



Securing Australia's Future Project 13
Review of Australia's Research Training System

Call for Input
Discussion Paper

August 2015

Disclaimer

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REVIEW OF AUSTRALIA'S RESEARCH TRAINING SYSTEM – DISCUSSION PAPER

INTRODUCTION

The Minister for Education and Training has commissioned the Australian Council of Learned Academies (ACOLA) to undertake a review of Australia's research training system. Written submissions in response to the consultation questions are now sought from stakeholders. **Submissions should be evidence based, provide examples where possible, and address the consultation questions.** To assist in stimulating debate this discussion paper has been developed. The discussion paper briefly sets out the scope of research training under consideration in this review, provides an overview of Australia's research training candidates, and sets out at a high level what research training should achieve in terms of equipping graduates and meeting end user needs. The discussion paper then explores each of the terms of reference (as numbered below) and highlights some of the initial issues the review will be considering.

SCOPE OF RESEARCH TRAINING WITHIN THIS REVIEW

Although research training can be delivered through a variety of different mechanisms this review will predominantly focus on the suite of activities that should be undertaken during, as part of or towards the completion of a higher degree by research (HDR), such as the research doctorate and research master's degree. Where appropriate the review will examine other degree models that provide research training such as the research professional doctorate, coursework professional doctorate or coursework masters programs with a significant research component. The review will pay attention to the different research training pathways, and consider how they can best prepare prospective HDR candidates.

THE RESEARCH TRAINING CANDIDATES

There are over 62,000 HDR candidates currently undertaking research training. In 2013 there were over 9,000 HDR completions. Approximately 70% of candidates are domestic and 30% are international enrolments. In 2011 the average age at commencement of a research doctorate was 33, and in 2012 over 18% of domestic research doctoral candidates were aged over 50. The most popular fields of education in which research training is being undertaken are society and culture, natural and physical sciences, health, and engineering and related technologies. These fields account for nearly 78% HDR completions¹. Further details are outlined in Appendix 1.

THE RESEARCH TRAINING GRADUATE

The research training graduate should be a well-equipped graduate with the knowledge and skills to demonstrate autonomy, authoritative judgement, adaptability and responsibility as an expert and leading practitioner or scholar².

THE EMPLOYERS AND OTHER BENEFICIARIES OF RESEARCH TRAINING GRADUATES

Potential employers and other beneficiaries of research training graduates include, among others, businesses, governments, non-government organisations, universities, publicly funded research organisations, peak bodies and charities. Research training should prepare candidates to succeed in these different industries.

TERMS OF REFERENCE

1. ENSURE THAT AUSTRALIA'S RESEARCH TRAINING MODELS ARE COMPARABLE WITH THE BEST IN THE WORLD

Given the globally competitive nature of higher education Australia's research training models must be among the best in the world if they are to attract the best domestic and international higher degree by research (HDRs) candidates³. Comparing Australia's performance will entail looking at the range of research training models in use and comparing their structure and outcomes.

The traditional research training model was essentially a research apprenticeship whereby each candidate completed an original research project under the supervision of a single academic⁴, producing a monographic style thesis that in the case of a doctorate made a significant and original contribution to knowledge. This approach has evolved in recent years. Candidates now have an advisory panel rather than a single supervisor, and in many institutions there is a requirement for candidates to also complete formal research training courses. These changes have resulted in research higher degrees being reconceptualised as research training rather than research that changes the course of knowledge⁵. The graduate rather than the research per se is now regarded as the most important outcome of HDR candidature.

The extent to which formal research training courses have been made a part of research training models varies between disciplines and institutions, both across and within different national research systems. There has been a gradual increase in Australian universities introducing both formal and informal coursework within their research training programs⁶. Over the last 25 years there has been a push in the UK to professionalise research training. Research councils have led the development of requirements for research training to comprise extensive discipline-specific and generic components. The need for transferable skills training was highlighted in the influential Robert's (2001) review⁷, and formal research training requirements covering all research councils are now in place⁸. Postgraduate research training programs designed by universities to address these requirements have been shown to be effective, reducing completion times and improving completion rates⁹. Research council sponsored doctoral training centres have recently been established by three research councils in the UK. While there are differences in their composition they are responsible for providing both government funded scholarships as well as expanded research training opportunities.

While the introduction of formal research training courses within higher research degrees is a more recent concept in Europe and Australia it is well established in North America through the cohort doctoral model, with candidates undertaking substantial taught elements which often include research training¹⁰ prior to embarking on the research. These taught elements are assessed separately to the thesis, and the research output may be less than is the case in Australia.

There has also been a change in the types of research output produced by HDR candidates. An increasing number of institutions encourage candidates to: produce a publication based thesis, and undertake professional and work-based doctorates, and, within the arts, practice doctorates¹¹.

