries for the Government to recoup on its investment. For this reason, some studies have taken a broader approach to calculating social benefits.

Table 2: Larkins: Returns on higher degrees by research broken down by category

Outcomes	**PhD**		**Masters**	
	Science & Technology	Humanities & Social Sciences	Science & Technology	Humanities & Social Sciences
Private rate	12.7	10.4	12.0	8.8
Social rate excluding spillover	5.2	7.2	5.2	6.2
Social rate including spillover	9.0	9.9	11.1	10.7

Private rates of return to HDRs

An Australian study to isolate HDRs from other postgraduate degrees was by Larkins (2001), and the study found that, based on 1997 figures of earning estimates, private rates of return ranged between 9% and 13% (Table 2), representing a estimated net lifetime gain of between $140,000 and $200,000 for PhD holders[18].

More recently Borland[19] calculated the average private rate of return to a postgraduate degree at 8% (compared to high school completion only). This is lower than the estimated rate of return to an undergraduate degree (13.5%) but the findings must be interpreted with caution as the cohort included a range of degrees, from post-graduate diploma to PhD student. Though the findings indicate a lower net lifetime gain ($85,550) of a postgraduate qualification compared to an undergraduate degree only ($114,878), the returns are still significant and may be greater if non research training degrees were excluded.

International studies have also found positive results on the returns to investment in HDRs. One Canadian study[20] found positive private returns of 10-15% to PhD studies across a range of subjects even when they were compared to earnings of a Masters degree. An analysis of longitudinal information about the earnings, social

[18] F. Larkins 2001 *The Economic Benefit of Australian University Degrees: Bachelor and Research Higher Degrees* Australian Economic Review, 34, pp. 403-414.
[19] J. Borland 2002 *New Estimates of the Private Rate of Return to University Education in Australia, Melbourne Institute Working Paper No. 14/02* Melbourne Institute, Melbourne.
[20] A Stark 2007 *Which Fields Pay, Which Fields Don't? An Examination of the Returns to University Education in Canada by Detailed Field of Study* Economic Studies and Policy. Analysis Division, Department of Finance, Canada
http://www.oecd.org/dataoecd/4/5/37578152.pdf

and educational characteristics of a UK cohort[21] found that PhD holders benefited the most from their education, with a private return of 15%.

Social rates of return to HDRs

The estimated social rate of return is comparable to a Bachelors degree at 9-11%[22]. In order to calculate this rate of return, Larkins included an estimate of the contribution HDR students make to the economy through research and development in terms of GDP growth. Including this 'spillover effect' more accurately reflects the contribution that HDR students make to the economy. Without the inclusion of the spillover benefits, the social return decreases, at between 5 and 7% (Table 2), and for some of the more expensive science and technology degrees, the Government investment was not recouped.

Other benefits of HDRs

The benefits of education are broad ranging: from economic benefits such as increased participation rates, employment rates, wages and productivity to 'softer' (and harder to measure) benefits such as the attainment of generic skills, improved well-being and improved health. However, the picture is also complicated where research training students are concerned, by their role in the university and research sectors as educators and workers, providing extensive and positive benefits for the economy and for society.

Postgraduate surveys suggest a range of positive outcomes for HDR students that exceed those of bachelor degree holders, including high levels of employment, high salaries and well developed employability skills.

HDR graduates report significantly higher earnings than comparable groups. HDRs can expect to earn high median starting salaries ($60,700 v $40,800 for bachelor degree holders)[23] and higher ongoing salaries, with the ARC calculating that they earn on average $6,600 more per annum than bachelor degree holders, and $19,300 more than those who completed high school only.[24] More positive results are reported from HDR graduates 5-7 years out, who earn a median salary of between $60,000 and $80,000, and 33% earn $80,000 or more.[25] OECD data suggests that Australian research salaries compare favourably with other OECD countries.[26]

Postgraduate surveys suggest a range of positive outcomes for HDR students including high, stable employment figures. HDR graduates four months out of university enjoy one of the highest employment rates of any cohort, at 87.6% (5.2%

[21] R. Blundell, L. Dearden, A. Goodman & H. Reed 2000 *The returns to higher education in Britain: Evidence from a British cohort* Economic Journal, Vol. 110, pp 82-99.
[22] F. Larkins 2001 *The Economic Benefit of Australian University Degrees: Bachelor and Research Higher Degrees* Australian Economic Review, 34, pp. 403-414.
[23] Graduate Careers Australia 2007 *Post Graduate Destinations 2006: The Report of the Graduate Destination Survey.*
[24] The Allen Consulting Group 2003 *A Wealth of Knowledge; The Return on investment from ARC funded Research, Report to the Australian Research Council* September 2003.
[25] University of Queensland Social Research Centre, *PhD Graduates 5 to 7 Years Out: Employment Outcomes, Job Attributes and the Quality of Research Training*, 2007.
[26] OECD *Ad hoc Working Group on Steering and Funding of Research Institutions: Complete Results of SFR Questionnaire on Working Conditions of Researchers in Universities and Public Research Organisations* OECD, Spain, 2006.

higher than bachelor degree holders).[27] Though this figure is slightly lower for HDR graduates than it is for postgraduate coursework students it should be noted that coursework students are more likely to be in full time employment at the time of doing their degree. Labour market outcomes for graduates 5-7 years out are even better, reporting just 2.2% unemployment (*c.f.* national average of 5%).

Other, less tangible benefits to the HDR student include gaining skills and attributes that are not necessarily acquired through shorter, course-based degrees. The most obvious of these are advanced research and inquiry skills, and skills in data management and collection, but they also range to capabilities such as confidence, project management, and the intellectual satisfaction of having conducted long-term and in-depth problem analysis. Skills like these pay dividends in a personal sense and aid employment prospects.[28]

Moreover, such skills form part of what is known as the 'generic skills base', the set of skills which can be adapted to suit a range of employment situations such as problem solving, data analysis, project planning, communication and research skills. Such skills are highly valued by business,[29] and are considered essential to the nation's ability to innovate.[30]

In the workplace, most PhD graduates use these generic research skills far more often than the knowledge related to their specific subject area. In appraising their own skills, more than 94% of post-graduate degree holders agreed that they had earned skills that would help them solve complex problems, in addition to an average agreement of 90% that they had gained other related skills such as the ability to develop ideas, plan work and tackle unfamiliar problems (as opposed to an average 65% of bachelor degree holders).[31] Further, nearly 85% of HDR graduates felt that they were satisfied with their degree, and 5-7 years out, when asked how useful their degree is to current employment, the responses are overwhelmingly positive regardless of whether they work in academia or not.[32]

There is room for improvement in the HDR experience (particularly in doctoral degrees), and much variation in the range of study experiences and skills outcomes for graduates.[33] Perceived skill levels and degree satisfaction are affected by a range of factors, including the level of program structure and extent of networking during the degree, and supervision styles.[34] Regardless of these factors, there is a gap across the board between the perceived importance of generic skills in the workplace, and the extent to which doctoral holders feel they have attained these

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[27] Graduate Careers Australia 2007 *Post Graduate Destinations 2006: The Report of the Graduate Destination Survey.*
[28] R. Neumann 2003 *The Doctoral Education Experience: Diversity and complexity* Department of Education, Science and Training, Canberra
[29] Business Council of Australia 2006 *New Pathways to Prosperity: A National Innovation Framework for Australia* Report, viewed December 2007 www.bca.com.au
[30] Productivity Commission 2006, *Public Support for Science and Innovation*, Research Report, Productivity Commission, Canberra.
[31] Graduate Careers Australia 2007 *Post Graduate Destinations 2006: The Report of the Graduate Destination Survey.*
[32] University of Queensland Social Research Centre (2007) *PhD Graduates 5 to 7 Years Out: Employment Outcomes, Job Attributes and the Quality of Research Training*.
[33] R. Neumann 2003 *The Doctoral Education Experience: Diversity and Complexity* Department of Education, Science and Training, Canberra.
[34] University of Queensland Social Research Centre 2007 *PhD Graduates 5 to 7 Years Out: Employment Outcomes, Job Attributes and the Quality of Research Training*.

skills.[35] These concerns are not new, and are echoed by business and Government, with the previous Government's 1999 White Paper outlining the need to address the problem of research degree graduates who are "often inadequately prepared for employment".[36] Nevertheless, in an environment where HDR graduates are increasingly seeking employment outside of academia,[37] there is ample evidence in terms of positive labour market outcomes to show that they are well-equipped to both win and perform well in these positions.

It is important to note that HDRs benefit the economy not just through their labour market outcomes, but through the considerable range of benefits that are generated by their work in the research and university sectors that are not reflected in their income, or quantified in their employment outcomes. Spillover benefits are that proportion of benefits that flow from education that benefit society as a whole but are not captured in the income of an individual. These benefits can be hard to identify and even harder to measure.

