

Meeting Australia's research workforce needs

A consultation paper to inform the development of the Australian Government's research workforce strategy

Department of Innovation, Industry, Science and Research

This paper has been compiled by the Department of Innovation, Industry, Science and Research and reflects the advice of the Research Workforce Strategy Reference Group, feedback and suggestions provided by a wide range of stakeholders, and analysis undertaken by the department over the course of 2009-10. Issues and ideas canvassed in the paper are not Australian Government policy and should not be represented as such.

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Abbreviations

ABS	Australian Bureau of Statistics
ANSTO	Australian Nuclear Science and Technology Organisation
APA	Australian Postgraduate Award
APA-I	Australian Postgraduate Award – Industry
ARC	Australian Research Council
AUQA	Australian Universities Quality Agency
AusAID	Australian Agency for International Development
CEO	Chief Executive Officer
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTS	Commercialisation Training Scheme
DEEWR	Department of Education, Employment and Workplace Relations
DIISR	Department of Innovation, Industry, Science and Research
ERA	Excellence in Research for Australia
GDS	Graduate Destination Survey
HDR	Higher Degree by Research
IAF	Institution Assessment Framework
IPRS	International Postgraduate Research Scholarship
NCGP	National Competitive Grant Program
NHMRC	National Health and Medical Research Council
OECD	Organisation for Economic Co-operation and Development
PhD	Doctor of Philosophy
PREQ	Postgraduate Research Experience Questionnaire
R&D	Research and Development
RTS	Research Training Scheme
RWS	Research Workforce Strategy
SOL	Skilled Occupations List
TEQSA	Tertiary Education Quality and Standards Agency

1. Introduction

1.1 Background

- 1.11 The Australian Government ('the government') outlined its intention to develop a research workforce strategy in *Powering Ideas: An Innovation Agenda for the 21st Century*.
- 1.12 In that statement, the government highlighted the vital importance of the research workforce to its forward vision for Australia's innovation system – a vision ultimately resting on highly skilled human capital for its fruition. It indicated that the strategy would look ahead to 2020 and ensure that Australia is able to meet expected shortfalls in the supply of research-qualified people. It also indicated that the strategy would address concerns about the lack of clear career paths for research students and the adequacy of research training in effectively preparing them for varied career outcomes.
- 1.13 Australia faces both challenges and opportunities in achieving these objectives and meeting the government's complementary aspirations to significantly increase the number of students completing higher degrees by research (HDR) over the next decade and progressively increase the number of research groups performing at world class levels.¹
- 1.14 There are three main challenges: (a) ensuring that there are sufficient HDR-qualified individuals to meet workforce demands; (b) maintaining the quality and international standing of Australian research degrees in the face of the expanding skill requirements and global competition; and (c) providing supportive career structures and pathways for researchers throughout their careers, while encouraging greater flexibility, mobility and adaptability in the research workforce to meet rapidly changing needs and priorities.
- 1.15 Australia has the opportunity to better harness and use the potential within its research workforce by developing and implementing a coherent, forward-looking and evidence-based research workforce strategy. At the highest level, this is about drawing on research skills to meet the productivity challenge of a future characterised by an ageing workforce and an increasing need to seek innovative and sustainable solutions in areas such as environmental management, climate change mitigation, social inclusion and health.

1.2 Purpose of this paper

- 1.21 This paper is provided as a basis for consultation on these challenges and opportunities.
- 1.22 The paper firstly identifies issues influencing Australia's capacity to produce the quantity, breadth and depth of research-qualified individuals it requires and to

¹ Australian Government, *Powering Ideas: An Innovation Agenda for the 21st Century* (Canberra: Commonwealth of Australia, 2009).

provide viable and productive career pathways to its researchers. Issues are organised under the following broad themes:²

- *Employer demand for researchers;*
- *Supply of researchers to Australia;* and
- *Research career pathways.*

These issues reflect the advice of a high-level reference group, established to support the strategy development process (see **Appendix A**), along with feedback and information garnered from a range of consultation and analysis activities undertaken by the Department of Innovation, Industry, Science and Research (DIISR) over 2009-2010 (see **Appendix B**), including two commissioned studies and a number of targeted roundtables and workshops with stakeholder groups.

- 1.23 The paper then proposes a set of priority focus areas and related actions for Australia to enhance its research workforce over the coming decade (see **Table 1**).
- 1.24 Specific consultation questions are posed throughout the paper (a full list of questions is provided at **Appendix C**) on which all stakeholder views are sought (government, public and private sector research employers, research training providers, individual researchers, students, relevant peak bodies, unions and other interest or advocacy groups).
- 1.25 Feedback received on the paper will inform the government's final research workforce strategy, due to be completed in the second half of 2010.

² The terms 'supply' and 'demand' are used consistently throughout this paper to describe the broad challenge of building a research workforce that can meet Australia's needs. The terms, while economic in origin, are not intended to detract from the human dimension of the workforce and the value and needs of individuals within it.

2. Australia's research workforce

2.1 Defining Australia's research workforce

2.11 Australia's research workforce can be defined by either employment focus or skill level, to include:

- individuals actively engaged in research activities in Australia, or
- individuals with HDR qualifications (doctorate by research and masters by research)

2.12 These characterisations are not exclusive. Not all HDR-qualified individuals are employed in a research capacity and not all researchers are HDR-qualified (for example, HDR students).³ In broad terms, however, the categorisations can be viewed as representing *activity* and *potential*; the former representing current deployment of skills and the latter representing skills available for potential deployment to meet both immediate and future demand. Both are important considerations in developing a long-term research workforce strategy for Australia and will be used interchangeably throughout this paper.

2.13 **Box 1** provides a snapshot of the broad composition of Australia's research workforce from both perspectives, along with a sense of how Australia compares to its international counterparts in the deployment of its research personnel.

2.2 Role and importance of the research workforce to Australia

2.21 Australia's research workforce is essential not only to the creation of knowledge but also to the dissemination and productive application of knowledge in the wider community.

2.22 In the public sector, the research workforce contributes to the generation and publication of the basic research that ultimately underpins many innovations.⁴ At the same time, it plays a vital role in conducting research and generating solutions in areas of public good, such as environmental sustainability, biodiversity protection and health care.

2.23 In the private sector, the research workforce contributes to innovation activities which can boost the profitability of individual firms and their capacity to compete in tightly contested national and global markets.⁵ It can also play an important role in supporting 'horizon scanning' within firms, enabling the rapid assessment of global research developments which present an opportunity or challenge to operations.

³ HDR students, while not yet having attained a formal HDR qualification, make a vital contribution to the research workforce, producing (or contributing to) a significant proportion of Australia's research output. See, for example, Australian Bureau of Statistics, *Research and Experimental Development, Higher Education Organisations, Australia, 2008*, Cat. No.8111.0.

⁴ Narin, F. *et al.*, 1997, *The Increasing Linkage Between U.S. Technology and Public Science*, Research Policy, Vol 26 (Issue 3).

⁵ Australian Bureau of Statistics, *Characteristics of Australian Business, 2006-07*, Cat. No. 8167.0.

2.24 More broadly and in all sectors of the economy, the research workforce contributes to Australia's capacity to absorb the 97 per cent of global knowledge generated outside Australia and to assimilate new-to-world technologies produced elsewhere.

2.25 The benefit of these contributions is reflected in productivity gains for Australia and increased competitiveness in the global economy.⁶

2.3 Current government policy and funding settings

Support mechanisms

2.31 The government's support for the research workforce falls into four main areas:

- funding for research training;
- funding (primarily in the form of fellowships) for individual researchers at various stages of their careers;
- incentives for employers to engage researchers and for researchers to develop industry-relevant skills and experience; and
- visa arrangements (both temporary and permanent) to enable international students and researchers to study and conduct research in Australia.

Funding in support of research training

2.32 The primary vehicles of government funding specifically for research training are the Research Training Scheme (RTS), Australian Postgraduate Awards (APAs), and International Postgraduate Research Scholarships (IPRS). Together, these schemes amount to over \$795 million in 2010, with the RTS at just over \$610 million accounting for the greatest proportion of funds.

2.33 The schemes are block grants distributed to universities on the basis of relative performance against an index comprising completions, research income and publications (see **Box 2**). APAs are awarded by administering universities directly to students as a stipend (\$22,500 p.a. for full-time candidates in 2010) to support the living costs associated with their research training while RTS supports institutions to meet the costs of research training. In contrast to APAs, IPRS funding is not provided to students as a stipend but is awarded to institutions to cover tuition fees and health cover costs for recipients and their dependants.

⁶ For the relationship between R&D and productivity in Australia see, for example: Khan, M. and Luintel, K., Sources of Knowledge and Productivity: How Robust is the Relationship?, STI Working Paper 2006/6, Paris, OECD, 2006

Box 1: Composition of Australia's research workforce

Research employment in Australia, whether characterised by possession of a research qualification (the 'potential' research workforce) or engagement in research (the 'active' research workforce) is concentrated in the higher education sector; however, a significant proportion of active research staff and research-qualified individuals are also employed in other sectors and industries in line with the broad distribution of research activity across the Australian economy.

The dominance of the higher education sector in Australia's research workforce profile contrasts to the situation in many other OECD countries, where the business sector is the primary employer of research personnel (see **Figure 1** below).

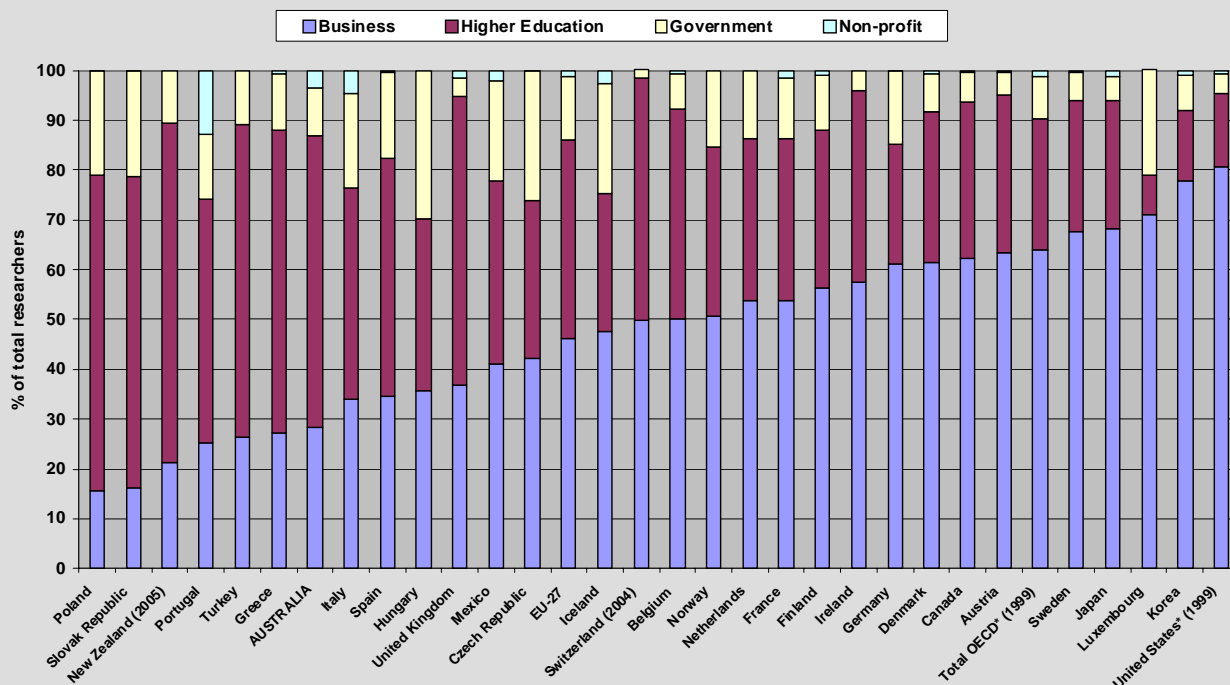
Australia's 'active' research workforce (as defined above) is characterised primarily by researchers (approximately 70 per cent of research personnel in 2006-07); however, dedicated technicians and support staff (at approximately 30 per cent of research personnel in 2006-07) also make a strong contribution to the total human resources devoted to R&D. This is particularly the case in the business sector, where researchers accounted for 52 per cent of research personnel in 2006-07 and technicians 32 per cent. Within the business sector, manufacturing is the largest industry of research personnel employment, followed by professional, scientific and technical services.