One area where Australia differs from most other nations is the examination of the thesis. Australia is one of the few countries that has a non-oral examination model. An oral exam offers examiners the opportunity to assess the candidate as well as the thesis. It can help examiners assess the candidate's knowledge of the subject area, establish authenticity of the work, and give the candidate an opportunity to rebut concerns raised by examiners. There have been suggestions that candidates, supervisors and examiners would benefit if an oral assessment was used to examine research doctorates¹². Consideration of the benefits and drawbacks of introducing an oral exam is needed given that the research training system is already producing high quality research outputs. In this regard it is important to consider the findings of a recent ARC Discovery project that has compared the two different models¹³. This project concluded that the inclusion of a viva would not make a

difference to Australian research doctorate examination results, but it could bring about other benefits such as greater closure for the candidate and the opportunity for collegial exchange¹⁴.

Examining these developments in Australia and internationally will reveal how research training models can be improved. It will be important to assess the outcomes of each model to help identify common beneficial elements. Potential criteria to compare different research training model outcomes include completion rates, average duration of candidature, graduate satisfaction surveys, employment outcomes and destinations, and employer satisfaction and perceptions.

2. ENSURE THAT RESEARCH GRADUATES ARE EQUIPPED FOR AND ACHIEVE EMPLOYMENT OUTCOMES IN A RANGE OF SECTORS, INCLUDING ACADEMIC TEACHING, RESEARCH AND INDUSTRY

It is estimated that about 50% research doctorate theses are examined by international examiners¹⁵ and the Australian research training system is generally held in high regard by international standards. However, some consider the breadth of Australian research training too narrow by international standards. While the nature of research training means that graduates can become specialised in a niche area of their discipline, there have been suggestions that some employers perceive research doctorate graduates to be over-specialised¹⁶. Developing high level competencies in a range of research skills could help improve employment opportunities in different career pathways which include academic research, government research, industry research, and non-research careers. In the UK particular attention has been paid to helping HDR candidates develop broader skills, particularly methodological skills. Graduates have found such skills to be useful for both academic and non-academic careers, and employers perceive these skills as valuable¹⁷.

For most disciplines, a research doctorate is an essential prerequisite for an academic career. To be successful in pursuing an academic career doctoral HDR graduates need to be able to show skills and experience in a range of areas. Postdoctoral opportunities in some disciplines are highly competitive, while tenured positions are extremely competitive across all disciplines. Gaining skills in writing for different audiences, including writing high-quality academic publications; teaching; grant writing; professional networking; and, increasingly, developing links with industry can help research graduates achieve positive employment outcomes. Many research training programs include such skills development, and effective research supervision also provides support in these areas.

Less clear in terms of skills development is how undertaking research training effectively prepares graduates for academic teaching. Undertaking research training does not necessarily equip HDR candidates in areas of pedagogy and course delivery and development. Many institutions in Australia have responded to this by developing postgraduate teaching courses for new employees and HDR candidates with teaching responsibilities, but this is rarely a formal component of research training.

The growing trend internationally is for a declining proportion of doctoral graduates to be employed in academic positions. In Australia at least half of all research doctoral graduates are employed outside the education sector¹⁸. A similar pattern has been found in the UK¹⁹, Canada²⁰, France²¹ and the United States²². Research has suggested that only around half of doctoral HDR candidates contemplate moving into an academic career²³. Within the UK the Royal Society has found that while 30% of doctoral HDR candidates will go on to become early career researchers, only 3.5% of doctoral graduates will eventually achieve the status of a permanent university researcher, and 0.45% will become professors²⁴. While those in science are more likely to pursue non-academic positions, at least 40% of social science doctoral graduates in the UK pursue non-academic careers²⁵.

As most HDR graduates will eventually seek employment opportunities in a range of different industries it is important to ensure they gain a wide range of broader transferable skills and an understanding on how to

apply them in different settings²⁶. This is particularly the case given that graduates today are likely to change career direction multiple times throughout their working life. HDR graduates should be highly employable because they are highly skilled and have technical expertise within their discipline. However, employers, universities, HDR candidates, scientists, researchers and other stakeholders have expressed concerns that the range of skills gained by HDR graduates is too narrow, and that a broader set of competencies are needed to help them transition into non-academic and industry roles²⁷.

The extent to which broader skills development is already being achieved or is necessary has been the subject of some debate²⁸. The data appears to suggest that doctoral graduates have high levels of employment²⁹, are least likely to find themselves unemployed over the long term³⁰. With over half of doctoral graduates already entering careers outside academia, graduates presumably have skills that employers value. Borrell-Damian suggests that in addition to the skills gained through research training, research graduates gain a group of competencies common to all fields which make them more employable outside an academic context³¹.

A much better understanding of the long-term employment outcomes for research graduates in Australia is needed, and there appears to be a lack of research in this area.