Perhaps most significant of these for HDR students is their contribution to the university and research systems in Australia, and accordingly to the considerable benefits that flow from these sectors. HDR students add value to universities by forming an important workforce within these institutions, so much so that in many countries, they are included on the payroll of universities, in recognition of this.[38] They contribute by producing new knowledge, publications, patents and spin offs and contributing to the culture through teaching.[39] HDR students further encourage innovation in universities through the involvement of universities with industry and other sectors at the doctoral level, which supports the inter-sectoral diffusion of knowledge.

HDR students make a complementary contribution to Australia's research system, through universities and other research institutions. Numerous estimates exist of the contribution of the research to Australia's economy. Economic spillover benefits from university research are particularly high, as academics are strongly encouraged to publicly disseminate the results of their research, and research has a broad range of applications. Accordingly, the estimated quantum that HDR students contribute to the economy through these benefits is also impressive: even using conservative estimates, Larkins calculated that each student would contribute up to $700,000 (1997 value) to GDP growth over a lifetime through their contribution to research.

While it is useful to measure the benefits of research and development in economic terms, it is important to note that given the large range of spillover benefits, the complex effect of research on productivity, and the many intangible benefits to society, no measurement of these effects can be exhaustive. Qualitative analysis

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[35] Graduate Careers Australia 2007 *Post Graduate Destinations 2006: The Report of the Graduate Destination Survey.*

[36] D. Kemp *Knowledge and Innovation: A Policy Statement on Research and Research Training*, Commonwealth of Australia, 1999.

[37] J. Thompson, M. Pearson, G. Akerlind, J. Hooper, N. Mazur, Postdoctoral *Training and Employment Outcomes,* Report to the Department of Education, Training and Youth Affairs, Canberra.

[38] OECD Directorate for Science, Technology and Industry Committee for Science and Technology Policy 2006 *Complete Results of the SFRI Questionnaire on the Working conditions of Researchers in Universities and Publicly Funded Research Organisations* OECD, Paris.

[39] J. Borland, P. Dawkins, D. Johnson & R. Williams 2000, *Returns to Investment in Higher Education The Melbourne Economics of Higher Education Research Program Report No. 1* Report to the Vice Chancellor, the University of Melbourne.

identifies some of the major benefits of public research as: new products and services, faster adoption of new technologies, beneficial social and environmental outcomes (such as improved public health outcomes) and other intangibles such as national prestige and contributions to the global pool of knowledge.[40] What is more is that research contributes to productivity through innovation, particularly through universities engaging with industry.[41] As vital members of the public research sector, HDR students are responsible for providing a substantial portion of these advantages.

The benefits of attracting the world's best and brightest postgraduate research students to study in Australia from overseas are also manifold. Australia and Australians benefit economically, socially, culturally, and in the long-term from its investment in international students, particularly those at the HDR level. International students contribute to a vibrant and diverse higher education sector, and help to build a critical mass of skills in areas of national importance. International students, for example, are more likely to be in non-health SET fields of study than domestic HDR students.[42] Almost half of international HDR students are in non-health SET fields of study (48.5%) compared with just over a third of domestic HDR students (35.7%). Overall, international students make up 18% of all HDR students, but 23% of all HDR students in SET fields of study. International students also help to build and maintain international collaborations and networks and international HDR students in particular forge academic linkages with Australia's leading researchers.

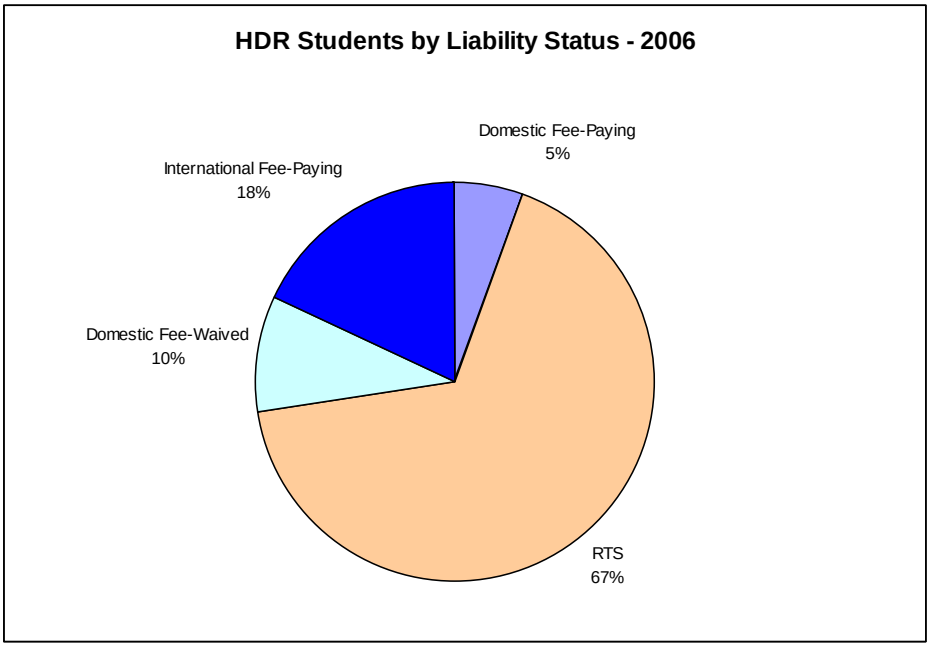
PART B: CHALLENGES FOR UNIVERSITIES TO RECRUIT, TRAIN AND RETAIN HIGH QUALITY RESEARCHERS AND RESEARCH STUDENTS

1. Income support for research students

Figure 12 shows that almost 70% of HDR students are domestic students supported by the RTS and therefore have no HECS-type liability accrued or tuition fees to pay. A further 10% of domestic students are fee-waived students, and only 5% of domestic students are fee-paying. In addition, almost 12% of international HDR students are supported under the IPRS program and therefore do not pay tuition fees.

[40] Productivity Commission 2006, *Public Support for Science and Innovation*, Research Report, Productivity Commission, Canberra.
[41] Doctoral Programmes in Europe's Universities http://www.eua.be/fileadmin/user_upload/files/Publications/Doctoral_Programmes_in_Europes_Universities.pdf)
[42] Department of Education, Science and Training, *2006 Higher education statistics*.

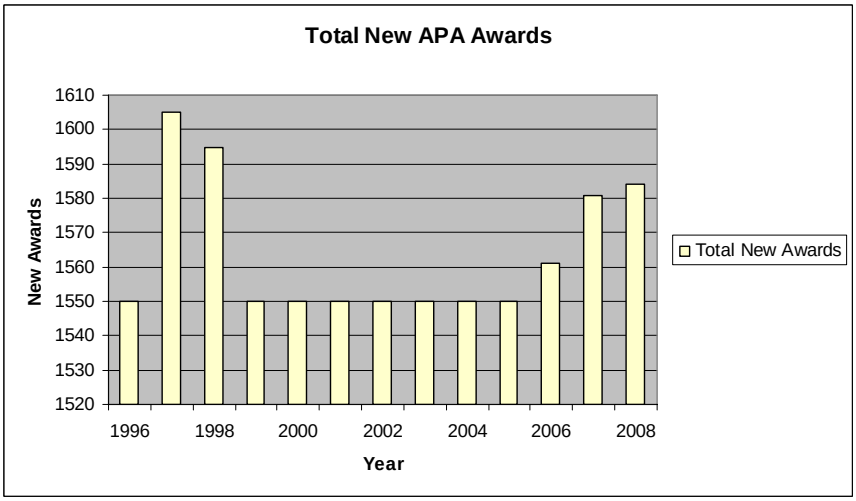
Figure 12: HDR Students by Liability Status - 2006[43]



The Australian Government's APA program provides income support for around 20% of the domestic postgraduate research students supported by the government under the RTS (or around 12% of total domestic HDR students), however this figure will rise with the additional APAs announced by Government as part of the Education Revolution.

As shown in Figure 13, there were 1,584 new APAs allocated to universities in 2008.

Figure 13: Total New APA Awards 1996-2008



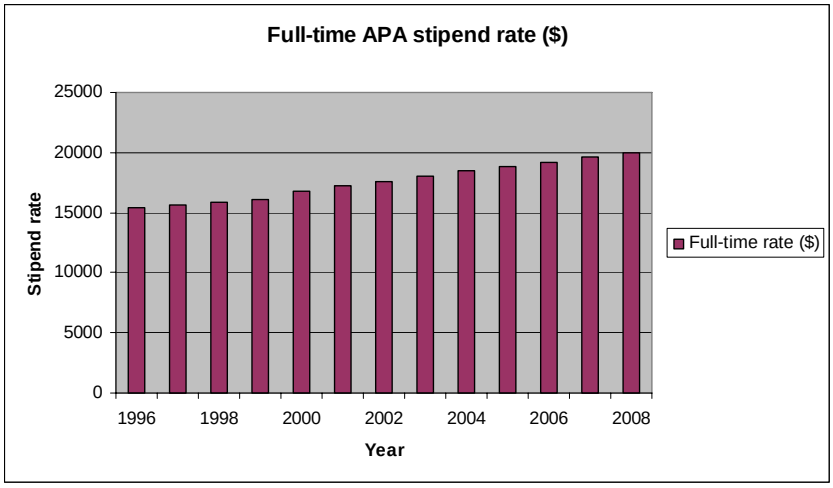
The value of a full-time, tax free Australian Postgraduate Awards (APA) stipend is $20,007 in 2008, or approximately $385 per week. APA holders also have access to relocation and thesis allowances.