Australia's 'potential' research workforce (as defined above) comprises primarily individuals with doctorates by research (estimated at approximately 86 per cent of total employment of research-qualified individuals in 2009), with masters by research qualifications making up a smaller proportion of the workforce. The primary industry of employment of research-qualified individuals is education and training (estimated at approximately 46 per cent of total HDR employment in 2009) followed by professional, scientific and technical services. Health care and social assistance and public administration and safety also account for a significant proportion of HDR employment.

Note: Proportions drawn from Access Economics, Australia's Future Research Workforce: Supply, Demand and Influence Factors. Report to the Department of Innovation, Industry, Science and Research (2010).

Figure 1: Comparison of Australia's 'active' research workforce with other OECD countries

Distribution of total researchers by sector of performance - by OECD country, 2006



Sources: Main Science Technology Indicators (MSTI) 2006/1*, MSTI 2009/2

2.34 A number of other Commonwealth scholarships are also available to students seeking support to complete HDR studies, for example, the Australian Postgraduate Award – Industry or APA-I administered by the Australian Research Council (ARC), Commonwealth Scientific and Industrial Research Organisation (CSIRO) Flagship Postgraduate Awards, AusAID scholarships, and Endeavour Postgraduate Awards administered by the Department of Education, Employment and Workplace Relations (DEEWR). Moreover, many scholarships or top-ups may be funded from other government research grants (for example, Cooperative Research Centres).

Funding in support of individual researchers at various stages of their careers

2.35 The government provides a number of fellowship schemes on a competitive basis to support researchers at different stages of their careers.⁷ These include, but are not limited to:

Early career fellowships

- Under the National Competitive Grant Program (NCGP) administered by the ARC, the government funds the Australian Postdoctoral Fellowships (112 awarded for funding commencing in 2010) and Australian Postdoctoral Fellowships Industry (15 awarded for funding commencing in 2010) to researchers within three years of their award of a PhD, and a number of Super Science Fellowships (50 awarded for funding commencing in 2010) to early-career researchers in areas of existing research strength. Through the National Health and Medical Research Council (NHMRC), a number of Career Development Awards are available to researchers with more than two but less than seven years' postdoctoral experience, and Training Fellowships (120 in the 2010 funding round) are available to researchers with up to two years experience.

Mid career fellowships

- Under the ARC's NCGP, the government funds the five-year Australian Research Fellowships and Queen Elizabeth II Fellowships (64 awarded for funding commencing in 2010) for researchers with up to eight years' postdoctoral experience, along with the Future Fellowships Scheme which offers four-year fellowships to outstanding researchers in the middle of their research career. Through the NHMRC, the government funds the NHMRC Research Fellowships Scheme for outstanding biomedical and health researchers with a proven track record; five-year fellowships for experienced clinical and public health researchers who wish to maintain both a research and a successful professional career; and two-year, half-time fellowships to protect the time of clinicians for research activities that can be expected to translate into improved clinical practice.

⁷ See ARC and NHMRC websites for more detail on individual schemes and outcomes: www.arc.gov.au and www.nhmrc.gov.au.

Senior researcher fellowships

- For senior researchers, the government, provides funding through the ARC for Australian Professorial Fellowships (27 awarded for funding commencing in 2010) for five years of research (with support for salary and on-costs). The ARC also administers the Australian Laureate Fellowships Scheme, which includes support for five years (salary, on-costs and project costs supported). Through the NHMRC the government provides funding for outstanding senior national and international researchers in the biomedical and health fields under the Australia Fellowships Scheme. The scheme offers a one-line budget of \$800,000 per year for five years to successful applicants.

2.36 A number of other support programs and prizes are offered by government through agencies such as the CSIRO, ANSTO and the National Film and Sound Archive, targeted at talented researchers at different stages of their research career. Fellowships and support schemes are also offered in specific areas, such as the ARC's Indigenous Researcher Fellowships provided under the Indigenous Researchers Development Scheme of the NCGP. In addition, the government makes a significant contribution to researcher salaries, through operating grants to both universities and publicly funded research agencies and direct salary payments to researchers in government departments.

Box 2: Origin and nature of research training block grants to universities

Australia's funding and policy settings for research training have been in place since the *Knowledge and Innovation* reforms to Australia's higher education research system were introduced in 2001. While individual programs have been augmented and enhanced subsequently, key elements of their operation have remained essentially constant.

The primary support schemes, the RTS (\$610,218,271 in 2010), APA (\$164,827,753 in 2010) and IPRS (\$20,019,000 in 2010), rely on a performance index which rewards universities' relative performance in delivering completions (weighted at 50 per cent), securing research income (weighted at 40 per cent) and producing publications (weighted at 10 per cent). HDR completions for RTS allocations are additionally weighted at 1:2.35 for low-cost to high-cost completions and 2:1 for doctorate to masters by research (i.e. a weighting of 4.7 for high-cost doctorate by research completion, 2.35 for a high-cost masters by research completion, 2.0 for a low-cost doctorate completion and 1.0 for a low-cost masters by research completion). APAs and IPRS completions are weighted only by level of course (doctorate by research or masters by research).

The performance index gives universities an incentive to deliver outcomes in the areas of *quantity* and *quality*. *Quantity*, or the potential workforce supply of research skills, is captured in the measurement of completions. *Quality*, or the calibre of the research environment in which training is conducted, is measured by the research capacity of the institution (using the proxy measure of research income) and its research outputs (using the proxy measure of publications).

The differential weighting of completions for high-cost and low-cost disciplines attempts to account for the significant cost variations which are associated with delivery of research training in different areas (for example, disciplines with high infrastructure costs versus those with low infrastructure requirements). The differential weighting of completions between doctorate and masters by research programs recognises the significantly greater resources required to support training of a doctorate candidate (at three or more years' duration) versus a masters by research candidate (two years' duration).

The maximum period of support under the RTS is four years. For APAs and IPRS, the maximum duration of support is three and half years and four years respectively. Universities have the flexibility to extend IPRS to up to four years; however, information collected as part of a recent review of the scheme suggests that in practice many universities place an upper limit on support of three years.

RTS, APA and IPRS funding is indexed annually. Base funding under the RTS and IPRS has been steady in recent years (RTS funding has been essentially fixed, barring indexation, since 2001) and is projected to remain so into the future, placing a limitation on growth in supported students if existing levels of funding per student are maintained. The government committed in the 2008-09 Budget to double the number of APA places available by 2012, and in the 2009-10 Budget increased the APA stipend by 10 per cent to \$22,500 per annum, significantly increasing both the level and extent of support available under this scheme. In announcing the increase to the APA stipend, the government also proposed, subject to consultation with the sector, to open APAs to recipients of IPRS.

Incentives for business employers to engage researchers and for researchers to develop industry-relevant skills and experience

2.37 Through the Enterprise Connect Researchers in Business Program, the government supports the placement (through support for up to 50 per cent of salary to a maximum of \$50,000 for each placement) of researchers from universities or public research organisations in businesses for a period of two to twelve months. The scheme's objectives include breaking down cultural barriers between sectors and speeding the dissemination of expertise.

2.38 The government also supports the development of and access to commercialisation skills through the Commercialisation Training Scheme (CTS) and the newly established Commercialisation Australia. The CTS has been provided since 2007 as a block grant to universities and supports the provision of courses to HDR candidates as part of their studies. Commercialisation Australia will provide assistance of up to \$50,000 to researchers to access specialist advice and services to build their skills, knowledge and networks.

Visas to support international students and researchers to study and conduct research in Australia

2.39 The government provides a number of visas to facilitate the entry of international students and researchers to Australia for the purpose of study and research. The Subclass 574 Postgraduate Research Sector: Temporary Visa is available to HDR students for the duration of their degree (subject to satisfactory progress), while the Subclass 485 Skilled Graduate visa is available to HDR graduates who work in an occupation on the Skilled Occupation List (SOL). Visiting academics and researchers have access to several visa options, including the Subclass 419 Visiting Academic visa for short-term, unremunerated visits and participation in research projects, and a range of temporary and permanent visa classes offered on the basis of employer sponsorship (such as the Subclass 457 visa) and other assessment criteria.

2.4 Monitoring and evaluation mechanisms

2.41 The government has put in place or has access to a number of monitoring and evaluation mechanisms to benchmark the performance of the research workforce and the policies and programs supporting it. Monitoring mechanisms can broadly be grouped according to the level of focus i.e. national, organisational and individual.

National

2.42 At a national level, the focus includes:

- inwardly focused data collection, primarily through the Australian Bureau of Statistics (ABS) (for example the Census and regular research and development

- (R&D) expenditure surveys), examining issues such as human resources devoted to R&D in different sectors and the skills base of the population;
- international benchmarking exercises undertaken by the OECD, European Union and United States National Science Foundation in relation to human resources devoted to R&D, highly skilled workers as a proportion of national population, research training program outputs, etc.; and
 - composite reviews and reports such as the recent system-wide review of the national innovation system, conducted in 2008, and the *Australian Innovation System Report 2010*, along with wider workforce analysis and priority setting, such as the work being done by Skills Australia.

Organisational

2.43 At an institutional or organisational level, the primary focus is on the research training process and the research environment in which this is embedded. Some monitoring mechanisms include:

- the Institution Assessment Framework (IAF) exercise, which has for a number of years collected Institution Performance Portfolios from universities comprising both qualitative and quantitative data in relation to research and research training activities and performance on an annual basis (the collection of this data is continuing as part of mission-based compacts with universities);
- the Australian Universities Quality Agency (AUQA) (to be subsumed into the new Tertiary Education Quality and Standards Agency (TEQSA), which conducts periodic audits of Australian universities, including with respect to research training; and
- regularly administered surveys, such as the Postgraduate Research Experience Questionnaire (PREQ), which attempt to capture students' perceptions of the quality of their research training experience with a view to informing improved institutional practice.

Individual

2.44 At an individual level, the primary focus is on graduate pathways and outcomes. In particular:

- the annual Graduate Destination Survey (GDS) collects data on HDR graduates' immediate career outcomes;⁸ and
- a number of studies have been produced less frequently, funded by agencies such as the ARC and NHMRC, exploring graduate outcomes over the medium to long term, including progression through the early stages of an academic career.

2.5 Rationale for a research workforce strategy

2.51 Although the support programs and monitoring and evaluation mechanisms outlined above have provided an adequate framework for the research workforce

⁸ Data is collected in October if the thesis is submitted in first semester or the following April for second semester submissions.

over the last decade, looking ahead to 2020 it is clear that there is both a need and scope for improvement in a number of areas.

- 2.52 The pace of change in research activities and the research and innovation systems in which they are embedded has been rapid. Globalisation has contributed to increased mobility of talent and an increasingly competitive market for the highly skilled. In turn, such developments have contributed to a move towards greater standardisation of processes, as evidenced by the Bologna reforms, and a heightened emphasis on the quality of research and research training programs. These developments all have implications for Australia if it is to maintain the competitiveness of its research training system and research workforce.
- 2.53 At the same time, recent reviews and studies have raised concerns about expected future shortfalls of research-qualified individuals, the availability of clear career paths for researchers and the capacity of Australia's research training system to deliver the quantity and quality of skills required to meet future demand both in the aggregate and in individual disciplines.
- 2.54 Finally, the government's reforms to and aspirations for innovation and higher education in Australia can be expected to place new pressures on Australia's research training system and research workforce over the next decade. Increasing the number of businesses investing in R&D will ultimately be dependent on the availability of suitably trained personnel to conduct the additional R&D.⁹ Similarly, raising the proportion of 25–34-year-olds holding a bachelor degree or above to 40 per cent by 2025 will require an increase in academic staff to teach the additional students.¹⁰
- 2.55 A 2010 study commissioned by DIISR suggests that Australia's supply of HDR-qualified individuals is likely to fall short of demand arising from these policy directions for some or all of the period to 2020, in the absence of intervention (see **Box 3** below).¹¹ This is an issue of considerable importance to Australia given the role of these reforms in delivering the productivity improvements that will be required to secure Australia's ongoing growth and prosperity.
- 2.56 The research workforce strategy is being developed against this backdrop and as an integral component of the government's wider reform agendas for innovation and higher education in Australia.
- 2.57 While led by the government, the strategy is important to all stakeholders – employers, research training providers, and individuals – in both the public and private sectors. The full potential of Australia's research workforce will only be realised with the active engagement of all these parties.