3. PROVIDE GREATER OPPORTUNITY FOR INDUSTRY RELEVANT RESEARCH TRAINING, INCLUDING THROUGH...

3A. SUPPORT FOR INDUSTRY RELEVANT RESEARCH PROJECTS AND EXPERIENCE

3B. ACCESS TO INDUSTRY AND BUSINESS RELEVANT SKILLS WITHIN RESEARCH TRAINING PROGRAMS, SUCH AS ENTREPRENEURIAL SKILLS

Supporting industry relevant research projects and experience has the potential to enhance HDR candidate experience³², improve future employability in a range of different careers³³, and increase the broader social and economic impacts of research. Increasing collaboration between universities and industry through postgraduate research training has the potential to help increase Australia's relatively low-level of university-industry collaboration³⁴, an area which the Australian Government has highlighted as a priority³⁵. Over time such collaborations help to build other ongoing linkages between universities and industry, enhancing workforce mobility and improving knowledge transfer between the sectors.

Support for industry relevant research projects and access to industry and business skills could be delivered through HDR candidates taking on more industry relevant research projects, or undertaking a research project directly within an industry organisation, and being embedded within the organisation's workplace for a period of time. The HDR candidate would gain access to training, facilities and expertise not available in an academic setting. Industry partners would gain a capable researcher willing to undertake a cutting-edge research project relevant to their priorities. In taking such an approach the difficulty of the HDR candidate working on a long-term project and the often short-term research needs of the industry partner need to be considered, in addition clear guidance on IP arrangements would need to be put in place.

Examples of this kind of approach are well developed overseas. The UK CASE PhD studentships allow industry to take the lead in arranging projects with an academic partner of their choice³⁶. The aim is to ensure doctoral HDR candidates receive a first-rate, challenging research training experience, within the context of a mutually beneficial research collaboration between academic and partner organisations. Partner organisations can be from industry, government, NGOs and charitable bodies³⁷, and the approach is taken across all disciplines. Other overseas approaches are outlined in the Department of Education (2014) report *Initiatives to enhance the professional development of research students* and include Mitcas Accelerate in Canada; the Danish Industrial PhD program; the CIFRE scheme in France; and the industrial doctoral training centres in the UK³⁸.

Research training is already taking place outside of universities such as in medical research institutes, CSIRO, ANSTO, cooperative research centres and through formal collaborations with industry partners, but these

initiatives are small in scale and scope compared to initiatives overseas³⁹. Part of the reason for this might be Australia's different industrial base with an economy made up of a greater proportion of SMEs and the lack of formal programs to link industry partners with HDR candidates. Increasing the number of industry projects or placements might require better incentives to be put in place to encourage industry to provide training opportunities. Such incentives could be delivered through the tax system or come in the form of new programs that provide advice and support for industry partners. It will be worthwhile to look at international examples of where such incentives have been developed.

Depending on the area of study such collaborative project approaches will not always be available or appropriate, but industry collaboration and training in relevant business skills could be delivered in other ways. Formal modules teaching business development or project management could form part of a research training program that encompasses broader skills development. Alternatively, encouraging HDR candidates to suspend studies for a period of time to undertake relevant work placements which are not necessarily directly related to their research project could help build a broader range of skills. To tailor such approaches, a better understanding needs to be developed of the specific types of industry and business relevant skills that could complement existing research training approaches. In addition to this an insight into employer attitudes about research training graduates and perceived skills deficiencies would be beneficial. In this regard lessons can be learnt from the existing programs already underway and the cooperative research centre program that has played an important role in supporting industry focussed research doctorates.

How such industry placements or collaborations impact on completion times needs to be examined. A more structured work environment could help aid completion, or conversely spending time away from research training activities at university could mean students take longer to complete their thesis. It should be possible to get a better understanding by looking at existing industry placement models and looking to see what impact they have had on completions times.

3. PROVIDE GREATER OPPORTUNITY FOR INDUSTRY RELEVANT RESEARCH TRAINING, INCLUDING THROUGH...

3C. RECOGNITION OF PRIOR EXPERIENCE IN INDUSTRY OR OTHER RELEVANT EMPLOYMENT

Most universities recognise relevant industry experience when assessing applications for HDR places. About 60% of HDR candidates in Australia are over the age of 30, with the average age at commencing being 33⁴⁰, and as such many HDR candidates have had previous full-time employment⁴¹. Prior to commencing an HDR, 23% of candidates completed a bachelor or postgraduate qualification 5-10 years previously, and 21% more than 10 years previously, indicating that a significant portion of HDR candidates are coming to research training with prior experience in industry or other employment⁴².

While this time away from academia does not appear to be a barrier to entry into research training, it may present opportunities to structure research training to take advantage of this experience. This approach would be particularly relevant where higher degrees by research with industry-relevant training components are offered, and would potentially act as an incentive for those with existing industry experience or other relevant employment to upgrade their skills through research training. As an example, it might be possible to offer research training projects within the HDR candidate's workplace, allowing them to continue their career while developing new research skills. Research training courses could be tailored according to different needs and marketed to specific groups, such as with the integrated PhD. Examples of both of these options are discussed further in part four.