The full-time APA stipend rate is fixed by Government through guidelines and indexed by the Higher Education Indexation Factor (HEIF) which is about 2% per

[43] Department of Education, Science and Training, *2006 Higher education statistics*.

annum (Figure 14). The HEIF is also used to index the total funding allocated under APA scheme and other research block grant funding.

Figure 14: Full-time APA stipend rate 1996-2008



The APA stipend for part-time students is $10,710. The part-time stipend is tax liable but is adjusted to above 50% of the full-time stipend rate to compensate for taxation.

Figure 15 plots growth in APA stipend rate from 1996 to 2007 compared with the Consumer Price Index (CPI)[44] and full time adult weekly earnings[45] obtained from the ABS. To allow for direct comparison between the data, the figures have been transformed to an index value, where 1996 figures start at a notional 100.

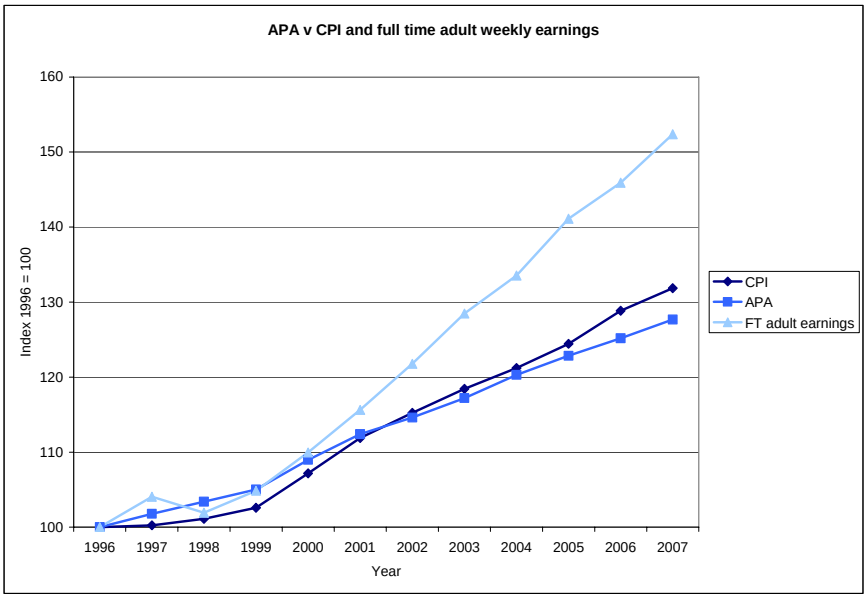
These data shows that the APA stipend rate closely tracked the CPI between 1996 and 2007, although since 2004 the CPI has increased at a slightly faster rate than the APA stipend rate leading to an apparent divergence by 2007 of about 4%.

Between 1996 and 2000 APA stipend rates closely tracked growth in full-time adult ordinary time earnings. However, since 2000 full-time adult ordinary time earnings have consistently grown more rapidly than either CPI or the APA stipend rate. Between 2000 and 2007 wages have grown by about 36%, in comparison with the APA stipend which has increased by about 13.5%.

[44] Based on ABS - LONGER TERM SERIES, CPI All Groups, Weighted Average of Eight Capital Cities : Index numbers available at: http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/6401.0Main%20Features6Mar%202008?opendocument&tabname=Summary&prodno=6401.0&issue=Mar%202008&num=&view

[45] Based on ABS 6302.0 - Average Weekly Earnings, Full-time adult ordinary time earnings (public and private sectors) available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/second+level+view?ReadForm&prodno=6302.0&viewtitle=Average%20Weekly%20Earnings,%20Australia~Nov%202007~Latest~21/02/2008&&tabname=Past%20Future%20Issues&prodno=6302.0&issue=Nov%202007&num=&view=&

Figure 15: APA versus CPI and full time adult weekly earnings



APA support is provided for three years, with a possible six-month extension. Most students, however, will take longer to complete their research degree (an RTS place, for example, provides four years of support, and the mean completion time for a full-time PhD is 5.4 years[46]).

Universities Australia published *Australian University Student Finances 2006: A summary of findings from a national survey of students in public universities* in 2006 and found the following[47]:

- The mean income for all full-time postgraduate students was $23,670. General and study-related expenditure was $21,570 including living and study related expenses of $2,050 (books, stationary, computers, library, union fees etc). This leads to an average income 'surplus' of $2,100. However 27.5% of full-time research higher degree students reported an 'annual budget deficit'.

- Full-time research higher degree students had considerably higher overall mean incomes ($26,830) compared to those doing coursework ($19,860) due in the main part to the combined income from scholarships and paid employment for research higher degree students.

- 76.3% of all full-time research higher degree students reported they were 'financially independent'.

- 43% of all full time postgraduate students have assets of less than $10,000 and 25.8% had assets of greater than $100,000.

- 56.9% of full-time research higher degree students had savings that could be used in the event of serious financial difficulty.

[46] Graduate Careers Australia 2007 *Post Graduate Destinations 2006: The Report of the Graduate Destination Survey.*
[47] Universities Australia, *Australian University Student Finances 2006: A summary of findings from a national survey of students in public universities*.

- 38.0% of full-time research higher degree students used up savings in order to study during 2006.

- 46.3% of full-time research higher degree students believe that supporting their studies puts a great deal of financial pressure on their parents or partner.

- 74.7% of part-time research higher degree students indicated they would prefer to study full-time if their financial circumstances permitted.

- 69.2% of all full-time and 87.4 per cent of all part-time postgraduates reported being in paid employment during semester.

- Full-time postgraduates reported working an average of 10.0 hours a week, whilst part-time students worked an average of 40.0 hours a week. The mean income from paid employment for full-time research higher degree students was $9,500.

- 37.6% of full-time postgraduate students and 52.9% of part-time postgraduate students surveyed believed that the paid work they were doing had an adverse effect on their studies.

2. PhD graduates

In 2006, 84.7% of research masters/PhD graduates were satisfied in the quality of their higher degree research experience.[48] There has been little change in this statistic since 1999. Some aspects of the higher degree experience are rated more highly than other by students. For example, students generally rate their experiences in relation to skill development, goals and expectations, and satisfaction with thesis assessment more highly than supervision, infrastructure and intellectual climate.[49] Overall PhD graduates are more satisfied with their courses than research masters graduates.[50]

The DEST-commissioned report, *PhD Graduates 5 to 7 Years Out: Employment Outcomes, Job Attributes and the Quality of Research Training*, conducted by the University of Queensland in 2007 surveyed the cohort of PhD graduates five to seven years out from graduation (1999-2001). The report found that at the time of the survey, 90% of respondents were in employment. About half of all the graduates worked in the higher education sector and an additional 13% worked in Scientific Research Services.[51] 79% of the respondents assessed the PhD as useful or very useful for the current or most recent job in their post PhD career.[52]

The report surveyed graduates as to the career aspirations they had on completing their PhDs. The report found that most graduates favoured a career as a university academic and that careers as researchers outside academia and work in the

[48] Graduate Careers Australia 2007. *Postgraduate Research Experience 2006, the Report of the Postgraduate Research Experience Questionnaire.*
[49] *Ibid.*
[50] *Ibid.*
[51] The University of Queensland Social Research Centre, *PhD Graduates 5 to 7 Years Out: Employment Outcomes, Job Attributes and the Quality of Research Training*, prepared for the Department of Education, Science and Training, March 2007, p.i.
[52] *Ibid*.

professional field were also popular. Least popular was a career as a manager or executive.[53]

Many factors may influence a graduate's aspirations to pursue a research career. Factors may be "intrinsic" such as interest in research, interest in the discipline area, for intellectual and academic development, or they may be "extrinsic" motivations such as for career advancement, to facilitate career change, or to improve pay. There may also be social factors, such as the prestige associated with the degree. The report found that respondents rated intrinsic reasons more highly than extrinsic ones for commencing a PhD.[54]

Nevertheless, the report found that females and international students were more likely to be employed in universities. Also, graduates who had career advancement reasons for undertaking a PhD were more likely to be working in the higher education sector. Universities were also the most common employer type for arts, humanities and social science PhDs, while graduates in other fields also found employment in other research and industry settings.[55]