⁹ Australian Government, *Powering Ideas: An Innovation Agenda for the 21st Century* (Canberra: Commonwealth of Australia, 2009).

¹⁰ Australian Government, *Transforming Australia's Higher Education System* (Canberra: Commonwealth of Australia, 2009).

¹¹ Access Economics, *Australia's Future Research Workforce: Supply, Demand and Influence Factors. Report to the Department of Innovation, Industry, Science and Research* (2010).

Box 3: Projected supply of and demand for HDR-qualified individuals

DIISR commissioned Access Economics in early 2010 to undertake a quantitative analysis of the likely level and nature of supply of and demand for research-qualified individuals in Australia over the period to 2020. The study examined a number of different scenarios as part of its projections:

- a base scenario;
- a high-growth, globally engaged scenario;
- a low-to-moderate-growth, inwardly focused scenario;
- a green economy scenario; and
- an innovation economy scenario.

For the *base*, *high growth* and *low-to-moderate growth* scenarios, key economic parameters (for example, net migration, labour productivity, unemployment and exports) were benchmarked according to the growth scenarios of the government’s latest Intergenerational Report (January 2010).

The *green economy* scenario took into account the impact on the workforce of environmental policies, such as feed-in tariff schemes, the Carbon Pollution Reduction Scheme and the Mandatory Renewable Energy Target.

The *innovation economy* scenario explored the impact of growth in R&D in line with the government’s aspirations to increase levels of business R&D and innovation in Australia. The scenario assumed that R&D expenditure as a proportion of GDP would rise to 2.5 per cent by 2020, with business delivering the majority of the increase.

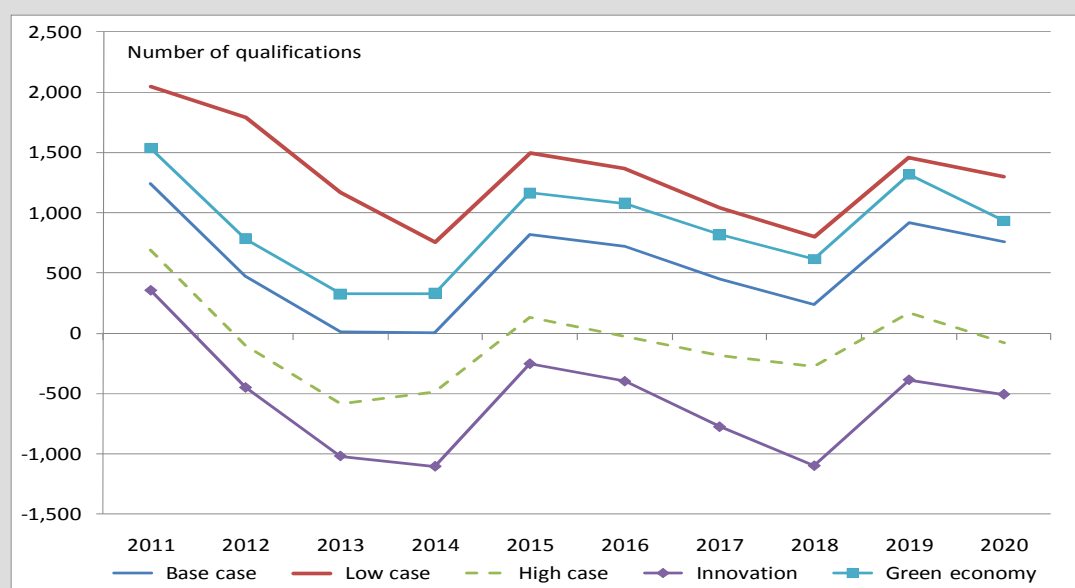
For the *base* and *innovation economy* scenarios, the report also explored the impact of meeting the *government’s target for 40 per cent of 25–34-year-olds to hold a bachelor degree or above by 2025* on both supply of research skills through the research training system and demand for new staff to teach expanded numbers of students.

The report found that for the *high-growth* and *innovation economy* scenarios, demand for HDR-qualified individuals will outstrip supply for some (high-growth scenario) or almost all (innovation scenario) of the period to 2020 (see **Figure 2** below).

If growth in attainments at a bachelor degree or above rises to meet government targets, the report found that the gap between supply and demand will be even more pronounced over the period 2011 to 2018 in the *innovation economy* scenario, while for the base scenario excess supply will be reduced over much of the forecast period, with a net shortfall in supply over 2012 to 2014 and in 2018.

The scenarios explored in the report are based on supply projections which see a continuation of strong growth in HDR completions over the next decade. It is important to note that the fixed pool of funding available through the RTS (see also **Box 2**) implies that an expansion in RTS support is likely to be required in the future if Australia is to maintain current levels of RTS funding per HDR student (and by extension maintain the quality of research training).

Figure 2: Projected supply less demand for postgraduate research qualifications



Source: Access Economics, *Australia’s Future Research Workforce: Supply, Demand and Influence Factors. Report to the Department of Innovation, Industry, Science and Research* (2010), p.7.

3 Employer demand for researchers

3.1 Characterising employer demand for researchers

3.11 Employer demand for researchers can be characterised in several ways:

- the market ‘pull’ for individuals to undertake research within the workplace;
- the skills and qualifications sought by employers, including HDR qualifications, but also generic, job-relevant and life skills; and
- the value placed by employers on researchers and research-qualified individuals, as reflected in remuneration and other employment conditions.

3.12 All these factors are critical influences on Australia’s research workforce, driving demand from students for qualifications, strategies adopted by employers to access skills, and the design of research training programs by universities. They represent a core area of focus in the development of the research workforce strategy.

3.2 Keeping pace with the changing nature of employer demand

3.21 Challenges for Australia

3.211 The changing nature of demand for researchers presents Australia with a number of challenges in future years, broadly grouped into three areas: the increasing *scale* of demand; the shifting *scope* of demand; and changes in the *nature* of demand. These areas are addressed below.

3.212 With respect to the *scale* of demand, a key challenge is to maintain the steady growth in researcher employment that has been achieved over the last decade (see **Figure 3**) in line with strong R&D expenditure growth across the Australian economy (most prominent in the business sector). As outlined in **Section 2**, this will be particularly important if Australia is to meet government aspirations to increase the number of businesses investing in R&D, lift current levels of business innovation and increase the number of research groups performing at world class levels over the next decade.¹²

3.213 A further challenge for Australia will be to address high levels of replacement demand (demand due to retirement) for research-qualified workers. This issue is particularly imminent and pertinent for the university sector, with many academic staff due to retire over the next decade.¹³ It can also be expected to produce significant pressures in some individual research disciplines, where a limited domestic pool of suitably trained workers and competition from

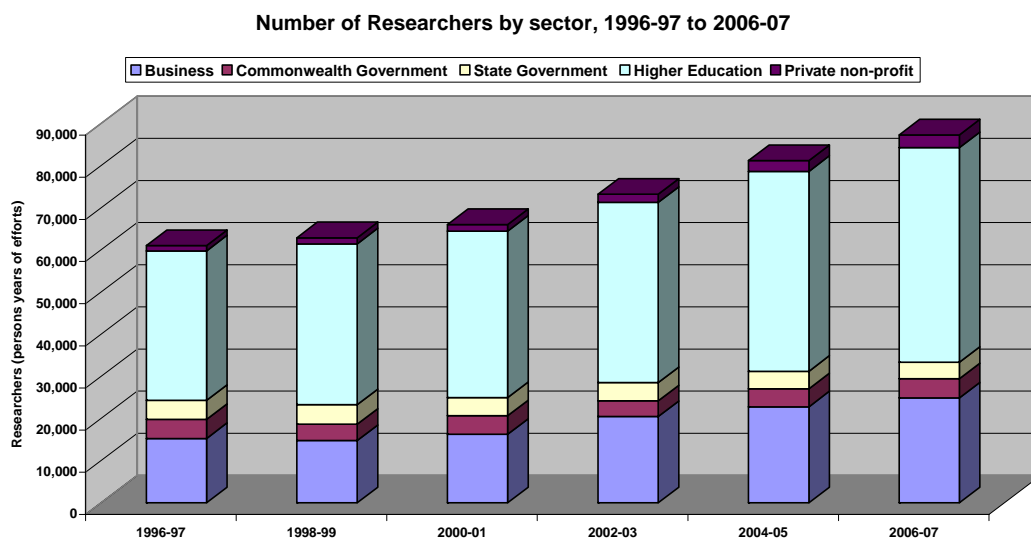
¹² Australian Government, *Powering Ideas: An Innovation Agenda for the 21st Century* (Canberra: Commonwealth of Australia, 2009).

¹³ Australian Council for Educational Research, *Supply, Demand And Characteristics of the Higher Degree by Research Population in Australia* (2009); Hugo, G., *The Demographic Outlook for Australian Universities’ Academic Staff*, CHASS Occasional Paper No. 6 (Adelaide: Council for Humanities, Arts and Social Sciences, 2008). Access Economics, *Australia’s Future Research Workforce: Supply, Demand and Influence Factors. Report to the Department of Innovation, Industry, Science and Research* (2010).

international employers may act to constrain workforce supply channels (discussed further in **Section 4**).¹⁴

3.214 Changes in the *scope* of demand, in response to shifts in the focus of R&D activity in different parts of the economy, also present challenges. While Australia’s R&D profile is constantly evolving, external drivers, such as the need for improved environmental management, climate change mitigation and improvements to health science and practice, can be expected to see further redistribution of resources and activity in future years.¹⁵ The specialised nature of many research areas is such that simply maintaining aggregate output of research skills will not necessarily be sufficient to meet this demand.

Figure 3: Growth trends in researchers by sector



Source: DIISR Analysis based on ABS, *Research and Experimental Development, All Sector Summary*, Cat. No. 8112.0, various issues.

3.215 Finally, ongoing changes in the *nature* of the researcher employment market in Australia – in particular, the *modes* of researcher engagement and *skills required* by employers – can be expected to continue to present challenges to both employers and researchers alike over the next decade.

3.216 In terms of *modes of employment*, the research workforce, like the wider workforce, is showing signs of increasing casualisation.¹⁶ This trend appears to stem from strategic decisions on the part of employers in the face of a number of factors, including affordability, need and flexibility.¹⁷ While such decisions and arrangements are not necessarily in themselves a cause for concern, the challenge for Australia lies in ensuring that they do not come at the expense of a

¹⁴ Allen Consulting Group, *Employer Demand for Researchers in Australia. Report to the Department of Innovation, Industry, Science and Research* (2010).

¹⁵ Access Economics, *Australia’s Future Research Workforce: Supply, Demand and Influence Factors. Report to the Department of Innovation, Industry, Science and Research* (2010).

¹⁶ See Coates, H. *et al.*, *The Attractiveness of the Academic Profession: A Comparative Analysis. Research Briefing* (2009). Available at: http://works.bepress.com/hamish_coates/46.

¹⁷ Allen Consulting Group, *Employer Demand for Researchers in Australia. Report to the Department of Innovation, Industry, Science and Research* (2010).

focus on the development of employees, including opportunities for career progression, or diminish the attractiveness of research careers in Australia (discussed further in **Section 5**).

3.217 With respect to *skill requirements*, a challenge for Australian researcher employers is to improve the broad employability skills of research staff, such as the core generic skills of communication, planning and organising and teamwork and preparedness for collaborative and interdisciplinary research,^{18,19} while building competencies in areas that can serve their individual organisational needs, such as global horizon scanning for research and technology developments. A further and related challenge is to expand the channels through which these skills needs are communicated and ultimately accessed. Information garnered through the research strategy development process suggests that these channels are not as well developed as might be desired, particularly in relation to potentially the most critical connection – that between researcher employers and research training providers.²⁰

3.22 Areas of opportunity for Australia

3.221 Australia can improve its capacity to respond to the changing nature of employer demand by focusing on workforce *planning and development*, and facilitating employer *access to research skills*.

3.222 Over the short term, the greatest benefits are likely to be achieved through efforts to strengthen existing workforce renewal strategies. To complement such action, removal of existing impediments to employers' access to researchers (whether trained domestically or internationally) and to their engagement will also be highly desirable.

3.223 In addition to the short term actions, over the medium to long term, significant positive steps can be made to promote and disseminate information about research employment needs and opportunities, both within Australia and internationally.