4. REMOVE BARRIERS IN THE REGULATORY FRAMEWORK TO FACILITATE INNOVATION IN DEGREE MODELS AND ALIGN WITH INTERNATIONAL BEST PRACTICE, INCLUDING...

4A. FACILITATING OPPORTUNITIES FOR MORE STRUCTURED RESEARCH TRAINING PROGRAMMES, INCLUDING THROUGH PROFESSIONAL DEVELOPMENT, COURSEWORK AND INTERNSHIPS

Many Australian universities and overseas institutions have already introduced research training courses within their research degree models, often focused on generic and transferable research skills. Particularly in Australia these changes have tended to occur within existing degree models, rather than through a new approach to research training. Recognising that different HDR candidates will have different research training aspirations and needs, there might be an opportunity to introduce a greater range of approaches to research training programs.

Examples of such approaches include the structured doctoral program in Germany, which includes taught elements with an interim assessment. Instead of working on an individual project, the HDR candidate's research has to fit within an existing research program. The HDR candidate works on their research project within a team, and with support from a group of academic staff⁴³. Other German innovative degree models with more structured research training include special forms of individual doctorates that involve collaborating with an industry partner. In this approach doctoral HDR candidates usually undertake their thesis in collaboration with the company where they are employed. This model is seen as helping to link work experience with applied research⁴⁴. One example of this model is the INI.TUM research centre, which is a partnership between Audi AG, the City of Ingolstadt and Technische Universität München (TUM). Through this partnership doctoral HDR candidates are employed by the university and work on a project in consultation with their supervisors at the university and within the company⁴⁵.

An alternative research training degree model that has been successfully implemented within the UK is the Integrated PhD, sometimes referred to as the New Route PhD. This model combines research with a structured program of advanced training. Candidates undertake formal master's level courses which provide advanced theoretical and practical research skills, in addition to undertaking generic training in professional and interpersonal skills. Many institutions offering this route confer interim awards throughout the program, such as a diploma or master's degree, as appropriate. Some universities are targeting this route to international HDR candidates⁴⁶ while others provide this pathway for middle or senior level managers⁴⁷. In addition to the typical thesis examination, HDR candidates have to complete assessments for the taught elements of their course to enable them to continue.

Some novel approaches have already been developed in Australia. For example Macquarie University has changed its approach at the HDR preparatory level⁴⁸ (see below). Some faculties at Monash University have introduced formal coursework requirements which go beyond broader research training modules, and include discipline specific training. While not directly relevant to structured research training most institutions now allow HDR candidates to submit a publication based thesis rather than a traditional monograph thesis⁴⁹. The CSIRO, cooperative research centres, and medical research institutes all support a large number of HDR candidates⁵⁰. The ATN Industry Doctoral Training Centre PhD program combines traditional independent research with coursework to broaden technical and professional skills, as well as seeing the candidate work with an industry sponsor to solve industry problems.

There might be opportunities to introduce innovative degree models, similar to those described above or newly developed to suit local market requirements, but the extent to which current funding and regulatory models inhibit such approaches being pursued in Australia is unclear and needs further examination. Given the focus on HDR completions there are strong incentives within the funding system for the traditional approach,

with few direct financial incentives for industrial collaboration or for providing substantial taught postgraduate modules.

4. REMOVE BARRIERS IN THE REGULATORY FRAMEWORK TO FACILITATE INNOVATION IN DEGREE MODELS AND ALIGN WITH INTERNATIONAL BEST PRACTICE, INCLUDING...

4B. SUPPORTING ALTERNATIVE PATHWAYS TO A PHD THAT ALIGN WITH INTERNATIONAL BEST PRACTICE, SUCH AS MASTER'S DEGREE PREPARATORY MODELS

Historically the traditional pathway to undertaking a research doctorate in Australia has been the completion of a three year bachelor degree followed by a one year honours program. The honours program usually comprises both formal taught modules including areas of research training, and the completion of a research dissertation⁵¹. However a greater number of HDR candidates are now coming from other pathways such as undertaking postgraduate qualifications in place or in addition to honours. Some universities have begun to move away from honours, instead using the research master's degree to fulfil this role⁵², while some have recently introduced a four year Bachelor of Philosophy degree⁵³.

In Europe the Bologna Process has led to agreement between European countries on standards within higher education qualifications. The standard entry pathway for candidature for a research doctorate is the completion of a 3-4 year bachelor and 1-2 year master's degree. Following the Roberts Review⁵⁴ in the UK there is an expectation in many disciplines that the standard pathway for doctoral scholarship funding would be to undertake a taught master's degree with a substantial and approved research training component. A similar approach has already been adopted by Macquarie University where an honours year has been dropped in favour of a Master of Research program⁵⁵.

Doctoral training centres in the UK have been given great flexibility to determine training packages appropriate to the requirements of specific discipline or cross-disciplinary research areas, as well as the needs of individual HDR candidates. This includes varying the length of both preparatory taught master's programs as well as the research doctorate itself.