3. Career pathways for researchers

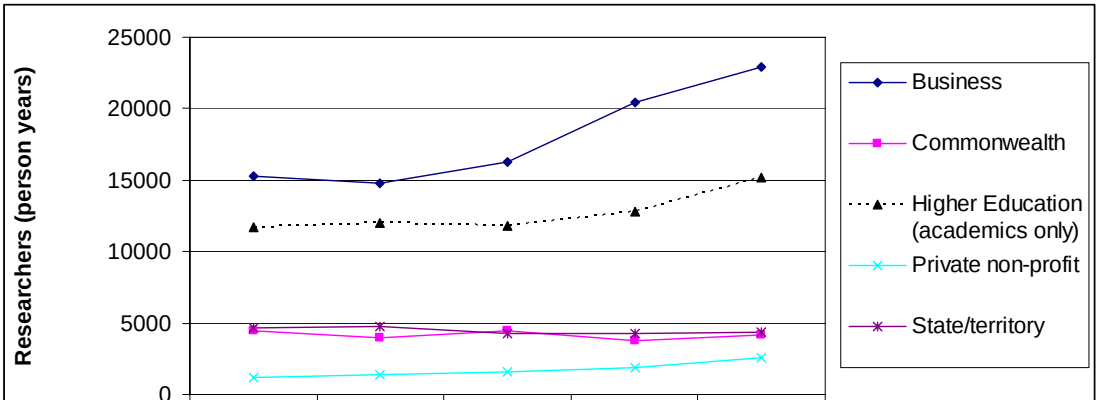
The largest single employer of researchers in Australia is the higher education sector which employed 58.4% of all researchers in 2004-05[56].

Australia was ranked the fifth highest amongst OECD nations for researchers employed in the higher education sector, well above the OECD as a whole (27.9%) and the EU15 (34.4%).[57] For further comparison, the United States had 16.6% of researchers in the higher education sector (and 79.9% in business) and the United Kingdom had 31.1% in higher education.[58]

When postgraduates studying for a higher degree in research are excluded however, business becomes the largest employer of researchers in Australia (Figure 16). The number of researchers has increased steadily in the business and private non-profit sectors in recent years, while growth in academic positions in the higher education sector has been flat until recently and the number of researchers employed by Commonwealth and State/territory governments has fallen (Figure 16).

[53] *Ibid.*
[54] *Ibid*.
[55] *Ibid.*
[56] Department of Education, Science and Training, *Australian Science and Technology at a Glance 2006*.
[57] *Ibid.*
[58] *Ibid.*

Figure 16: Researchers devoted to R&D in Australia 1996-7 to 2004-05[59]



	1996-97	1998-99	2000-01	2002-03	2004-05
Business	15307	14767	16221	20451	22899
Commonwealth	4503	3989	4418	3739	4203
Higher Education (academics only)	11675	12000	11853	12817	15226
Private non-profit	1189	1382	1549	1906	2577
State/territory	4627	4768	4306	4297	4327

University staff statistics give a clearer picture of the actual number of researchers employed in the higher education sector by disaggregating staff into research only or teaching and research classifications (the ABS data records research effort in person years). Table 3 shows that the number of research only full time equivalent staff has increased steadily since 1996 although the number of teaching and research staff has grown only marginally over the same period.

Table 3: FTE for Full-time and Fractional Full-time Staff by Function, 1996 to 2006[60]

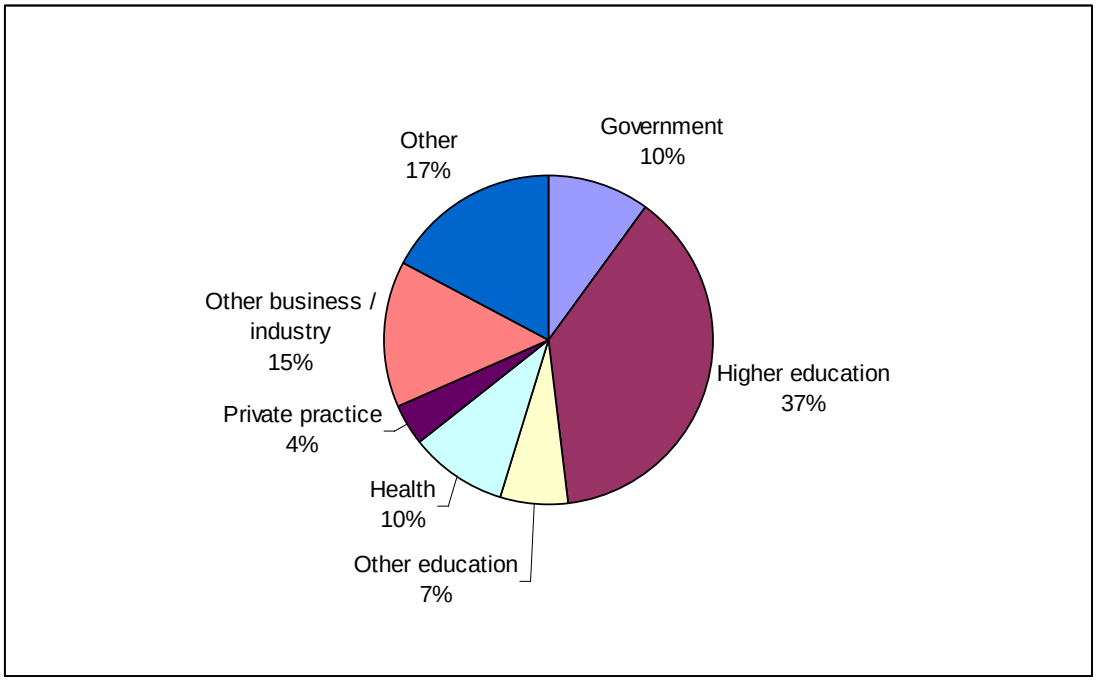
	Research Only		Teaching and Research	
Year	FTE	% change on previous year	FTE	% change on previous year
1996	7,757		24,904	
1997	7,849	1.2%	24,006	-3.6%
1998	7,619	-2.9%	23,757	-1.0%
1999	7,757	1.8%	23,365	-1.7%
2000	7,866	1.4%	23,138	-1.0%
2001	8,116	3.2%	23,413	1.2%
2002	8,654	6.6%	23,457	0.2%
2003	9,306	7.5%	23,685	1.0%
2004	9,866	6.0%	24,336	2.7%
2005	10,358	5.0%	25,204	3.6%
2006	11,140	7.5%	25,204	0.0%

87.6% of PhD and research masters graduates available for full-time employment in 2006 were in a full-time job shortly after completing their degrees and earning on average $60,700 (up from $59,000 in 2005).[61] The employment destinations of PhD

[59] Australian Bureau of Statistics, *Research and Experimental Development* (various)
[60] Department of Education, Employment and Workplace Relations, *Staff 2006: selected higher education statistics*.
[61] Graduate Careers Australia 2007 *Post Graduate Destinations 2006: The Report of the Graduate Destination Survey.*

and research masters graduates (Figure 17) are varied, with over a third finding employment in the higher education sector.

Figure 17: Employment sector of Research Masters / PhD graduates if working full time[62]



Early and Mid Career Researchers

Those graduates that do choose an academic career path can encounter obstacles in the transition from study to employment. Graduates intent on a research career generally enter the workforce at the postdoctoral level, however such opportunities are limited. More than 30% of postdoctoral employees are in short term contracts or casual employment 5-7 years after graduating, and even more are employed part-time.[63]

In 2006, the Australian Government supported 140 places ear-marked for early career researchers through the ARC and 50 through the National Health and Medical Research Council (NHMRC).

Problems with research career pathways were identified in the Productivity Commission's *Research Report on Public Support for Science and Innovation* (2007), namely:

- The propensity for high performing high school students to choose to pursue vocationally oriented tertiary degrees rather than degrees that may lead to research degrees.
- The difficulties for early career researchers to attract competitive grants as they lack the 'track record' of more established researchers.
- The lack of post-doctoral training positions.

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[62] *Ibid.*
[63] The University of Queensland Social Research Centre, *PhD Graduates 5 to 7 Years Out: Employment Outcomes, Job Attributes and the Quality of Research Training*, prepared for the Department of Education, Science and Training, March 2007, pp.19-20.

- The ageing academic workforce.