Workforce planning and development

3.224 Research workforce planning and development has the potential to deliver the greatest dividends to Australia if approached coherently across national, professional and organisational levels.

3.225 At a *national* level, Australia can take steps to improve the rigour and frequency of data collection and reporting on characteristics of its research

¹⁸ Allen Consulting Group, *Employer Demand for Researchers in Australia. Report to the Department of Innovation, Industry, Science and Research* (2010).

See also Australian Industry Group and Deloitte, *Skilling for Innovation, Report of a National CEO Survey* (2008).

¹⁹ Western *et al.*, *PhD Graduates 5 to 7 Years Out: Employment Outcomes, Job Attributes and the Quality of Research Training*, (2007).

²⁰ Allen Consulting Group, *Employer Demand for Researchers in Australia. Report to the Department of Innovation, Industry, Science and Research* (2010).

workforce, along with its foresight capability. In particular, a focus on improving the granularity of existing data (along with greater comparability of different data sets) to allow improved identification of HDR skills and more robust definition of research roles has the potential to enhance decision-making processes at all levels.²¹ Such activity is likely to have maximum impact if embedded within the wider framework of workforce planning currently under way within Skills Australia and undertaken as part of a holistic review of the data.²²

3.226 At *professional* and *organisational* levels, the most immediate benefits stand to be gained through a dual focus on succession planning and talent management strategies.²³ While examples of good practice in both these areas are widespread, information gathered through the research workforce strategy development process suggests that there is still considerable scope for improvement in future years. In particular, the diagnosis of critical and vulnerable skills at all levels of research activity within organisations (from senior management to support staff) could be strengthened, and more closely targeted progression and retention strategies for staff (including dedicated technical and support staff) could be implemented.²⁴

Facilitation of access to researchers and their employment in Australia

3.227 Australia can best enhance access to researchers and facilitate their entry into or movement within the Australian labour market at two levels: *national* and *organisational*.

3.228 At a *national* level, the most productive area of focus for Australia is to address existing impediments (in policy or practice) for researcher employers to access global talent. Feedback received from employers engaged in the research workforce strategy development process suggests that action to streamline visa categories and expedite processing times would be a positive first step in this direction.²⁵

3.229 At an *organisational* level, in addition to more active and targeted recruitment strategies (discussed below), positive improvements can be made through action to enhance flexibility and the use of skills within the workplace. In particular, strategies to up-skill existing staff and to develop flexible working conditions to

²¹ Issues with existing data include limited capacity to disaggregate HDR qualifications; lack of clarity in the definition of and detailed information on technical and other support staff; and difficulties in aligning classification codes to enable robust matching of research skills supply and research activity data.

²² Skills Australia, *Australian Workforce Futures: A National Workforce Development Strategy* (2010).

²³ Higher Education Funding Council for England, *The Higher Education Workforce Framework 2010: Main Report* (2010).

²⁴ The role and needs of technical research staff in the R&D operations of organisations has been explored by Dr Phillip Toner *et al.* as part of a recent report for DEEWR, *The Role and Contribution of Tradespeople and Technicians in Australian Research & Development- An Initial Study* (2010, unpublished) Among the study's findings were the existence of current and prospective trades and technician labour shortages and a need to better define career paths for technical research staff and expand the opportunities available to both of them.

²⁵ Allen Consulting Group, *Employer Demand for Researchers in Australia. Report to the Department of Innovation, Industry, Science and Research* (2010).

retain personnel whose contributions might otherwise be lost will be highly desirable (for example, staff with family responsibilities, retired staff wishing to maintain some research activity, casual staff with the potential to make more substantial contributions to the organisation etc).

3.230 At the same time, strategies to harness the contributions of currently under-represented groups within organisations, such as Indigenous researchers, have the potential to not only assist in meeting significant anticipated demand but also more broadly in enriching the stock of knowledge produced by Australia's research workforce. Achieving traction in this area will require leadership at the very highest level within organisations and ongoing efforts at all stages of the educational pipeline (discussed further in **Section 4**).

Dissemination and promotion of research employment needs and opportunities

3.231 The increasing mobility of the research workforce (both national and global) necessitates ongoing focus on the effective dissemination of research employment needs and marketing of opportunities within Australia and internationally.²⁶

3.232 While many institutions are already active in their international promotion activities (particularly in the university sector) and initiatives such as the *Australian Researchers' Mobility Portal* offer valuable resources to researchers contemplating a move to or from Australia, there is also some scope for improvement in key areas.²⁷ In particular, the largely untapped potential of Australia's research diaspora could be better recognised and used at both national and institutional levels.²⁸ Existing international practice, which uses the diaspora to facilitate exchanges, communicate job and research opportunities in the home country and share experiences of researchers, may serve as a useful model for this purpose.²⁹

3.233 Similarly, while there are examples of good practice with respect to disseminating and meeting employer requirements for research skills within Australia, there is also scope for greater effort in this area.³⁰ An extension of existing university HDR programs focused on the development of generic skills to a wider range of universities and expanded involvement of employer groups in the development of program content can be expected to support improved employer communication of and access to core, job-ready skills in the future. Collaborative research training arrangements between universities and

²⁶ Hugo, G., *Issues and Options for Enhancing the International Mobility of Researchers: An Australian Perspective*, Paper prepared for OECD Committee for Scientific and Technological Policy and Steering and Funding of Research Institutions workshop on the International Mobility of Researchers, IEA, Paris, 28 March 2007.

²⁷ At www.mobility.org.au. In addition, the government's recently announced *My University* website will be a valuable addition to existing resources.

²⁸ OECD, *The Global Competition for Talent: Mobility of the Highly Skilled* (Paris: OECD, 2008).

²⁹ See the Austrian Office of Science and Technology's *Scientist Network* at www.ostina.org/scientists/ost-scientist-network.

³⁰ See the Australian Technology Network Learning Employment Aptitudes Program at www.atn.edu.au/students/LEAP.htm and other university initiatives to meet the broader (non-academic) skill requirements of employers.

employers that target the changing needs of individual industry sectors and occupations could usefully complement such activity by building competencies and interdisciplinary capabilities in areas of mutual university and national or industry-specific strength and priority (discussed further in **Section 4**).

Questions for consultation:

Q1: Do the issues identified adequately capture the challenges facing Australia in adapting to the changing nature of employer demand and meeting its innovation aspirations over the next decade? If not, what other challenges should be considered?

Q2: Do the issues identified adequately capture the opportunities available to Australia to better respond to the changing nature of employer demand in Australia and meet national innovation aspirations? If not, what other opportunities should be considered?

4 Supply of researchers to Australia

4.1 Characteristics of research workforce supply

4.11 The supply of research workers is best measured by the skills of individuals.

While the possession of skills does not guarantee active engagement in research (as discussed in **Section 2**), this measure does give a sense of the annual influx of potential researchers to the workforce.

4.12 Based on this definition, Australia's research workforce supply comes from three main sources:

- domestic student HDR completions in Australia;
- international HDR students completing and subsequently staying on in Australia; and
- migration of research-qualified individuals.

Within this mix, domestic student completions dominate, with international sources (student completions and other means of migration) representing a smaller but still significant proportion of potential researcher supply to Australia.³¹

4.13 To meet employer demand for researchers and maintain the competitiveness of Australia's research workforce, supply from each of these sources needs to meet required levels of *quantity* and *quality*. With respect to *quantity*, the challenge is to produce the breadth and scale of skills required by the workforce in the short, medium and longer terms. With respect to *quality*, the challenge is to develop the diverse disciplinary, interdisciplinary and generic skills increasingly required by researchers as they progress their careers not just in academia but in business, government policy-making and other roles in society. A further challenge is to continue to build and maintain the world-class status of Australian research training programs.

4.2 Meeting Australia's research workforce supply needs - quantity

4.21 Challenges for Australia – quantity

4.211 While recent trends in supply to Australia's research workforce have on the whole been very positive, Australia faces a number of challenges in continuing to deliver skills at levels that keep pace with employer demand into the future.

4.212 Demand for individuals with research qualifications is predicted to grow more strongly than overall employment demand over the next decade, driven by employment growth, retirements and skills deepening (the propensity of workers to hold a HDR qualification) across the Australian economy.³² As outlined in

³¹ Australian Council for Educational Research, *Supply, Demand and Characteristics of the Higher Degree by Research Population in Australia. Report to the Department of Innovation, Industry, Science and Research* (2009).

³² Access Economics, *Australia's Future Research Workforce: Supply, Demand and Influence Factors. Report to the Department of Innovation, Industry, Science and Research* (2010).

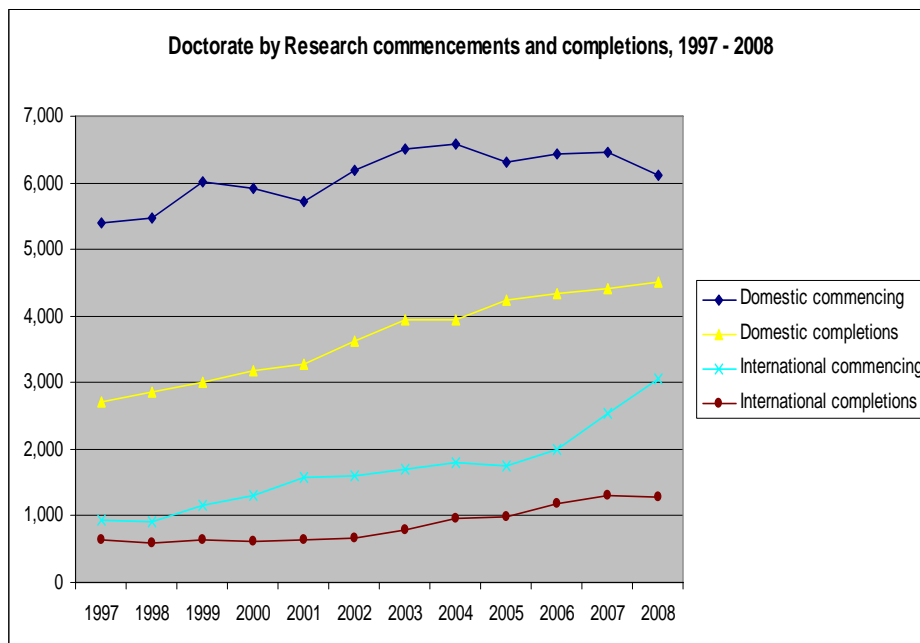
Section 2, it can also be expected to be influenced strongly by government policies and reforms, such as recently announced targets for educational attainment at the bachelor degree level or above by 2025,³³ and an expansion of R&D activity across the economy in line with the government’s aspirations for increased business R&D investment.³⁴

4.213 To meet these pressures Australia will need to continue to expand its output of both domestic and international HDR graduates and maintain a steady supply of HDR-qualified workers to its economy through migration.

4.214 Although completions of both domestic and international students have grown steadily in recent years and annual intake of HDR-qualified individuals through migration has been strong, there are some indicators that significant effort will be required over the next decade to achieve these outcomes.

4.215 In particular, while there has been strong growth in both domestic and international completions of the *doctorate by research* qualification in recent years, a plateau in domestic commencements since 2003-2004 (see **Figure 4** below) suggests that this trend is not set to continue into the future. Similarly, a steady decline in domestic commencements and completions of the *masters by research* qualification and their stagnant or very weak growth for international students implies that qualifications at this level will continue to fall in future years.

Figure 4: Doctorate by Research commencements and completions



Source: DIISR analysis of DEEWR University Statistics – published and unpublished data
 Note: International commencements may ultimately be reflected as domestic completions due to conversions to permanent residency of the course of student studies.

³³ Australian Government, *Transforming Australia’s Higher Education System* (Canberra: Commonwealth of Australia, 2009).

³⁴ Australian Government, *Powering Ideas: An Innovation Agenda for the 21st Century* (Canberra: Commonwealth of Australia, 2009).