The pathway for entry to a research doctorate in the United States varies by institution but typically a bachelor's degree is the minimum prerequisite, although a postgraduate qualification is seen as desirable at the most prestigious institutions. The program itself comprises substantial taught elements in the first three years, where the HDR candidate must make satisfactory progress before advancing to candidacy in their fourth year, and completing their doctoral dissertation over at least the next two years⁵⁶.

While the UK and the US approaches differ they both contain substantial taught preparatory research training components at the postgraduate level. This contrasts with the Australian approach where preparatory research training is delivered at the undergraduate level through the final year of an honours bachelor degree. As preparation for undertaking a research doctorate, the honours year has similarities to some one year master's degrees, but it is important to determine whether it provides appropriate preparation for a research doctorate program.

The advantages of a separate master's degree include providing HDR candidates with a distinct additional qualification, and increases HDR candidate choice—allowing HDR candidates to pursue the preparatory year of research training at other institutions. The advantages of the four year honours approach include HDR candidates being able to access undergraduate financial support for the honours year, and the high regard with which the honours degree is held in Australia.

5. SUPPORT ADMISSION AND ATTAINMENT FOR PHD CANDIDATES FROM NON-TRADITIONAL BACKGROUNDS, INCLUDING SUPPORTING INDIGENOUS RESEARCH STUDENTS

There are a range of groups from which HDR candidates could be defined as having a non-traditional background. Devlin⁵⁷ suggests non-traditional backgrounds include students the following backgrounds:

- Mature age
- VET pathways
- Students from low socio-economic backgrounds
- Indigenous
- Rural
- First in family to attend university
- Off campus
- Part-time
- Flexible entry

The higher education student data collection provides participation data for some of these groups, which allows an assessment of whether current support mechanisms are working, and where further efforts might be needed. This longitudinal data allows trends to be examined, and will enable the effectiveness of future support measures to be evaluated.

Ratios can be used to indicate whether candidates from different equity group backgrounds are under- or over-represented in the research doctorate population. Ratios of less than 1.00 indicate under representation of an equity group, while ratios of 1.00 and above indicate good representation. These ratios are calculated using the following method:

“The calculation is based on the performance indicator rate (eg. participation rate) divided by a equity reference value for that indicator (eg. equity group proportion in the general population). This is a better measure of equity because it makes a comparison between the equity group and a suitable benchmark. Ratios of less than 1.00 indicate poor performance, while ratios of 1.00 and greater indicate good performance.”⁵⁸

Data for some non-traditional background groups are presented below to provide an overview of the current landscape of equity group participation in research doctorates⁵⁹. Care must be taken when looking at these data given the lower sample size for doctoral HDR candidates when compared to the whole student population. The data presented in this table is for domestic doctor HDR candidates only.

Group	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Non-English speaking background	1.67	1.71	1.72	1.68	1.76	1.72	1.73	1.7	1.67	1.26	1.26
Disability	0.41	0.42	0.46	0.48	0.48	0.49	0.52	0.55	0.57	0.56	0.57
Low socio-economic status – all ages (2006 definition)	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.17
Regional	0.51	0.52	0.52	0.51	0.51	0.51	0.51	0.51	0.5	0.51	0.51
Remote	0.22	0.24	0.25	0.22	0.22	0.24	0.24	0.23	0.23	0.24	0.25
Regional/Remote⁶⁰	0.49	0.49	0.5	0.48	0.49	0.48	0.49	0.49	0.48	0.49	0.49
Indigenous	0.32	0.35	0.35	0.4	0.41	0.45	0.49	0.5	0.44	0.4	0.37

Table 1 Participation ratios of Australian domestic doctoral HDR candidates from non-traditional backgrounds. Source: Department of Education (2015) Higher Education Data Collection – custom analysis

The data suggests that participation from doctoral HDR candidates from non-traditional backgrounds has remained relatively stable over the last ten years.

Participation by doctoral HDR candidates from non-English speaking backgrounds is good with ratios well above 1.0 reported for most of the reporting period, but with a notable decline in the last two years. Participation from doctoral HDR candidates with a disability has increased steadily over the reporting period.

Participation from indigenous doctoral HDR candidates increased quite significantly between 2003 and 2010, but has declined since. Participation ratios from other groups have remained relatively stable over the reporting period. The extent to which a relatively small participation sample size for some of these groups and how this impacts on the overall ratios needs to be determined before any firm conclusions can be made. However with the exception of participation from doctoral HDR candidates from non-English speaking backgrounds, all the other non-traditional participation background groups are consistently lower than is desirable.

There are a number of initiatives in place to encourage participation by doctoral HDR candidates from non-traditional backgrounds. The Australian Postgraduate Award is open to all HDR candidates and provides successful applicants with a stipend to assist them with living costs. A number of universities and NGOs offer scholarships for Indigenous HDR candidates to undertake a doctorate, while some universities provide scholarships for HDR candidates with a disability.