The Productivity Commission's report also found that academic researcher salaries have declined in relative terms for most of the past 25 years.[64]

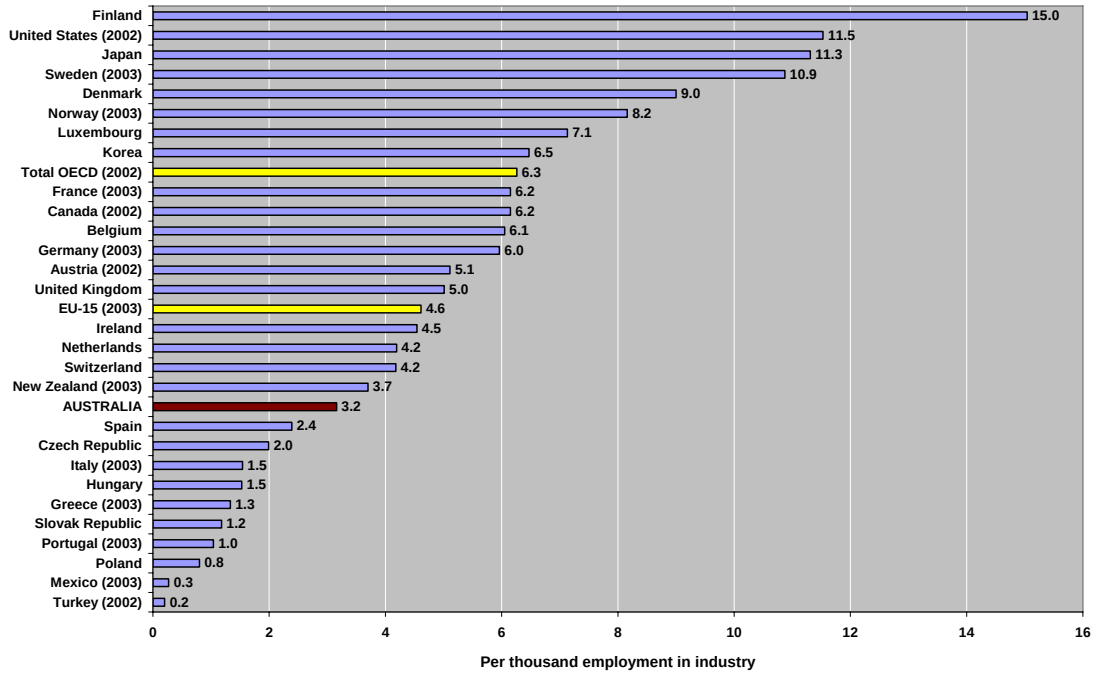
The Australian Government has announced a boost for mid-career researchers with the commitment of the Future Fellowships program. The program, to be administered by the ARC, will offer four year fellowships valued at $140,000 a year to 1,000 of Australia's top researchers in the middle of their career. In addition, each researcher's institution will receive a $50,000 grant to support the purchase of related infrastructure and equipment for their research project.

Researchers in Business

Australia has a low proportion of researchers employed in the private sector compared with other nations. In 2004, the business sector accounted for only 28% of total researchers in Australia, significantly less that the OECD average of 64.4%.[65]

In 2004, Australia had around 3.2 business researchers (person years) per thousand employment in industry (Figure 18)[66]. This was also low compared with 6.3 business researchers of the OECD as a whole, 4.6 business researchers for the EU15, 11.5 business researchers for the United States, and 5.0 business researchers for the United Kingdom.

Figure 18: Total business enterprise researchers per thousand employment in industry – by OECD country, 2004



The Government has announced that it will commit $10 million within the Enterprise Connect program to support the placement of researchers from universities or public

[64] Productivity Commission, *Research Report on Public Support for Science and Innovation*, March 2007, p.261
[65] Department of Education, Science and Training, *Australian Science and Technology at a Glance 2006*.
[66] *Ibid.*

research agencies into businesses where it is identified that such a placement would help to develop and implement a new idea with commercial potential.

Under this initiative, the Government will provide funding for up to 50% of salary costs – to a maximum of $50,000 – for each 12 month placement. The primary aim of the scheme is to speed the dissemination of expertise, increase competitiveness, and create jobs.

4. Australian researchers overseas

In its 2006 report, *Economic Impacts of Migration and Population*, the Productivity Commission found that overall, movement from Australia on a permanent or long-term basis has been trending up over the past two decades. Moreover, emigrants tend to be highly educated and of prime working age.[67] This correlates with other recent research into the demography of Australia's academic workforce which concluded that although Australia is recording a net gain of academics by migration, there is a high turnover so that over the eleven years to 2004 for a net gain of 5,007 there were 14,703 in-movements and 9,696 out-movements.[68]

In 2003-04, about 55% of Australian-born emigrants departed permanently for three countries, namely the United Kingdom, New Zealand and the United States.[69] There is also a predominant pattern of Australian academics going overseas leaving for North America (especially the United States) and Europe (predominantly the United Kingdom)[70].

Research has highlighted that in "a survey of over 2,000 Australian expatriates living in foreign countries, some 167 were employed as academics…the reasons given by respondents for going overseas…indicate the overwhelming dominance of employment related reasons for moving". [71] The report added that "many also mentioned the greater access to research funding and superior conditions for research".[72]

Importantly, many Australian academics overseas are keen to return, largely for family and lifestyle reasons and that this intention can be turned into action if academics receive a specific job offer .[73]

The Australian Government's new Future Fellowships scheme aims to act as an additional incentive to attract high calibre researchers in all disciplines across the spectrum of pure basic, strategic basic and applied research to undertake their work in Australia.

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[67] Productivity Commission, *Economic Impacts of Migration and Population Growth: Productivity Commission Research Report,* 24 April 2006, pp.22-23
[68] Graeme Hugo, The Demography of Australia's Academic Workforce: Patterns, Problems and Policy Implications', Presentation to the Monash Seminars on Higher Education, Monash University, 7 September 2004, p.10
[69] Productivity Commission, *Economic Impacts of Migration and Population Growth: Productivity Commission Research Report,* 24 April 2006, p.257
[70] Graeme Hugo, 'The Demography of Australia's Academic Workforce: Patterns, Problems and Policy Implications', Presentation to the Monash Seminars on Higher Education, Monash University, 7 September 2004, p.16
[71] *Ibid.* p.15
[72] *Ibid.* p.16
[73] *Ibid.* p.24

5. The global competition for the best and brightest researchers and researchers-in-training

In a global knowledge-based economy, the market for scientists, researchers and researchers-in-training is an international one. Australia can score its performance in the global competition to attract, produce and retain the best and brightest minds by using international benchmarks such as PhD holders in the population, growth rates of total researchers, and the country's ability to attract the best and brightest international students.

The share of doctorate holders in the population or labour force of Germany and Switzerland is two or three times higher than in Australia (Table 4). There are only 7.8 PhD holders per 1,000 workers in Australia, compared to 20.1 in Germany and 8.2 in Canada (Table 4).

Table 4. Number of doctorate holders in the population[74]

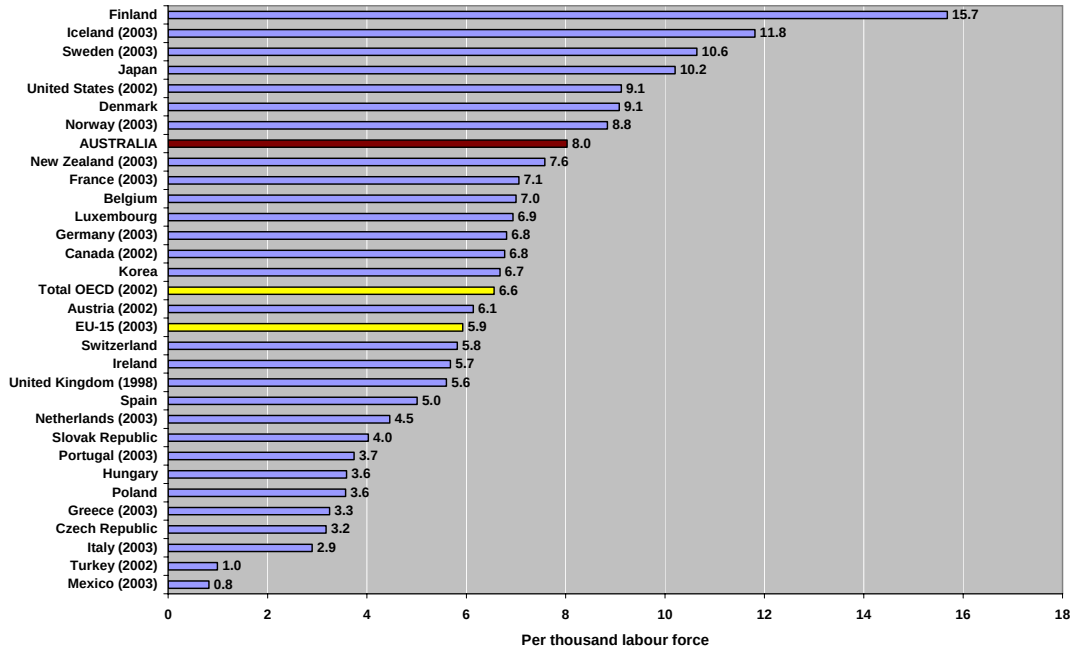
	Argentina (2005)	Australia (2001)	Canada (2001)	Germany (2003)	Portugal (2004)	Switzerland (2003)	United-States (2003)
Number of doctorate holders per thousand population[1]	0.2	5.9	6.5	15.4	2.1	23.0	8.4
Number of doctorate holders per thousand labour force[1]	0.5	7.8	8.2	20.1	2.6	27.5	10.7
Graduation rates at doctoral level[2]		1.3	0.8	2.0	2.5	2.6	1.3
New doctorates per 100 university graduates		2.3	3.9	11.2	7.0	10.1	2.3

1. Doctorate holders and population of 25-64 years old, except for Argentina (total doctorate holders and total population).
2. Graduation rates are for 2002; they are calculated as the number of persons receiving a doctorate level degree as percentage of the population at the typical age of graduation.