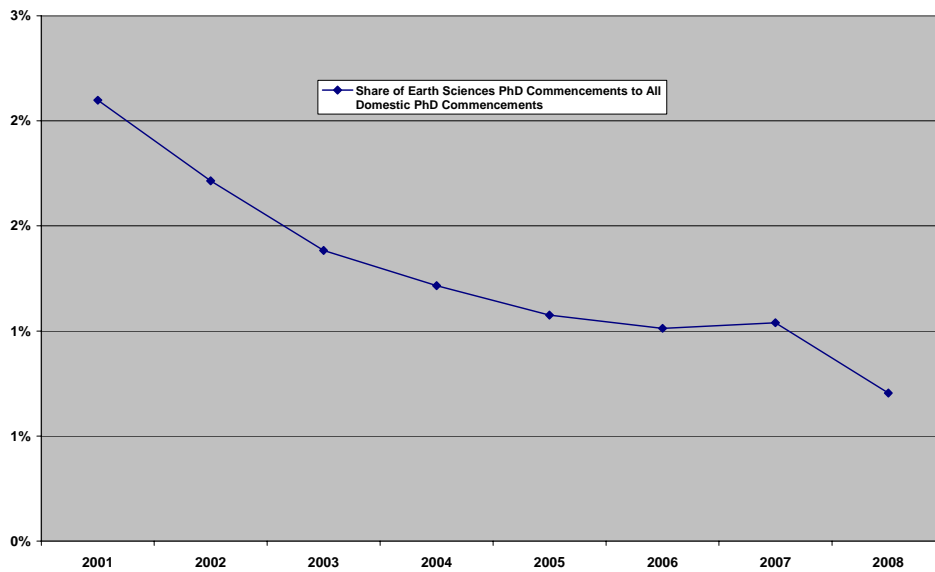
- 4.216 Furthermore, while the strong growth in international HDR student commencements and completions in recent years is accompanied by positive indications that this is translating to significant workforce supply (around 40 per cent of international HDR students who complete their degrees convert to permanent residency),³⁵ the increasingly competitive global market for students and researchers and the vulnerability of Australia's intake to changing economic conditions in source countries mean that this performance can not be taken for granted in the future.
- 4.217 Finally, in addition to challenges associated with strengthening aggregate growth in HDR commencements and completions, Australia faces specific challenges in some disciplines and equity groups.
- 4.218 Critical enabling sciences and core disciplines such as earth sciences, in particular, have experienced a net decline in domestic numbers and loss in their share of overall domestic HDR students in recent years (see **Figure 5**), driven by a combination of highly remunerated employment opportunities for students elsewhere and a declining pool of eligible candidates from earlier stages of the education pipeline.
- 4.219 Moreover, an ongoing challenge exists in raising the participation in research training and attainment of HDR qualifications of key equity groups. In spite of strong growth in Indigenous doctorate by research candidates as a share of all candidates, Indigenous student representation remains well below the implicit population share of 2.5 per cent (see **Box 4**). Addressing this issue is likely to be a medium- to long-term challenge for Australia given the persistence of significant Indigenous under-representation at school and undergraduate levels. It will be important to monitor the impact of government higher education equity targets in future years to ensure that any ensuing expansion of undergraduate enrolments translates to a corresponding increase in completing Indigenous students going on to study at the HDR level.

4.22 Areas of opportunity for Australia – quantity

- 4.221 Australia can best position itself to increase the supply of research skills in future years by implementing strengthened *attraction* and *retention* strategies.
- 4.222 Over the short-term, the significant lead time to produce research graduates necessitates a focus on *lowering attrition* from and *encouraging timely completion* of research degrees.
- 4.223 Over the medium to long term, Australia will need to focus its efforts on both *increasing the pool of students* commencing HDR training in Australia and *facilitating the transition of HDR-qualified individuals* into its research workforce.

³⁵ Australian Council for Educational Research, *Supply, Demand and Characteristics of the Higher Degree by Research Population in Australia. Report to the Department of Innovation, Industry, Science and Research* (2009); and Access Economics, *Australia's Future Research Workforce: Supply, Demand and Influence Factors. Report to the Department of Innovation, Industry, Science and Research* (2010).

Figure 5: Earth Sciences Percentage Share to All Domestic PhD Commencements, 2001-2008



Source: DEEWR University statistics, unpublished data.

Attrition and times to complete

4.224 While levels of attrition from research degrees have dropped in recent years to average around 17 per cent for domestic doctorates and around 15 per cent for international doctorate, current levels still represent a significant limiter to Australia's HDR output.³⁶ Similarly, although completion times now average around five years for domestic doctorates and four years for international doctorates (including both full-time and part-time students), a significant proportion of students are still exceeding the candidature support time available to them.³⁷

4.225 Not all factors contributing to these attrition rates and extended times to complete are amenable to intervention. Information garnered throughout the research workforce strategy development process suggests, however, that significant positive traction could be achieved by extending existing Commonwealth scholarship support times. In particular, extension of APA scholarships (currently limited to a maximum of three and a half years) to align with the maximum period of funding under the RTS (four years, full-time equivalent) could help reduce attrition and increase timely completion.³⁸

³⁶ DIISR internal analysis, drawing on DEEWR published and unpublished data. The definition of attrition used for this purpose is the DEEWR University Statistics definition.

³⁷ DIISR internal analysis, drawing on DEEWR published and unpublished data.

³⁸ There is some evidence to suggest that the majority of students changing their enrolment status over their degree may do so in the final years of candidature, i.e. when scholarships and other supporting resources are exhausted or near to exhaustion. See Pearson, M., Cumming, J., Evans, E., Macauley, P. and Ryland, K., "Exploring the Extent and Nature of the Diversity of the Doctorate Population in Australia: A Profile of the Respondents to a 2005 National Survey", in M. Kiley and G. Mullins (eds), *Eighth Quality in Postgraduate Research Conference: Research Education in the New Global*

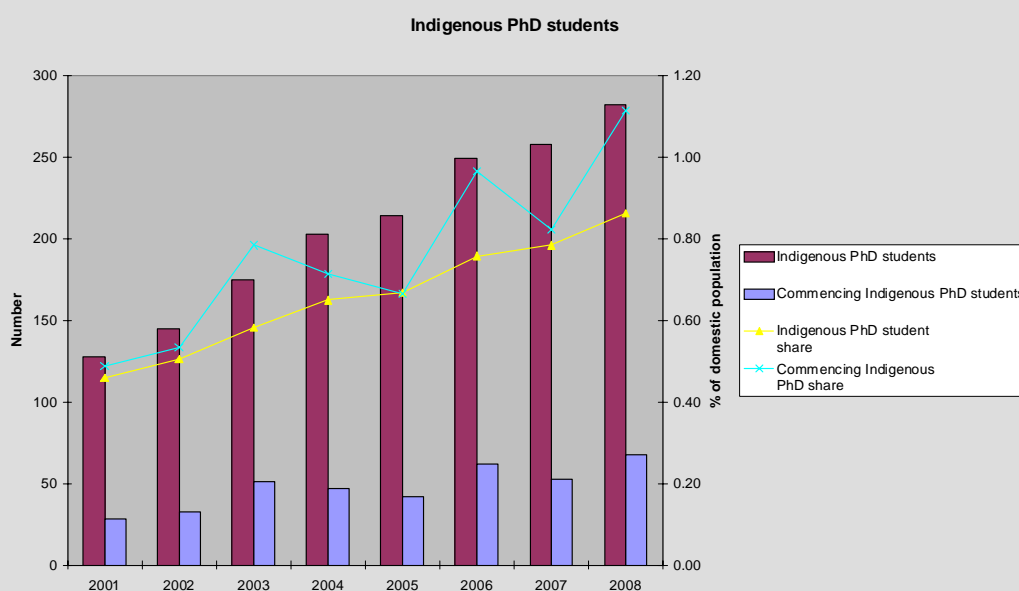
Box 4: Indigenous participation in research training

The 2006 Census post-enumeration survey estimated that Australia's Indigenous population was just over 513,000 out of a total resident population of 20.7 million. The Indigenous population represents 2.5 per cent of the total, suggesting that the Indigenous share of students undertaking research training should be close to 2.5 per cent on equity grounds.

The Indigenous proportion of domestic PhD candidates has grown strongly from 0.46 per cent in 2001 to 0.86 per cent in 2008, but is still well below the implicit population share of 2.5 per cent. Statistics for PhD commencements and completions also show solid growth from 2001 to 2008 (**Figure 6** below). Indigenous masters by research students have maintained or increased their share of domestic enrolments, commencements and completions over the same period.

Indigenous HDR enrolment patterns differ from those of other candidates, with Indigenous students being more likely to enrol in fields of education such as education, society and culture and creative arts than non-Indigenous students and being less likely to enrol in fields such as natural and physical sciences, engineering and related technologies and information technology.

Figure 6: Growth in Indigenous PhD commencements and enrolments, 2001-2008



Source: DEEWR higher education statistics, published and unpublished data.

Increasing the pool of students commencing HDR training

4.226 Positive progress in increasing the pool of students commencing HDR training is likely to be best achieved through a combination of *incentives for students* and *incentives for research training providers*.

4.227 With respect to *students*, the most immediate and viable opportunity is to expand current scholarship availability to meet strong demand from international students. Opening APAs to IPRS candidates would be a first positive step in this direction and additionally contribute to the broader objective

to facilitate access to research training by the best possible students, regardless of their origin.

- 4.228 A further area of future opportunity is for Australia to provide incentives for uptake of HDR training in areas of low demand but high priority and broad utility to Australia, such as the enabling sciences. While the diverse factors influencing student study decisions and their variation across individual discipline areas prohibit a uniform solution to this issue, there is potential to achieve some headway, over time, by giving universities increased flexibility to top-up APA scholarships in priority areas. Priorities for this purpose could be established at either national or institutional level, but the latter may best capture state or regional supply issues and support improved alignment of research training with institutional strengths and priorities.
- 4.229 With respect to *research training providers*, significant progress can be made by removing disincentives for universities to take on additional HDR students. In particular, an expansion of the fixed pool of funding available through the RTS and IPRS schemes would ease the pressure on universities to support additional students through unsustainable practices, such as cross-subsidising research training from funds dedicated to other purposes and reducing the resources made available per HDR student. The most immediate returns, given indicators of strong existing student demand, could be delivered by expanding the IPRS program. Over time (and as strategies to encourage greater domestic student uptake of HDR training have effect) an increase to the number of RTS places will also be desirable to ensure that any further expansion of research training does not compromise the quality of its provision.

Facilitating the transition of HDR-qualified individuals into the research workforce

- 4.230 Positive progress with respect to the transition of HDR-qualified individuals into the workforce (particularly HDR graduates) can best be achieved by focusing on *pathways*. While Australia has benefited greatly in recent years from a high proportion of international HDR students progressing their careers in Australia upon completion (as outlined in **Section 4.21**), in the future there is potential to improve the scale of this skill translation and its alignment with the needs of Australia's employment market through targeted institutional support programs that increase awareness of information and opportunities, develop connections between students and employers and provide job-ready skills (discussed also in **Section 3**). Work to progress some of these outcomes is already under way for the wider international student body as part of the Council of Australian Governments' International Student Strategy.³⁹

³⁹ See <http://aei.gov.au/AEI/GovernmentActivities/InternationalStudentsTaskforce/COAGStrategy.htm>.

4.3 Meeting Australia's research workforce supply needs – quality

4.31 Challenges for Australia – quality

4.311 While all available indicators suggest that both the *quality* of Australia's research training system and its intake of research-qualified individuals through migration are strong, looking ahead over the next decade it is also clear that there are some areas in which further effort will be required to maintain these high standards. Drivers include:

- the changing nature of demand for research skills;
- the changing circumstances of students and researchers and modes in which they engage with research activity; and
- global moves to streamline degree structures and enhance the rigour and relevance of research training.

These areas are addressed in turn below.

4.312 As outlined in **Section 3**, the nature of researcher employment and research activity in Australia has changed over the last decade, providing a new set of challenges to research training providers. Firstly, the multidisciplinary nature of contemporary research is necessitating more focus on the development of knowledge and experience that spans traditional discipline boundaries and prepares students to work effectively in diverse teams. Secondly, the many different roles (public sector and private sector) in which HDR graduates now deploy their skills require an increased focus on the development of both broad-based, generic skills (such as communication) and specific skills and knowledge that can aid subsequent employment (such as understanding of the commercialisation process). The three-year doctorate may not be well placed to support these additional demands without some modification.

4.313 The changing nature of its HDR student cohort also presents some challenges to Australia. The average age of HDR candidates in Australia has increased over the last decade, with a significant proportion of students now commencing their degrees in the 30-39 year age bracket and above.⁴⁰ These demographic changes are reflected in the changing circumstances under which students are approaching studies, with many students having family and financial responsibilities that require more flexible modes of engagement with their degree, such as part-time and external (off-campus) study. They also have implications for pathways into HDR study.