Improving access to research training for HDR candidates from non-traditional backgrounds might require further targeted action, for example increasing the number or value of scholarships available for such candidates. Action might also be required at the school and undergraduate level so that there is a sufficient pipeline of HDR candidates from non-traditional backgrounds eligible to participate in research training.

6. ENSURE THE RESEARCH WORKFORCE PIPELINE IS SECURE IN FIELDS OF NATIONAL IMPORTANCE, INCLUDING AREAS ALIGNED WITH NATIONAL SCIENCE AND RESEARCH PRIORITIES

To help ensure that Australia has research capacity in the areas aligned with the national science and research priorities⁶¹ researchers from a broad range of different disciplines will need to be trained, and will need to be equipped to work in multidisciplinary teams to tackle complex problems. The science and research priorities are to be reviewed every two years and are subject to change, while undertaking research training is a lifelong investment. Those disciplines where there is likely to be a deficiency in research capacity need to be identified as a high priority. To do this will require projections of future research workforce needs, and researcher training rates in areas required to meet future demand. The annual Higher Education Research Data Collection can provide information on the current academic workforce, as well as postgraduate research training degree enrolments and completions (course completions by field of education are summarised in Appendix 1)⁶². These data should allow forecasts to be made about the future research workforce supply, and will help identify disciplines where the research workforce pipeline is less secure. Areas of deficiency need to be identified and addressed.

For a strong and healthy research workforce pipeline, there needs to be good career progression opportunities within a high performing research system. Key junctures have been identified where research careers can come under pressure, undermining the long term robustness of the research workforce⁶³. These include attracting students to study core disciplines at school and university; ensuring a supply of high quality undergraduate students choose to undertake research doctorates; the transition from early- and post-doctoral opportunities to ongoing positions; and the transition from researcher to leadership roles⁶⁴, with each of these stages potentially affected by gender and cultural diversity issues.

Examples of targeted action to help secure the research workforce pipeline have included investing in school science education initiatives, providing additional Australian Postgraduate Awards, and career point specific research council scholarships. The Australian Government recently stated its desire to make the Future Fellowship program ongoing, providing more secure support for outstanding mid-career researchers. Also important are researcher mobility programs that provide opportunities for HDR candidates and early career researchers to gain experience and exposure with leading international research programs and expertise.

Effectively dealing with gender equity issues will help make the research workforce pipeline more secure. Within most disciplines gender inequity becomes more pronounced as careers progress, to the point where men outnumber women by 4 to 1 at the professorial level⁶⁵. The reasons for this gender disparity have been identified on many occasions⁶⁶, but until substantial and effective action is taken to address this systemic problem there will continue to be an exodus of talent from the research system including in areas of current and future national priority. Action will be required at different career stages to make a lasting difference, and given that many of those undertaking research training today will be the researcher leaders of the future, it is worth considering what changes to research training are needed to help encourage the next generation of researchers to achieve gender equity in their discipline.

7. ENSURE THAT OUR RESEARCH TRAINING SYSTEM DELIVERS A HIGH QUALITY RESEARCH AND LEARNING ENVIRONMENT AND CONTINUES TO SUPPORT STUDENT CHOICE AND COMPETITION BETWEEN PROVIDERS

The quality of the research training environment should be at the heart of HDR candidate choice and competition between providers. Australian universities will need to continue to provide a high quality research training environment to remain attractive to both domestic and international HDR candidates. To do this, the benchmark for what constitutes a high quality research training environment needs to be agreed and then measures developed to see the extent to which that environment is being delivered. The quality of research training can be assessed through mechanisms including student satisfaction surveys and other metrics such as completion rates, duration of candidature and employment outcomes, as well as through direct consultation with current and recent HDR candidates and their representative organisations.

The Council of Australian Postgraduate Associations has undertaken research to identify optimal research education experiences, and has identified best practice support for postgraduate research training in the areas of supervision, minimum resources, researching funding, and collegial environments⁶⁷. The final proposed Higher Education Standards Framework sets out the minimum acceptable requirements for the provision of higher education⁶⁸. These standards set out the need for institutions to provide a research training policy framework; a supervisory and study environment along with project resources; principal and associate supervisors; and induction into codes of conduct, ethics, health and safety, and intellectual property arrangements. These standards can be seen as the minimum level required in providing satisfactory research training environments, and are not necessarily indicative of world-class quality. Going beyond these minimum standards will help universities compete for the very best domestic and international HDR candidates.

The Australian Council of Graduate Research has published more detailed good practice principles, and these provide more extensive details in the areas of graduate research selection and admissions; facilitating completion; candidate development; resources and intellectual climate; research supervision; and thesis examination⁶⁹. These principles are seen as the consensus standards as practiced by most Australian higher education providers.

Measuring HDR candidate satisfaction with the quality of research and learning environments is an important way to assure quality, and the Postgraduate Research Experience Survey provides robust data on this. The results show an upward trend over the last ten years, with overall satisfaction levels with the quality of higher degree by research experience reported at 87%⁷⁰. The overall quality of research training in Australia appears to be very good from the HDR candidate's perspective, but this survey does not provide details about individual institutions, meaning it cannot effectively support choice.