Source: First OECD/Eurostat/UIS data collection on careers of doctorate holders and OECD Education database.

Australia had 8.0 researchers per thousand labour force in 2004, above the OECD as a whole but below countries such as the United States (Figure 19). Note that not all persons categorised as researchers will hold a higher degree by research.

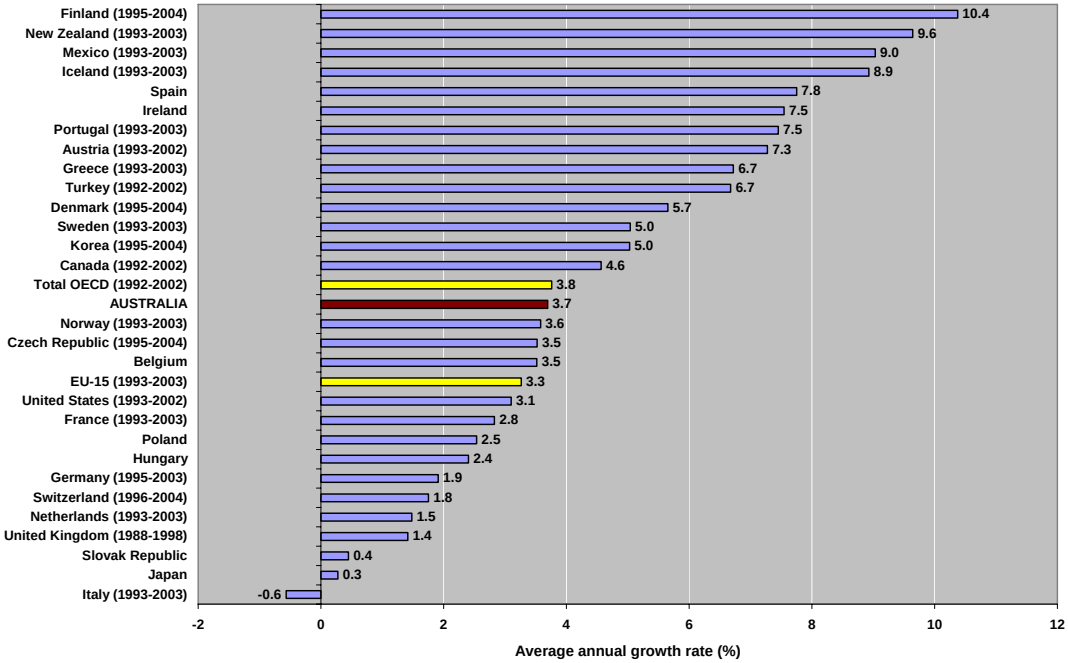
Figure 19: Total researchers per thousand labour force – by OECD country, 2004[75]



[74] OECD STI Working Paper 2007/2 *Labour market characteristics and international mobility of doctorate holders: results for seven countries.*
[75] *Ibid.*

Numbers of researchers are increasing in almost all OECD countries as well as in Brazil, Russia, India and China. In Ireland, for example, there are plans to double the number of postgraduate researchers by 2013[76]. However, over the ten year period to 2002, Australia's growth rate in total researchers amounted to 3.7% per annum, less than the OECD as a whole at 3.8%, and Finland and New Zealand who both reported a growth rate of around 10% per annum (Figure 20).

Figure 20: Growth of total researchers at average annual rate – by OECD country 1994-2004[77]



Most international students enrolled in higher education level courses choose to study in OECD countries. Australia is successful at attracting these students and in 2004 Australia attracted a 6% share of all tertiary students enrolled outside their country of residence.[78]

International students comprise 18% of all HDR students. Just under 9,000 international students undertook their PhD or Masters by Research in Australia in 2006.

At the HDR level, country of origin data is available for students in receipt of an International Postgraduate Research Scholarship (IPRS) and also for international HDR students excluding IPRS students.

IPRS students (1,040 students in 2006) comprise approximately 12% of all international HDR students. In 2006 IPRS holders came from 90 countries and those from South East Asia or North East Asia comprised 34% of all IPRS holders. Chinese students were the largest group of IPRS holders, representing 12.5% of all IPRS students. However, only three of the top ten countries of residence were from

[76] Irish Department of Enterprise, Trade and Employment, *Strategy for Science, Technology and Innovation 2006-2013.*
[77] Department of Education, Science and Training, *Australian Science and Technology at a Glance 2006*,
[78] Australian Bureau of Statistic, 'Article: International students in Australia', *Australian Social Trends 2007,* p.1

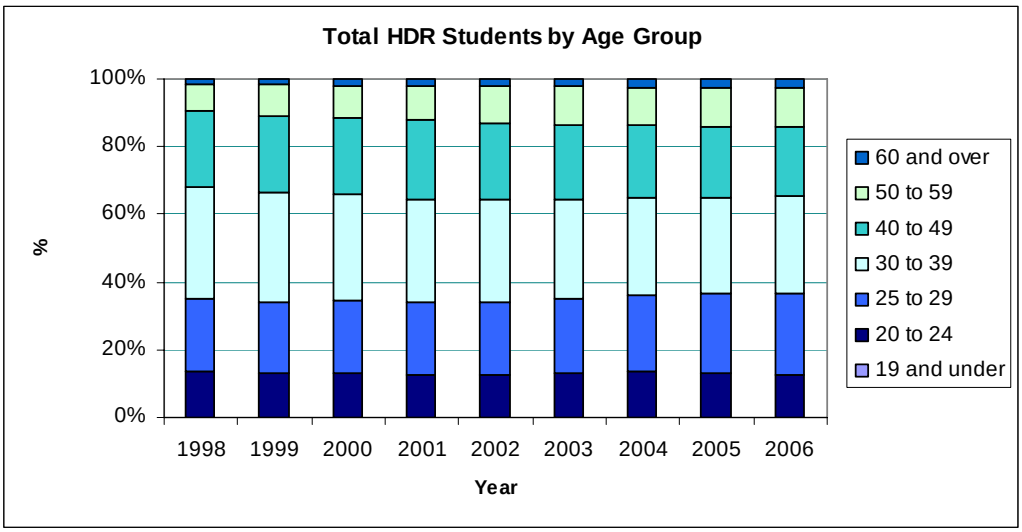
South East Asia or North East Asia: China (1st), Malaysia (equal 6th) and Vietnam (8th). The remaining top ten countries for the IPRS cohort were Germany (2nd), India (3rd), United States of America (4th), Canada (5th), Bangladesh (equal 6th), Iran (9th) and Italy (10th).

International HDR students (excluding IPRS holders and other supported students such as AusAID) came from 158 countries in 2006. Similar to the IPRS holders, the top ten countries included China (1st), Malaysia (2nd), India (3rd), Iran (5th), Germany (6th), the United States of America (7th), and Vietnam (8th). However, the following countries of origin appeared in the top ten for international HDR students but not for IPRS holders: Thailand (4th), Singapore (9th) and Taiwan (10th).

6. The ageing academic workforce

HDR students are most likely to be aged between 30-39 years old. Between 1998 and 2006, however, there have been increases in the 29 years and below categories and the 40 and above (Figure 21). Examination of the domestic HDR age breakdown indicates that the increase in the younger age group is due to international HDR students.

Figure 21: Total HDR Students by Age Group[79]



In its 2006 report, *Public Support for Science and Innovation*, the Productivity Commission found that the academic workforce (as a whole) is significantly older than the workforce in general. The academic workforce comprises a greater share of workers aged 55 and older, and fewer aged 35 or less. More than 50% of academics across the sector are aged 45 or more, a figure that has remained steady since 2001.

Other statistics collected by DEST show that in 2006 almost 27% of Australia's academic staff were at retirement age (over 55), a significant increase from 18% in 2002.

Other studies have concluded that Australia's academic workforce is likely to experience a period of substantial loss of workers through retirement over the next decade.[80]

[79] Department of Education, Science and Training, *2006 Higher education statistics*.

[80] Graeme Hugo, 'The Demography of Australia's Academic Workforce: Patterns, Problems and Policy Implications', Presentation to the Monash Seminars on Higher Education, Monash University, 7 September 2004, p.9.

Appendix A - Process for determining grants (extracts from relevant program guidelines)

Research Training Scheme

1.1 DIISR determines each higher education providers (HEP's) RTS grant amount using two steps. The first step is the calculation of a pre-safety net grant amount using the formula at paragraph 1.2 for 2008. For the determination of pre-safety net grants a performance index is calculated for all HEPs as explained at paragraph 1.3.