4.314 Finally, global moves to streamline and strengthen research training provision present challenges to Australia in the future. In particular, a shift across Europe towards the Bologna model of at least eight years' training for attainment of a doctorate (three- or four-year bachelor degree, two-year masters degree and three-year doctorate) places the doctoral pipeline in Australia at a cross-roads.⁴¹

⁴⁰ Access Economics, *Australia's Future Research Workforce: Supply, Demand and Influence Factors. Report to the Department of Innovation, Industry, Science and Research* (2010).

⁴¹ See Chambaz, J., "Reforming Doctoral Education in Europe – A Response to Global Challenges", in M. Kiley and G. Mullins (eds), *Eighth Quality in Postgraduate Research Conference: Research*

With seven years' nominal training for doctorates (three-year bachelor degree, one-year honours and three-year doctorate) and no dedicated time allocation for academic and professional competency building, Australia faces the prospect of a weakened capacity to compete with its European counterparts for candidates in future years. The marketability of its domestic doctoral graduates in the global research workforce may also be at risk.

4.32 Areas of opportunity for Australia – quality

4.321 Australia can best position itself to strengthen the quality of its research training programs and reinforce its position as a global research training provider of choice by refreshing the *flexibility, scope* and *focus* of its training provision.

4.322 Over the short term, Australia can remove considerable pressures on existing HDR students and thereby contribute to their improved productivity during candidature by *providing greater flexibility for part-time engagement* with HDR study. Such a move may also assist in attracting an expanded pool of candidates to HDR study.

4.323 Over the medium to long term, Australia can enhance the overall quality and relevance of its research training programs and their global marketability by *revitalising the structure of Australian research degrees and related support mechanisms* to place renewed focus on the depth and breadth of training provision and alignment with areas of institutional and national research strength and opportunity.

Providing greater flexibility for part-time engagement in HDR studies

4.324 Australia has an immediate opportunity to improve the productivity and retention of its HDR students by *removing current restrictions on part-time candidature* from scholarship guidelines. This would give institutions considerable autonomy to put in place practices that meet the demands of individual training programs, while at the same time allow students greater freedom to negotiate modes of HDR study that meet their own unique individual needs and circumstances.

Revitalising the structure of Australian research degrees

4.325 With respect to the more fundamental opportunity to rethink the *future of HDR degrees in Australia*, the most productive step forward would be for Australian universities to review (in conjunction with government, employer groups and professional bodies) the efficacy of Australia's doctoral pipeline and its capacity to meet future needs. The review could productively examine the flexibility within honours and doctoral programs to accommodate demand for strengthened competency development at both discipline-specific and generic levels, provide flexible entry pathways to students approaching research degrees at different

stages in their lives and careers, and support nimble deployment of research skills across the economy.

- 4.326 Following the outcomes of this review, and over the medium to long term, the implications of any proposed changes for the Australian Qualifications Framework and government support (such as through the Commonwealth Grant Scheme, student income support and the RTS) would need to be explored and addressed.

Revitalising research training support mechanisms

- 4.327 With respect to the future *revitalisation of research training support*, positive action can be taken in two areas: developing an improved understanding of and better practices to meet the *full costs of research training*; and developing improved incentives and support structures for *aligning research training provision with areas of institutional and national strength and priority*.
- 4.328 Australian universities will shortly have access to improved information on the costs of research through transparent costing conducted under the Sustainable Research Excellence in Universities Scheme. Considerable benefits for both government and universities can be achieved by extending such analytical work to research training.
- 4.329 In particular, existing cost differentials within the RTS funding formula for high- and low-cost fields of HDR study require re-examination in light of changes in both disciplinary practice and demands. Similarly, the nominal cost per RTS place will need to be reconsidered in light of new expectations of HDR candidates, including the development of a broader competency base in future years to meet changing demands of employers. The key concern for Australia must be to ensure that any expansion in the breadth and depth of training provision does not compromise quality in other areas (such as the standard of resources provided to support studies).
- 4.330 The availability of robust and detailed information relating to areas of research strength through Excellence in Research for Australia (ERA) also has the potential to contribute to improving the quality of Australia's research training outcomes in future years.
- 4.331 At one level, ERA will provide an opportunity for Australia to examine the alignment of its research training provision with areas of both institutional and national research strength and adjust existing incentives to deliver an improved return on public investment. Such examination can best be achieved as part of a comprehensive review of the RTS funding scheme, including examination of the cost of training as discussed above.
- 4.332 At another level, if used in conjunction with strategies to enable greater flexibility in the joint provision of research degrees between institutions, ERA can assist in promoting research training collaborations between universities around complementary skills and resources. In their simplest form, and over the short term, such collaborations might amount to a joint HDR award between two

institutions (joint degrees are currently awarded but not acknowledged in research training funding formulae). Over the longer term, collaborations might extend to the development of national HDR programs in individual disciplines or multidisciplinary areas where research programs are already well established and Australia has the capacity to enhance its global standing but multidisciplinary training is limited or not available.

Questions for consultation:

Q3: Do the issues identified adequately capture the challenges facing Australia in delivering required levels of research skills to its workforce over the next decade? If not, what other challenges should be considered?

Q4: Do the issues identified adequately capture the opportunities available to Australia to enhance its supply of research skills over the next decade? If not, what other opportunities should be considered?

5 Research career pathways

5.1 Drivers of research career pathways

5.11 The career pathways open to, and experienced by Australia's researchers, define our capacity to recruit talent to our research workforce and retain and develop the individuals within it. Some considerations include:

- *Visibility* – the awareness among students and the wider community of research career options and opportunities.
- *Attractiveness* – the employment conditions and opportunities associated with a research career in Australia.
- *Flexibility* – the openness of our research workforce to transitions between Australia and other countries, between sectors and institutions within Australia, and into and out of the workforce.
- *Support structures* – the extent and effectiveness of support available to researchers to consolidate and progress their research careers.

5.12 The diversity of research careers in Australia prohibits a one-size-fits-all approach to these issues, but their powerful influence on decisions to undertake research careers and attrition from them makes it important to identify pressure points and tailor strategies to address them.

5.2 Promoting research careers in Australia

5.21 Challenges for Australia

5.211 Although Australia has been successful in promoting research careers to both students and established researchers, in looking to the future it is clear that there are some areas in need of improvement. In particular, a *decline in the perceived attractiveness of research*, the apparent *low visibility* of research career paths, and *policies and actions in other countries to internationalise their research workforces*, may limit supply to and encourage attrition from our research workforce.

5.212 Within the university research sector, the primary employment option for researchers in Australia, a recent study has reported a decline in the attractiveness of Australian academic employment compared to other countries on a number of measures, including job satisfaction, workload and some aspects of environmental support.⁴² These perceptions are complemented by concerns that the short-term, project-based nature of many research positions and the need to juggle other responsibilities, such as heavy teaching loads and family needs, make the establishment of a research career and progression to more stable leadership roles a significant challenge for many researchers in Australia.⁴³

⁴² Coates, H. *et al.*, *The Attractiveness of the Academic Profession: A Comparative Analysis*. Research Briefing (2009). Available at: http://works.bepress.com/hamish_coates/46.

⁴³ Feedback provided by researchers during consultations undertaken by DIISR over 2009-10.

- 5.213 While the attractiveness of research careers outside of academia is more difficult to establish, a widespread lack of awareness of available opportunities and options is evident. In particular, consultations conducted for the research workforce strategy suggest that the concept of a research career is weakly defined in Australia, with the information bases, support structures and championing offered within many other professions perceived as limited or lacking for researchers as a group.
- 5.214 Finally, an increasingly competitive global market for researchers, coupled with high researcher mobility (see **Section 5.3** below), is placing increased pressure on Australian research employers to adopt more targeted marketing strategies, expand employment incentives and expedite recruitment timeframes to avoid loss of potential research personnel.⁴⁴ The rise of China and India, along with other emerging economies, as significant global research competitors can be expected to increase these pressures in future years.⁴⁵

5.22 Areas of opportunity for Australia

- 5.221 Australia can enhance its promotion of research careers in future years by focusing on *improving awareness of the diversity of research career options* in Australia.
- 5.222 Over the short term, Australia can take steps to *improve information on research careers*, and communicate potential pathways and support options more effectively to both prospective and existing researchers.
- 5.223 Over the medium to long term, and building on this action, effort will most productively be directed at *strengthening the definition of career pathways* and *improving support structures* at both national and institutional levels (discussed in **Section 5.4**).

Improving the information base

- 5.224 Information failures in relation to research career paths and opportunities are exacerbated by weak definition of research qualifications in data collections (discussed in **Section 3**). Another contributing factor is the very limited longitudinal data available to assist in mapping career experiences at a national level and communicating both the diversity of roles available and the contribution of research training to positive career outcomes.
- 5.225 Australia can take immediate steps to address this gap and lay the foundations for long-term planning with respect to its research workforce by initiating a national longitudinal study of HDR graduates. For maximum utility and rigour, such a study would capture individuals in the final years of HDR training and

⁴⁴ Dowds, N., 2010, *International experiences of human resource management in higher education: A report for the Higher Education Funding Council of England*, February 2010; Allen Consulting Group, *Employer Demand for Researchers in Australia. Report to the Department of Innovation, Industry, Science and Research* (2010).

⁴⁵ Prime Minister's Science, Engineering and Industry Council (PMSEIC), 2006, *Strengthening Australia's Position in the New World Order*, Working Group on Asia Report to PMSEIC, June 2006

follow career outcomes at two-to-three-year intervals for at least the ten-year timeframe of the research workforce strategy. Complementary action to communicate the results of the study at regular intervals to students, researchers, employers and the wider community would also be highly desirable, with international approaches offering some potential models for consideration in this context.⁴⁶

5.3 Encouraging mobility

5.31 Challenges for Australia

5.311 Available indicators suggest that Australia's research workforce (like that of other countries) is highly mobile, with research careers in many cases spanning national (and in some cases sectoral) boundaries and multiple organisations of employment.⁴⁷

5.312 There is also evidence to support strong positive returns to Australia arising from this mobility. Benefits include the circulation of tacit knowledge; access to skills, infrastructure and other resources which are unavailable or insufficiently advanced domestically; strengthened links between countries, often targeted to areas of complementary strength and priority; and the development of individual networks that can contribute to research performance long after direct physical engagement ends. The last of these benefits is particularly pertinent to Australia's aspiration to increase the number of research groups performing at world-class levels, with some evidence to indicate that international experience may contribute to higher citation rates.⁴⁸

5.313 In spite of these benefits and positive existing activity, however, Australian researchers cite challenges in maintaining desired levels of mobility both within Australia and internationally. Challenges fall into two areas: *disincentives to transitions between sectors and into or out of the research workforce in Australia*, and *barriers to international mobility*, particularly in relation to shorter-term visits or longer-term work placements which provide a clearly defined pathway back to Australia.⁴⁹ These challenges are discussed below.

5.314 With respect to *disincentives to workforce transitions*, a frequently cited obstacle to transition out of the academic workforce (whether for a temporary period of unemployment or movement to another sector) is publishing track record – a key factor for researchers in keeping pace with research activity in their chosen field and maintaining required levels of output to compete for

⁴⁶ See the work of the Vitae group in the United Kingdom: www.vitae.ac.uk/researchers/1270/Careers.html

⁴⁷ Hugo, G., *Issues and Options for Enhancing the International Mobility of Researchers: An Australian Perspective*, Paper prepared for OECD Committee for Scientific and Technological Policy and Steering and Funding of Research Institutions workshop on the International Mobility of Researchers, IEA, Paris, 28 March 2007.

⁴⁸ OECD, *The Global Competition for Talent: Mobility of the Highly Skilled* (Paris: OECD, 2008).

⁴⁹ Mobility is also being examined as part of a House of Representatives Standing Committee on Industry, Science and Innovation inquiry into Australia's international research collaboration. See www.aph.gov.au/house/committee/isi/intresearch/index.htm.

grants and career progression opportunities.⁵⁰ More broadly, a lack of portability of superannuation arrangements and prohibitive pay differentials are perceived to encourage unidirectional rather than more fluid transitions between areas of research employment, such as between academia and the business enterprise sector.⁵¹

5.315 With respect to *international mobility*, while many fellowship schemes actively encourage inward flows of researchers to Australia, researchers report less support for movement out of Australia, particularly at the critical formative stages of a research career.⁵² This is a complex issue for Australia given the capacity of support to contribute to brain drain; however, the benefits stemming from connections built through periods of mobility may outweigh any loss through researchers ultimately furthering careers elsewhere.