There are a range of other indicators that should be used to help assure quality, including completion rates and times, as well as graduate outcomes. To ensure institutions provide a high quality research training and learning environment such outcomes could be linked to funding incentives. For example within the UK research system the Economic and Social Research Council has implemented a policy whereby institutions that

fail to achieve an overall four-year submission rate of 60 per cent become ineligible to receive new research council funded research doctorate studentships⁷¹.

8. MAKE THE BEST USE OF CURRENT RESOURCES INVESTED IN RESEARCH TRAINING BY ALL STAKEHOLDERS, INCLUDING UNIVERSITIES, INDUSTRY AND THE AUSTRALIAN GOVERNMENT.

Each year the Australian Government makes a substantial investment of over \$980 million in postgraduate research training through the research block grants. The components of the block grants supporting research training include the Research Training Scheme (RTS), the Australian Postgraduate Awards (APA), and the International Postgraduate Research Scholarships (IPRS). Funding amounts for each higher education provider through these programs are determined by a set of metrics⁷². The arrangements for block-grants are to be simplified and will be the subject of a separate review⁷³.

The RTS provides block grants to higher education providers to support research training for candidates undertaking research doctorates and research master's degrees. Through the RTS higher education providers will receive \$678 million in 2015 to support research training⁷⁴. Universities may supplement their RTS block grants with funding from other sources to increase RTS enrolments. On average, universities are funding 27% of the costs of research training from sources other than the RTS block grant⁷⁵. Research from Deloitte Access Economics (2011) shows that research training costs are more likely to be linked to the requirements of individual projects than certain disciplines, and that not only are there significant differences in costs across universities, but also within universities and within certain disciplines.

The RTS scheme allows domestic candidates to undertake higher degrees by research without paying tuition fees. In the 2015/16 Budget the Government signalled its intention to reduce the amount of support it provides through RTS, and to allow higher education providers to introduce a student contribution for RTS supported candidates. The maximum contribution rate would be \$3,900 per year for full time HDR candidates in a high-cost course, and \$1,700 for a low-cost course.

Support for international HDR candidates to meet the cost of tuition fees for higher degrees by research is made through the International Postgraduate Research Scholarships (IPRS). Through IPRS higher education providers will receive approximately \$22.2 million in 2015, and 330 new IPRS places will be provided in 2015. Applications for IPRS places are made by HDR candidates to higher education providers who in turn are responsible for determining awards. With just under 5,000 overseas students commencing a higher degree by research each year, the competition for these awards is very strong.

Australian Postgraduate Award (APA) scholarships are awarded to HDR candidates of exceptional potential undertaking a higher degree by research. The awards are available for both domestic candidates and also to international candidates in receipt of an IPRS. The purpose of the award is to assist HDR candidates in meeting their general living costs while undertaking research training. The awards are open to both international and domestic HDR candidates, and last for two years for a research master's degree, and three years for a research doctorate degree. In 2015 the Australian Government support through the program will be approximately \$280 million⁷⁶. The current value of an award held full-time is \$25,849 per annum, and 3,497 awards will be made in 2015. With over 9,000 domestic HDR candidates enrolling each year on postgraduate research courses about one-third of candidates will receive an APA. Some candidates may receive financial support through an award from a research council, CRC or other funding scheme, often as part of a wider research program.

Financial support for domestic HDR candidates differs from many other nations in that the support for tuition fees and cost of living expenses are separate. Within Australia, support for tuition fees is indirectly covered through the RTS, for all domestic HDR candidates. This support is neither means tested nor awarded on the basis of ability (except to the extent that university policy dictates a minimum standard or other competitive process for acceptance into an HDR program), while support for living costs are provided through the APA on a

competitive basis. In contrast, government support for doctoral HDR candidates in United Kingdom comprises tuition fee and income support and is allocated on a competitive basis. Support through scholarships awarded by universities within the United States varies, and can be awarded on the basis of excellence and need.

These contrasting systems are likely to impact on postgraduate research training recruitment in different ways. A lower financial entry barrier to commencing a research degree, and the incentives within the system for universities to increase research degree completions might increase the number of commencing candidates. However this may result in a reduction in the quality of candidates, and an increase in candidates commencing without the financial capacity to see the program through to completion.

Alternative approaches that concentrate research training support for HDR candidates by providing a greater number of fully funded scholarships covering both tuition fees and living expenses might allow a greater number of high-quality candidates to be recruited. This approach should provide these candidates with a better opportunity to complete their research training with fewer financial pressures. Although this approach might increase quality of candidates and experience, it would likely see reduced access to research training opportunities from those unable to secure a scholarship. The impacts on the quality of recruitment and completion of different approaches need to be better understood to ensure funding is being targeted most effectively.