The second step is the application of a safety net to minimise adverse impacts. The application of the safety net is described at paragraph 1.4.

1.2 For 2008, the pre-safety net grant is determined by:

(a) A = each HEP's 2005 grant amount indexed to 2008 prices
(b) B = each HEP's 2006 grant amount indexed to 2008 prices
(c) C = each HEP's 2007 grant amount indexed to 2008 prices
(d) D = Total RTS Pool 2008 x 0.25
(e) Each HEP's pre-safety net grant is determined by:

(A x 0.25) + (B – (0.75 x A)) + (C – (B – (0.75 x A)) – (0.5 x A)) + (D x HEP's specific performance index)

1.3 Completions, research income and publications data make up the RTS performance index where:

(a) HDR student completions are weighted at 50 per cent;
(b) Research income are weighted at 40 per cent; and
(c) Research publications are weighted at 10 per cent.

Completions data are collected through the Higher Education Student Data Collection and weighted by course level and field of study:

(a) Low cost: high Cost completions are weighted at 1:2.35
(b) Doctorate degrees by research: Master degrees by research are weighted 2:1.

For a list of high cost fields of study see Appendix 1.

Research income and research publications are described in, and collected through, the Higher Education Research Data Collection (HERDC).

Research income is collected in four categories under the HERDC:

(a) Category 1: Australian Competitive Grants Income;
(b) Category 2: Other Public Sector Research Income;
(c) Category 3: Industry and Other Research Income;
(d) Category 4: Cooperative Research Centres Research Income,

and is unweighted.

Publications are collected in four categories under the HERDC:

(a) Books;
(b) Book chapters;
(c) Journal articles;
(d) Conference papers,

with books weighted by a factor of 5 and the other three categories weighted by a factor of 1.

Data for all components of the RTS performance index are averaged over the most recent two years for which data is available.

Where one or more HEPs are unable to provide or confirm data in the time available to calculate grant amounts, DIISR may determine interim grant amounts and then revised (final) grant amounts when DIISR has satisfactory datasets.

1.4 To minimise adverse impacts on HEPs, a safety net is applied to ensure that no HEP's RTS grant will fall below 95 per cent of its previous year's RTS grant amount indexed to current prices.

The pre-safety net grant amount is used to determine whether a HEP has lost or gained funds from their previous year's indexed RTS grant. All gains are placed in a pool from which funds are drawn to provide a safety net for HEPs that have realised a loss greater than 5 per cent from their previous year's RTS grant. The funds remaining in the pool are then returned to HEPs that gained, based on their percentage contribution to the pool.

Australian Postgraduate Awards

(1) The amount of *APA* grant payable to an eligible scholarship *provider* under section 46-15 of *the Act* for a year will be determined using the number of new *APAs* allocated to the *provider* for that year and the previous three years.

(2) The amount of *APA* grant paid to a *provider* for a year is the sum of the following amounts:
- (a) the number of new *APAs* allocated to the *provider* for that year multiplied by [SR[81] + $375 (relocation component)];
- (b) the number of new *APAs* allocated to the *provider* for the year prior to that year multiplied by (SR x 0.9);
- (c) the number of new *APAs* allocated to the *provider* for the year two years prior to that year multiplied by (SR x 0.75); and
- (d) the number of new *APAs* allocated to the *provider* for the year three years prior to that year multiplied by [(SR x 0.4) + $750 (thesis component)].

(3) For the purpose of (2)(a), the number of new *APAs* allocated to the *provider* is determined by applying the Research Training Scheme (RTS) formula (specified at http://www.dest.gov.au/sectors/research_sector/programmes_funding/programme_categories/professional_skills/research_training_scheme.htm) The RTS formula gives a 50% weighting to *HDR* completions, a 40% weighting for research income, and a 10% weighting for research publications, each taken over the two most recent years for which data are available. For the purpose of the *APA* allocation, *HDR* completions are not weighted on the basis of the field of study.

(4) For the purpose of (2)(b), (c) and (d), the number of new *APAs* allocated to the *provider* for each of the three previous years is the number approved by the Minister for those years.

(5) Where the formula results in less than one but more than zero *APAs* for a *provider*, a default of one *APA* will be allocated to the *provider*.

[81] SR is the stipend rate for a full-time student for the current year.

International Postgraduate Research Scholarships

(1) The formula used to allocate the notional number of *Endeavour IPRS* to *provider*s gives a 50% weighting to *HDR* completions, a 40% weighting for research income and a 10% weighting for research publications, each taken over the two most recent years for which data are available.

(2) Where the formula results in less than one but more than zero *IPRS* for a *provider*, a default of one *Endeavour IPRS* will be allocated to the *provider*.

(3) The amount of *Endeavour IPRS* grant paid to an eligible scholarship *provider* under subsection 46-15(2) of *the Act* for the year 2007 or any later year (the "**new year**") will be determined in accordance with paragraphs 4.5.5(4) and 4.5.5(5).

(4) Subject to any adjustment that may be made under paragraph 4.5.5(5), the amount of *Endeavour IPRS* grant to be paid to a *provider* for any new year (a "**New Year Grant Amount**") is equal to:

(A + B + C + D) x E / F

where:

A = number of notional *Endeavour IPRS* allocated to the *provider* for the new year multiplied by 0.925

B = number of notional *Endeavour IPRS* allocated to the *provider* for the year prior to the new year multiplied by 0.925

C = number of notional *Endeavour IPRS* allocated to the *provider* for the year two years prior to that year multiplied by 0.775

D = number of notional *Endeavour IPRS* allocated to the *provider* for the year three years prior to that year multiplied by 0.65

E = the total amount available for *Endeavour IPRS* in the new year, as specified in paragraph 4.5.1

F = sum of (A+B+C+D) for all *providers*

(5) For the purposes of this paragraph 4.5.5(5), a "**Prior Year**" is 2004, 2005 or 2006.

If, for any Prior Year, there was a difference between:

(a) the amount of *Endeavour IPRS* grant paid to a *provider*;

and

(b) the *provider's* actual total cash expenditure on *Endeavour IPRS* payments;

then *DEST* may adjust the amount of any New Year Grant Amount, as calculated under paragraph 4.5.5(4), to account for that difference.

Note that IPRS grants are adjusted annually in accordance to program guidelines to manage earlier years' program under- and overspends.

Commercialisation Training Scheme

8.95.1 HEPs preliminary CTS grant amounts will be determined according to the total CTS funds available multiplied by each HEP's share of the initial CTS performance index which includes all eligible HEPs and is calculated according to paragraph 8.95.3. If all preliminary grant amounts are greater than the minimum CTS grant amount (as specified in paragraph 8.95.4), then the preliminary grant amounts become the final CTS grant amounts.

8.95.2 Where one or more HEPs have a preliminary grant amount less than or equal to the minimum CTS grant amount, but greater than zero, these HEPs final CTS grant amount will be equal to the minimum CTS grant amount. The final CTS grant amounts for all **"remaining HEPs"** (i.e. those HEPs not allocated a minimum grant amount) are then determined according to a formula calculated as follows:

(1- ratio) x secondary grant amount + minimum CTS grant amount

where:

(a) the **"ratio"** is equal to the **"excess amount"** divided by the sum of the remaining HEPs' **"secondary CTS grant amounts"**; and

(b) the excess amount is equal to the remaining HEPs preliminary grant amounts plus all minimum grant amounts previously allocated minus the total CTS funds available for the Grant Year; and

(c) for each remaining HEP, the secondary CTS grant amount is equal to its preliminary CTS grant amount minus the minimum CTS grant amount.

The CTS performance index

8.95.3 The CTS performance index is a list of the relative performances of a group of HEPs defined for a particular purpose.

The relative performances are expressed as a percentage of the sum of all performances within the defined group. Each HEP's percentage is known as a share.

A share is the sum of three performance components after each has been multiplied by a proportioning factor:

- HDR student completions performance has a proportioning factor of 0.5
- Research Income performance has a proportioning factor of 0.4
- Research Publications performance has a proportioning factor of 0.1

HDR student completions performance
HDR student completions performance for a HEP is equal to a HEP's weighted completions divided by total weighted completions of a defined group of HEPs.

Weighted completions equals the sum of all categories of completions after each has been multiplied by the specified weighting factor:

- Doctorate degree by research has a weighting factor of 2;
- Masters degree by research has a weighting factor of 1.

Each category of data is the average of the most recent two years for which data is available and is sourced from the Higher Education Student Data Collection.

Research income performance
Research income performance for a HEP is equal to a HEP's weighted Research income divided by total weighted Research income of a defined group of HEPs.

Weighted Research income equals the sum of all categories of Research income after each has been multiplied by the specified weighting factor:

- Australian Competitive Grants Income has a weighting factor of 1;
- Other Public Sector Research Income has a weighting factor of 1;
- Industry and Other Research Income has a weighting factor of 1;
- Cooperative Research Centres Research Income has a weighting factor of 1.