5.32 Areas of opportunity for Australia

5.321 Australia has the capacity to better facilitate mobility in its research workforce and secure associated dividends for Australia in future years by *addressing impediments* to mobility and *strengthening associated support* frameworks.

5.322 Over the short term, Australia can take immediate steps to examine and address the *impact of career breaks* on the progression of researchers.

5.323 Over the medium to long term, dividends can be achieved by *extending and improving mobility support mechanisms* for Australian researchers.

Addressing the impact of career breaks

5.324 While existing policy and practice at both national and institutional levels promote the assessment of candidates on the basis of relative opportunity, feedback provided over the course of the research workforce strategy development process suggests that there is scope for more targeted effort in this area. In particular, a review of the impact of career breaks and transitions on determinants of career progression, such as attainment of research grants and fellowship awards, would assist in identifying any persistent impediments in current systems and appropriate actions to address them.

Improving mobility support mechanisms

5.325 While Australia has taken very positive steps in recent years to open many of its research fellowship schemes to international talent, there is potential to complement this action in future years by developing support schemes that incorporate some international or multi-sectoral experience and facilitate the transition of returning researchers to Australia's research workforce.

⁵⁰ Feedback provided by researchers and employers through research workforce strategy consultation and analysis activities.

⁵¹ Ibid

⁵² Ibid. See also submissions to the House of Representatives Standing Committee on Industry, Science and Innovation Inquiry into Australia's international research collaboration at www.aph.gov.au/house/committee/isi/intresearch/subs.htm.

- 5.326 Although such international boomerang schemes are already available to individual groups, such as health and medical researchers or researchers of prestigious merit, Australia might consider the benefits of extending opportunities to a wider researcher base and across the different stages of research careers.⁵³
- 5.327 Australia might also consider the merits of increased focus on the reintegration of recently mobile researchers into its research workforce. While many schemes exist in individual institutions (often targeted at women) to support return to work after an employment break, less focus is currently directed at facilitating re-entry of other groups, such as researchers spending a period of time in the business or government sectors. Targeted programs, along the lines of the Marie Curie European Reintegration Grants, may assist in filling this gap, reducing disincentives to mobility between sectors and reclaiming Australia's research diaspora.⁵⁴

5.4 Supporting career progression

5.41 Challenges for Australia

- 5.411 While researcher mobility brings many positive benefits to Australia, it can also negatively impact on our research capability if not positively motivated and appropriately monitored and managed. In particular, attrition from research careers due to inflexible, inadequate or poorly targeted support structures benefits no one and represents a missed opportunity for Australian researchers, employers and the country as a whole.
- 5.412 Australia faces a number of challenges with respect to research careers in future years, broadly grouped into the areas of *opportunity* and *practice*.
- 5.413 From an *opportunity* perspective, although the outlook for researcher employment in Australia appears positive, with many positions likely to open up in future years in response to anticipated age-related retirements (discussed in **Section 3**), inequities in the progression of men and women to senior roles persist, suggesting that Australia is wasting considerable potential within its research workforce.
- 5.414 In the university sector (for which data is most readily available), representation of women and men has reached parity up to Academic Level B (see **Figure 7**), but there is still very low representation at the most senior levels. This underrepresentation is particularly pronounced in key scientific disciplines, such as engineering and information technology and is complemented by underrepresentation in senior fellowship awards and membership of relevant learned societies.⁵⁵ It is also evident for other equity groups, with Indigenous

⁵³ See the NHMRC C.J. Martin Fellowship scheme for early-career biomedical researchers.

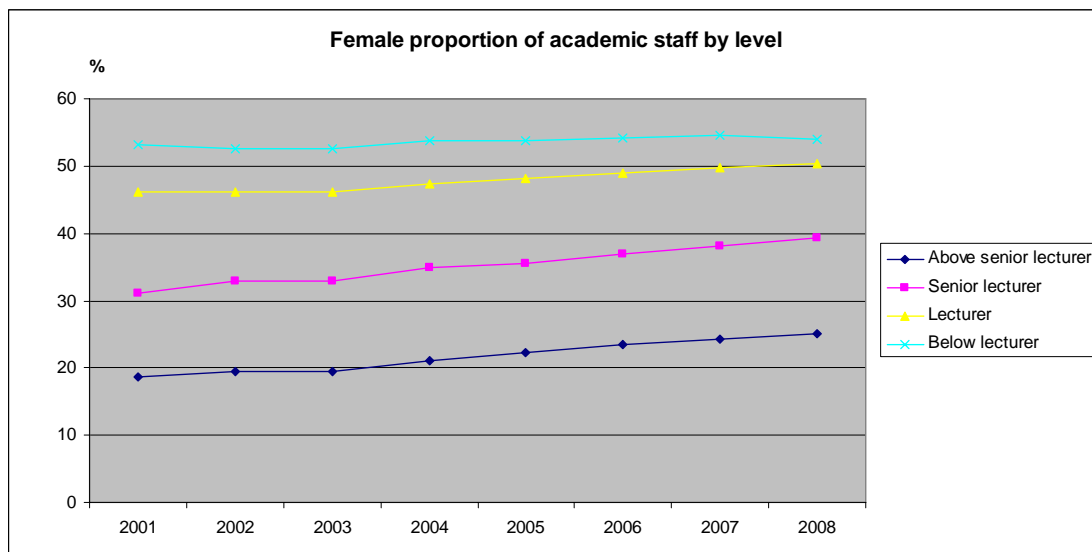
⁵⁴ See http://cordis.europa.eu/fp7/mariecurieactions/erg_en.html.

⁵⁵ Bell, S., *Women in Science and Technology in Australia: Maximising Productivity, Diversity and Innovation* (Canberra: Federation of Australian Scientific and Technological Societies, 2009).

employment in the higher education sector still significantly below that required to achieve population parity.

5.415 At an *operational* level, researchers consulted as part of the research workforce strategy development process highlighted the difficulties associated with transitioning between the different stages of an academic career, particularly the critical steps from development roles to independent researcher and (ultimately) research leader. While fellowship and other support programs were acknowledged and valued, areas of perceived weakness include:

- Poor articulation of the support opportunities available to researchers and the relationship between them.
- A mismatch between career development timeframes and needs and funding availability and focus.
- Insufficient or patchy focus on career planning and professional development that can directly further career objectives.
- Poor recognition of and support for suitable exit routes, such as transitions into non-academic research or non-research roles.
- Insufficient acknowledgement of and support to meet family responsibilities while managing a research career in some workplaces.



Source: DEEWR University statistics, unpublished data.

5.42 Areas of opportunity for Australia

5.421 Australia has the capacity to better harness the potential of its research workforce in future years by implementing more *targeted and tailored professional development support* for its researchers and strengthening its focus on *leadership* at all levels.

5.422 Over the short term, the most useful thing Australia can do is strengthen strategies to support researchers at critical stages of their research career, such as the transition from HDR student to researcher and from support role to

independent researcher status. It can also develop more seamless pathways between streams of activity, such as between teaching and research, and between administrative or technical roles and core research employment.

5.423 Over the medium to long term, Australia can give its research workforce more stability and security by improving the balance between short-term, project-based support for researchers and longer-term development opportunities.

Supporting stages of and transitions within research careers

5.424 Australia has an immediate opportunity to facilitate the career decisions and transitions of its research workforce through *action to streamline the communication of policies and support programs*. Feedback received from researchers over the course of the research workforce strategy development process highlights a weak understanding of both the breadth of opportunities available, their relationship to one another and their place in research career ladders. A national mapping of government programs and initiatives (Commonwealth, State and Territory), building on work currently under way within DIISR (see **Appendix B**), would go some way to addressing this issue if regularly monitored and updated to ensure the currency of the information.

5.425 Australia can also take positive action to better support the individual needs and career objectives of its research workforce by improving people management strategies. In particular, an extension of existing mentoring programs to a wider user base (including targeting programs for groups such as women) and a stronger focus on talent ladders for research leaders (whether within disciplines, institutions or industries) are highly desirable. For optimum impact, such actions would ideally be constructed to align with wider institutional workforce renewal strategies (see **Section 3**), particularly in the area of succession planning.

Enhancing career stability

5.426 While Australia has in place a suite of funding programs which support researchers at the different stages of their careers (as outlined in **Section 2**), the short-timeframe and project-based nature of many initiatives may contribute to less seamless career development pathways than desired and limited autonomy for researchers in determining the direction of their research activity in the early stages of their careers. An expansion of successful team-based and mission-driven schemes, such as the NHMRC Program Grants, to a wider disciplinary base and more extended timeframes (up to ten years' duration) may go some way to addressing this issue.⁵⁶

⁵⁶ See: <http://www.nhmrc.gov.au/grants/apply/programs/index.htm>

Questions for consultation:

Q5: Do the issues identified adequately capture the challenges facing Australia in providing productive and viable career paths to its researchers over the next decade and promoting them adequately? If not, what other challenges should be considered?

Q6: Do the issues identified adequately capture the opportunities available to Australia to better support researchers at the different stages of their careers over the next decade? If not, what other opportunities should be considered?

6 Priorities for action

6.1 Implementation of the research workforce strategy

- 6.11 As outlined in **Section 1**, the research workforce strategy is a long-term endeavour for Australia. While formally covering the decade ahead to 2020, the strategy is also intended to position Australia to better leverage the potential of its research skills well beyond that period.
- 6.12 The challenges and opportunities identified in this paper indicate significant efforts will be required by all parties to deliver desired outcomes – especially government, universities and other research training providers, and research employers.
- 6.13 Not all identified issues are amenable to immediate action and some issues will best be dealt with as part of wider national efforts to realise the full potential of Australia’s workforce and strengthen its contribution to national growth and productivity.
- 6.14 The core issue for Australia is to remain on task and to ensure that the strategy ultimately represents not just a snapshot in time but an evolving framework which can be flexibly adapted to meet the changing needs and priorities of Australia’s research workforce.

6.2 Proposed areas for priority action

- 6.21 This paper has identified a wide range of research workforce challenges and opportunities, along with proposed actions to meet them, under the broad themes: employer demand (**Section 3**), supply of researchers to Australia (**Section 4**), and research career pathways (**Section 5**).
- 6.22 **Table 1** below attempts to draw together these issues and organise them into a framework of possible priority areas and actions for the next decade.
- 6.23 Actions are organised into areas of immediate priority and amenability to intervention and areas that require further work and alignment with other processes to achieve. Specifically, short-term actions are expected to be taken in the three-year period from 2011 to 2013, medium-term actions from 2014 to 2017, and long-term actions over the remaining life of the strategy to 2020.
- 6.24 Responsibility for actions is assigned across government, research training providers, and research employers, with many actions spanning more than one of these groups. Whilst the role of individuals (students, researchers and so on) is not explicitly recognised in **Table 1**, their crucial importance in delivering outcomes should be recognised and drawn on in the final strategy.

Questions for consultation:

Q7: Are the priority areas for action outlined in **Table 1** the right ones? What other priorities should be identified?

Q8: Does the allocation of responsibilities for priority areas and actions outlined in **Table 1** adequately capture the roles of all parties? Are there any issues relating to the allocation of responsibilities that need to be considered?

Q9: Are the timeframes outlined in **Table 1** appropriate? Are there any priority areas that require more immediate or longer-term action?

7. How to respond to this paper

Please keep responses concise and address the questions posed in the paper. You may attach additional material to your response if you wish.

Please email submissions to: rws@innovation.gov.au.

Written submissions can be mailed to:

Research Workforce Strategy – Submission
Research Funding and Policy Branch
Research Division
Department of Innovation, Industry, Science and Research
GPO Box 9839
CANBERRA, ACT 2601

Email is the preferred mode of submission.

The deadline for submissions is Friday, 6 August 2010. Earlier submissions are welcome.