Each category of data is the average of the most recent two years for which data is available and is sourced from the Higher Education Research Data Collection.

Research publications performance
Research publications performance for a HEP is equal to a HEP's weighted Research publications divided by total weighted Research publications of a defined group of HEPs.

Weighted Research publications equals the sum of all categories of Research publications after each has been multiplied by the specified weighting factor:

- Books have a weighting factor of 5 ;
- Book chapters have a weighting factor of 1;
- Journal articles have a weighting factor of 1;
- Conference papers have a weighting factor of 1.

Each category of data is the average of the most recent two years for which data is available and is sourced from the Higher Education Research Data Collection.

Appendix B - 2008 Research Block Grant amounts in actual year prices

	RTS	APA	IPRS	IPRS Adjustment	CTS
Charles Sturt University	$3,185,307	$541,450	$110,921	$6,944	$30,599.00
Macquarie University	$10,996,611	$1,864,307	$348,428	$24,544	$108,807.00
Southern Cross University	$3,441,718	$677,933	$121,928	$36,876	$34,299.00
University of New England	$7,700,108	$1,305,397	$232,850	$0	$70,604.00
University of New South Wales	$46,905,743	$7,642,699	$1,414,032	$0	$452,202.00
University of Newcastle	$13,715,357	$2,389,236	$432,677	$17,131	$134,746.00
The University of Sydney	$58,534,746	$9,625,715	$1,795,058	$0	$557,017.00
University of Technology, Sydney	$9,054,252	$1,571,035	$292,967	$0	$91,767.00
University of Western Sydney	$7,642,732	$1,322,934	$245,974	$33,645	$72,474.00
University of Wollongong	$12,087,110	$1,908,618	$348,428	$36,740	$108,960.00
Deakin University	$9,453,804	$1,619,598	$288,310	$0	$84,708.00
La Trobe University	$12,133,073	$1,995,490	$367,902	$118,046	$103,505.00
Melbourne College of Divinity	$574,860	$151,098	$55,461	$0	$21,226.00
Monash University	$42,738,965	$7,182,116	$1,346,717	$179,461	$404,520.00
Royal Melbourne Institute of Technology	$13,963,070	$2,439,391	$483,480	$108,279	$126,740.00
Swinburne University of Technology	$6,041,212	$970,815	$166,382	$0	$55,060.00
University of Ballarat	$1,802,222	$343,820	$55,461	$0	$21,226.00
The University of Melbourne	$66,370,836	$11,154,358	$2,107,496	$0	$607,553.00
Victoria University	$5,068,170	$838,739	$150,717	$67,948	$41,383.00
Bond University	$446,470	$115,555	$55,461	$0	$21,226.00
Central Queensland University	$2,467,357	$399,745	$55,461	$0	Not eligible
Griffith University	$13,037,903	$2,274,227	$428,020	$49,556	$119,761.00
James Cook University	$8,483,802	$1,305,397	$221,842	$0	$70,798.00
Queensland University of Technology	$13,044,533	$2,349,597	$448,341	$0	$137,707.00
The University of Queensland	$54,096,102	$8,677,436	$1,603,698	$0	$462,456.00
University of Southern Queensland	$2,147,727	$372,971	$55,461	$0	$21,226.00
University of the Sunshine Coast	$632,611	$82,544	$55,461	$0	$21,226.00
Curtin University of Technology	$13,289,977	$2,404,788	$456,808	$0	$126,505.00
Edith Cowan University	$4,334,913	$879,033	$166,382	$12,170	$47,576.00
Murdoch University	$9,403,466	$1,567,064	$301,434	$0	$79,278.00
The University of Notre Dame Australia	$296,619	$62,162	$55,461	$0	Not eligible
The University of Western Australia	$31,238,891	$5,077,433	$947,486	$0	$280,272.00
The Flinders University of South Australia	$10,389,454	$1,716,756	$332,763	$85,801	$94,361.00
The University of Adelaide	$28,126,820	$4,210,322	$769,250	$0	$218,697.00
University of South Australia	$10,019,370	$1,832,312	$332,763	$40,781	$103,893.00
University of Tasmania	$14,650,722	$2,287,356	$454,692	$31,823	$129,145.00
Batchelor Institute of Indigenous Tertiary Education	$167,901	$62,162			Not eligible
Charles Darwin University	$2,851,007	$507,002	$99,914	$0	$28,499.00
The Australian National University	$30,824,261	$5,249,148	$958,493	$0	$290,276.00
University of Canberra	$2,574,710	$461,437	$95,257	$39,157	$25,702.00
Australian Catholic University	$1,440,486	$327,799	$55,461	$0	Not eligible
TOTAL	**$585,375,000**	**$97,767,000**	**$18,315,098**	**$888,902**	**$5,406,000**

Appendix C

Support for research training outside the Innovation, Industry, Science and Research portfolio

National Health and Medical Research Council (NHMRC) Scholarships

The aim of the NHMRC scholarships scheme, managed within the health and ageing portfolio, is to support outstanding Australian health and medical graduates early in their career so that they can be trained to conduct research that is internationally competitive and develop a capacity for original independent research. This is usually achieved by NHMRC funding its scholars to attain a PhD by full-time research. The Scholarships funding type includes the following categories: Biomedical Postgraduate Research Scholarships; Medical and Dental Postgraduate Research Scholarships; Gustav Nossal Scholarship; Pharmacy Guild Postgraduate Scholarship; Primary Health Care Postgraduate Research Scholarship; Public Health Postgraduate Scholarship; Training Scholarships for Indigenous Health Research; and Partnership – Scholarship.

Endeavour program

The Endeavour Awards, administered under the education, employment and workplace relations portfolio, is an internationally competitive, merit-based program providing opportunities for citizens of the Asia-Pacific region to undertake study, research and professional development in Australia. Awards are also available for Australians to do the same abroad. A smaller number of awards are available for participants from Europe and the Americas.

Endeavour Postgraduate Awards provide full financial support for international students for up to three years to undertake a postgraduate qualification at a Masters or PhD level either by coursework or research in any field of study in Australia. The awards cover tuition fees, a monthly stipend, travel and establishment allowances, and health cover costs. Up to 80 awards are offered each year.

Up to 98 awards are also offered each year under the *Endeavour Europe Awards*, which provide financial assistance for postgraduate students from participating countries in Europe to undertake, in any field of study, either an Australian Masters degree or PhD in Australia. The awards include a monthly stipend, travel and establishment allowances, and health cover costs although they do not provide funding to cover tuition fees and funding is available for 12 months only.

The *Endeavour Research Fellowships* provide financial support for postgraduate students and postdoctoral fellows from participating countries to undertake short-term research (4-6 months), in any field of study, in Australia. Up to 117 awards are offered each year, and the fellowship includes a monthly stipend, travel and establishment allowances, and health cover costs. The *Endeavour Research Fellowships* are also available to up to 90

Australian researchers and researchers-in-training to undertake 4-6 months in participating countries. Another four awards are provided specifically to Indigenous postgraduate students and postdoctoral fellows.

AusAID

The Australian Scholarships administered by AusAID provide educational, research and professional development opportunities to support growth in the region and to build enduring links at the individual, institutional and country levels.

Australian Development Scholarships (ADS) strengthen human resource capacity in Australia's partner countries to contribute to long-term development needs and promote greater stability within the Asia-Pacific region. ADS are available for full-time undergraduate or postgraduate study, from Certificate level to PhD at participating Australian universities and Technical and Further Education (TAFE) institutions. The scholarships are offered for the minimum period necessary for the individual to complete the academic program specified by the Australian HEP and up to 1000 awards are offered each year. Scholarship holders are required to return to their country of citizenship for two years after they have completed their studies to contribute to the development of their country.

Australian Leadership Awards (ALA) aim to develop leadership, build partnerships and links, and address priority issues in the Asia-Pacific region. ALA comprises scholarships and fellowships. ALA Scholarships are academically elite awards offered to high achievers from the Asia-Pacific region each year to undertake postgraduate study (Masters or Doctorate) and a Leadership Development Program in Australia. ALA Scholarships are an investment in the future of the Asia-Pacific region. In this regard, ALA scholars are required to return to their home country or the region for two years after they have completed their studies. An ALA Doctorate Scholarship, taken over four years can be valued up to $300,000. ALA Fellowships are for short term study, research and professional attachment programs in Australia delivered by Australian organisations. ALA Fellowships complement the longer term ALA Scholarships providing opportunities to senior officials and mid-career professional who cannot leave their positions for extended periods.

University scholarships

Individual universities also provide additional scholarships and awards, including tuition-waivers, living stipends, and "top-up" allowances to attract the best and brightest domestic and international HDR students. The amount and value of these scholarships vary across universities and may be targeted at students in areas of research strength within the university. These scholarships are sometimes funded from grants received under the Institutional Grants Scheme.