Important note: *Unless otherwise requested by submitting individuals or organisations, submissions will be made publicly available on the DIISR website shortly after they are received.*

Table 1: Proposed priority areas for action

Time frame / Responsibility	Priority Areas	Short term Actions (2011-2013)	Medium Term Actions (2014-2016)	Long Term Actions (2017-2020)
Government	<ol style="list-style-type: none"> 1. Attraction and retention of students and researchers 2. Enhancement of the quality of the research training experience in Australia 3. Facilitation of pathways into and transitions within research careers in Australia 4. Improvement of Australia's information base with respect to the research workforce 	<ol style="list-style-type: none"> 1. (a) Opening APAs to IPRS; (b) Enhancement of pathways and support for international research students to gain research experience and employment in Australia post completion; (c) Examination of the impact of migration policies on the research workforce and opportunities for improvement; (d) Development of strategies to improve engagement with and utilisation of research diaspora and build international research linkages 2. (a) Addressing issues relating to flexibility in HDR candidature; (b) Extension of APA to four years to align with RTS support; (c) Review of RTS with view to enhancing incentives for: HDR completions, alignment of research training with areas of identified research strength and/or priority, and research training quality (d) Development of a framework for provision of joint HDR degrees between individual institutions and for multi-partner arrangements (working with training providers and other relevant parties); (e) Development of strategies which allow for more flexible pathways to a doctorate and improved alignment with international practice (working 	<ol style="list-style-type: none"> 1. (a) Doubling the number of IPRS; (b) Examination of the impact of migration policies on the research workforce and opportunities for improvement; (c) Implementation of strategies to engage with and utilise research diaspora and build international linkages; (d) Expansion of 'boomerang' mobility support programs to a wider user base; (e) Development of research workforce re-integration support scheme; (f) Examination of scope within existing taxation arrangements to better facilitate research student studies and encourage researcher employment 2. (a) Implementation of any revisions to the RTS emerging from completed review; (b) Revision of existing funding settings in light of examination of cost of research training; (c) Implementation of joint provision of HDR degrees between individual institutions 3. (a) Implementation of actions to address impediments to career progression arising from career breaks and/or mobility); (b) Extension of NHMRC program 	<ol style="list-style-type: none"> 1. (a) Ongoing monitoring of inflows and outflows to Australia's research workforce (b) Examination of the impact of migration policies on the research workforce and opportunities for improvement; (c) Implementation of strategies to engage with and utilise research diaspora; (d) Implementation of research workforce re-integration support scheme 2. (a) Introduction of joint (and where appropriate) multi-partner doctoral programs in areas of national strength and/or priority (working with research training providers and other relevant parties) 3. (a) Implementation of actions to address impediments to career progression arising from career breaks and/or mobility; (b) Ongoing extension of NMRC program grants to a wider discipline base 4. (a) Implementation of more robust systems for monitoring supply and demand for researchers in Australia and tracking the career outcomes of research-qualified individuals; (b) Publication/promotion of areas of research training quality in Australia; (c) Ongoing monitoring and promotion of research program

Time frame / Responsibility	Priority Areas	Short term Actions (2011-2013)	Medium Term Actions (2014-2016)	Long Term Actions (2017-2020)
		<ul style="list-style-type: none"> with research training providers) 3. Examination of the impact of research career breaks on career progression 4. (a) Development of principles and indicators for quality research training provision; (b) Examination of scope to support the inclusion of student publications in ERA; (c) Mapping and promotion of research workforce program support available 	<ul style="list-style-type: none"> grants to a wider discipline base 4. (a) Re-examining and addressing need for additional research training places for HDR students; (b) Development of more robust systems for monitoring supply and demand for researchers in Australia over the longer term and tracking the career outcomes of research-qualified individuals; (c) Implementation of outcomes of examination of reporting of student publications in ERA; (d) Ongoing monitoring and promotion of research program support available 	<ul style="list-style-type: none"> support available
Universities and other research training providers		<ul style="list-style-type: none"> 1. Continued enhancement and refreshment of institutional policies and support for international students 2. (a) Addressing issues of flexibility in HDR candidature (institutional practice); (b) Improved alignment of research training with employer needs (working with employers); (c) Development of a framework for provision of joint HDR degrees (working with government); 3. Development of strategies which allow for more flexible pathways to a doctorate and improved alignment with international practice 4. Continued enhancement of data collection and management practices 	<ul style="list-style-type: none"> 1. Continue enhancement and refreshment of institutional policies and support for international students 2. (a) Implementation of framework for joint provision of HDR degrees; (b) Implementation of principles and indicators for best practice with respect to research training quality 3. (a) Implementation of strategies to allow for more flexible pathways to a doctorate and improved alignment with international practice; (b) Ongoing extension and development of existing mentoring programs 	<ul style="list-style-type: none"> 1. Continued enhancement and refreshment of institutional policies and support for international students 2. Introduction of joint (and where appropriate) multi-partner doctoral programs in areas of national strength and or priority 3. Review of principles and indicators for best practice with respect to research training quality 4. Continued enhancement of data collection and management practices with respect to HDR students (domestic and international)

Time frame / Responsibility	Priority Areas	Short term Actions (2011-2013)	Medium Term Actions (2014-2016)	Long Term Actions (2017-2020)
		with respect to HDR students (domestic and international)	4. Continued enhancement of data collection and management practices with respect to HDR students (domestic and international)	
Researcher employers (including business, not-for-profit organisations, universities, government departments and agencies)		1. Continued enhancement of policies and support for international researchers 2. Improved alignment of research training with employer needs (working with training providers) 3. (a) Implementation of improved succession planning and talent management strategies; (b) Extension of existing mentoring programs to as wide as possible a user base as possible	1. Continued enhancement of policies and support for international researchers 2. Continued engagement with research training providers to deliver job-ready graduates 3. (a) Ongoing implementation of succession planning and talent management strategies; (b) Extension of existing mentoring and talent development programs to as wide as possible a user base	1. Continued enhancement of policies and support for international researchers 2. Continued engagement with research training providers to deliver job-ready graduates 3. (a) Ongoing implementation of succession planning and talent management strategies; (b) Extension of existing mentoring programs to as wide as possible a user base

Appendix A

Research workforce strategy reference group and subgroups

Table A1: Membership of the research workforce strategy reference group

Ms Anne Baly (Chair)	DIISR
Mr Jason Coutts	DEEWR
Dr Chris Duncan	Commonwealth State and Territory Advisory Council on Innovation
Prof Tim Brown	Universities Australia
Prof Linda Rosenman	Non-aligned Universities
Prof Max King	Group of Eight
Prof Ross Milbourne	Australian Technology Network of Universities
Prof Michael Barber	Innovative Research Universities Australia
Prof Stephen Garton	National Academies Forum
Ms Anna-Maria Arabia	Federation of Australian Scientific and Technological Societies
Ms Helen O'Neil	Council for the Humanities, Arts and Social Sciences
Dr Carolyn Allport	National Tertiary Education Union
Ms Tammi Jonas	Council of Australian Postgraduate Associations
Mr Malcolm Farrow	Professions Australia
Ms Sue Beitz	Skills Australia
Mr Patrick Coleman	Business Council of Australia
Dr Peter Burn	Australian Industry Group

Table A2: Membership of reference group subgroups

Employer Demand Subgroup	
Dr Anne Byrne (Chair)	DIISR
Dr Joanne Bright	DIISR
Dr Chris Duncan	Commonwealth State and Territory Advisory Council on Innovation
Ms Sue Beitz	Skills Australia
Mr Malcolm Farrow	Professions Australia
Prof Ross Milbourne	Australian Technology Network of Universities
Prof Linda Rosenman	Non-aligned Universities
Ms Tammi Jonas	Council of Australian Postgraduate Associations
Mr Patrick Coleman	Business Council of Australia
Dr Peter Burn	Australian Industry Group
Research Training Experience	
Dr Anne Byrne (Chair)	DIISR
Dr Joanne Bright	DIISR
Mr Jason Coutts	DEEWR
Professor Stephen Garton	National Academies Forum
Dr Carolyn Allport	National Tertiary Education Union
Prof Max King	Group of Eight
Prof Michael Barber	Innovative Research Universities Australia
Ms Tammi Jonas	Council of Australian Postgraduate Associations
Research Career Pathways	
Dr Anne Byrne (Chair)	DIISR
Dr Joanne Bright	DIISR
Ms Anna-Maria Arabia	Federation of Australian Scientific and Technological Societies
Ms Helen O'Neil	Council for the Humanities, Arts and Social Sciences
Dr Carolyn Allport	National Tertiary Education Union
Prof Tim Brown	Universities Australia
Prof Max King	Group of Eight
Ms Tammi Jonas	Council of Australian Postgraduate Associations

Consultation and analysis activities informing the Consultation Paper

Meetings of the Research Workforce Strategy Reference Group and Subgroups

The Reference Group met three times over the period September 2009 to June 2010, on 11 September 2009, 16 March 2010 and 31 May 2010.

In addition, the Employer Demand and Research Training Experience subgroups each met three times and the Research Career Pathways subgroup met twice over this period to discuss and progress analysis and consultation activities.

Consultation activities

DIISR and Reference Group members held a number of workshops and roundtables with stakeholders over 2009-10 to examine issues under each subgroup theme:

- workshop with postgraduate students on their research training experiences – 2 December 2009;
- workshop with the National Academies exploring research career issues from a disciplinary perspective – 17 December 2009;
- roundtables with early-to-mid-career researchers exploring issues affecting research careers in Australia – 21, 27 and 29 January 2010;
- roundtable with research leaders exploring the development of researchers and their career progression in Australia – 12 February 2010;
- open forum discussion with science researchers as part of the Science Meets Parliament event – 9 March 2010;
- workshop with members and delegates of the Industry Innovation Councils (Auto, IT, Textile, Clothing and Footwear and Space Industry Innovation Councils) – 4 May 2010; and
- workshops with leading researchers and policy experts to explore the future direction of individual research disciplines in Australia and the impact on the research workforce – May-June 2010.

DIISR also met with a number of individual peak bodies and organisations over the period September 2009 to June 2010 to discuss their perspectives on Australia's future research workforce needs, including Cooperative Research Centre education managers, university and professional peak bodies, the Australian Public Service Commission, and deans and directors of graduate studies within universities.

Analysis activities

DIISR undertook a range of analysis work between September 2009 and June 2010 to develop an improved evidence base with respect to Australia's research workforce. Analysis was conducted in three areas:

- commissioned studies;

- in-house quantitative analysis and literature review of data and information relating to Australia's research workforce (including information garnered by recent government reviews and inquiries, such as the 2008 reviews of the national innovation system and Australian higher education and the House of Representatives Inquiry into Research Training and Research Workforce Issues in Australian Universities); and
- in-house examination of government support programs and initiatives supporting Australia's research workforce.

Commissioned studies

DIISR commissioned two major studies to underpin the research workforce strategy development process:

- Employer demand for researchers in Australia – conducted by the Allen Consulting Group
- Australia's future research workforce: supply, demand and influence factors – conducted by Access Economics

The final reports of these studies are on the DIISR website:

www.innovation.gov.au/Section/Research/Pages/ResearchWorkforceIssues.aspx

Consultation questions

Q1: Do the issues identified adequately capture the challenges facing Australia in adapting to the changing nature of employer demand and meeting its innovation aspirations over the next decade? If not, what other challenges should be considered?

Q2: Do the issues identified adequately capture the opportunities available to Australia to better respond to the changing nature of employer demand in Australia and meet national innovation aspirations? If not, what other opportunities should be considered?

Q3: Do the issues identified adequately capture the challenges facing Australia in delivering required levels of research skills to its workforce over the next decade? If not, what other challenges should be considered?

Q4: Do the issues identified adequately capture the opportunities available to Australia to enhance its supply of research skills over the next decade? If not, what other opportunities should be considered?

Q5: Do the issues identified adequately capture the challenges facing Australia in providing productive and viable career paths to its researchers over the next decade and promoting them adequately? If not, what other challenges should be considered?

Q6: Do the issues identified adequately capture the opportunities available to Australia to better support researchers at the different stages of their careers over the next decade? If not, what other opportunities should be considered?

Q7: Are the priority areas for action outlined in **Table 1** the right ones? What other priorities should be identified?

Q8: Does the allocation of responsibilities for priority areas and actions outlined in **Table 1** adequately capture the roles of all parties? Are there any issues relating to the allocation of responsibilities that need to be considered?

Q9: Are the timeframes outlined in **Table 1** appropriate? Are there any priority areas that require more immediate or longer-term action?