APPENDIX 1 – SELECTED HIGHER DEGREE BY RESEARCH DATA

Field of Education	Doctorate by Research	Master's by Research	Percentage of total HDR completions
Natural and Physical Sciences	1,748	207	21
Information Technology	313	45	4
Engineering and Related Technologies	1,113	245	15
Architecture and Building	99	18	1
Agriculture, Environmental and Related Studies	344	51	4
Health	1,140	220	15
Education	482	95	6
Management and Commerce	592	65	7
Society and Culture	1,615	227	20
Creative Arts	341	249	6
Food, Hospitality and Personal Services	0	0	0
TOTAL^(a)	7,787	1,422	100

Table 2 HDR completions by field of education in 2013. Source – Department of Education (2015) *Selected Higher Education Statistics – 2013 Student Data: 2013 Award completions*

Age Group	Doctorate by Research	Master's by Research	Percentage of HDR domestic students
Under 30	12,562	2,084	34
30 to 39	10,367	2,064	29
40 to 49	6,718	1,398	19
50 to 59	4,768	912	13
60 and over	1,920	381	5
TOTAL	36,364	6,861	100

Table 3 Age profile of domestic HDR students in 2013. Source - Department of Education (2015) *Selected Higher Education Statistics 2013 Student Data: 2013 All students*

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ENDNOTES

- ¹ See Appendix 1 for further details
- ² This outcome is taken from the AQF level 10 criteria descriptor. See Australian Qualifications Framework (2015)
- ³ Higher Degree by Research students are postgraduate students undertaking a research doctorate or research masters degree. Depending on the structure of degree this can also include some professional doctorates.
- ⁴ Group of Eight (2013)
- ⁵ Collinson, J.A. (1998)
- ⁶ Kiley (2014); For a specific example see Australian National University (2015)
- ⁷ Roberts Review (2002)
- ⁸ Humphrey et al (2012); RCUK (2015)
- ⁹ Humphrey et al (2012).
- ¹⁰ Louw & Muller (2014)
- ¹¹ Louw & Muller (2014).
- ¹² Kiley, M. (2009)
- ¹³ Holbrook et al (2015)
- ¹⁴ Holbrook et al (2015)
- ¹⁵ ANU (2012); Regional Universities Network (2011) citing estimates made by the Deans and Directors of Graduate Studies
- ¹⁶ McCarthy & Simon (2007)
- ¹⁷ Purcell, Durbin, & Warren (2005)
- ¹⁸ Neumann & Tan (2011)
- ¹⁹ Haynes, Metcalfe & Videler (2009)
- ²⁰ King (2008)
- ²¹ Giret (2005)
- ²² Nerad et al (2007)
- ²³ Neuman (2003)
- ²⁴ Royal Society (2010)
- ²⁵ Purcell, Durbin & Warren (2005)
- ²⁶ Borrell-Damian (2009)
- ²⁷ Edwards, Bexley, & Richardson (2010); DIISR (2011); Group of Eight (2013); Australian Council of Learned Academies (2012)
- ²⁸ Neuman (2003)
- ²⁹ Nerad, et al (2007)
- ³⁰ Neumann, R. & Tan, K.K. (2011)
- ³¹ Borrell-Damian, L. (2009)
- ³² HDR students that have been a part of an industry collaboration program are more likely to report satisfaction with their research training, see Council of Australian Postgraduate Associations (2012). Doctoral candidates participating in collaborative programs with industry have been reported to value the expanding range of employment opportunities the collaboration brings. See Borrell-Damian (2009)
- ³³ Edwards, D., Bexley, E. & Richardson, S. (2010)
- ³⁴ Australian Council of Learned Academies (2015) shows that Australian businesses collaborate less with higher education or public research institutions than their international counterparts.
- ³⁵ Department of Education and Training (2015)
- ³⁶ The CASE studentships is also known as a Collaborative Studentship
- ³⁷ Engineering and Physical Sciences Research Council (2015)
- ³⁸ Department of Education (2014)
- ³⁹ Case study examples of such initiatives are outlined in Department of Education (2014)
- ⁴⁰ Group of Eight (2013)
- ⁴¹ Department of Education (2013)
- ⁴² Department of Innovation, Industry, Science and Research (2012)
- ⁴³ DAAD (2014)
- ⁴⁴ DAAD (2014)
- ⁴⁵ DAAD (2014)
- ⁴⁶ For example see Lancaster University management School (2015)
- ⁴⁷ For example see Newcastle University (2015)
- ⁴⁸ See Macquarie University (2015)
- ⁴⁹ An overview of PhD by publication is provided by Jackson, D. (2013)
- ⁵⁰ DIISR (2012) states that in 2009-10, 1,219 FTE PhD students were supported in a Cooperative Research Centres, while CSIRO sponsored 375 and supported 733 PhD students
- ⁵¹ Typical requirements for undertaking a PhD at an Australian university are available at University

of New South Wales (2015) and Australian National University (2015a)

⁵² For example Macquarie University now offers two-year full-time Master of Research (MRes) programs replacing most honours programs as the main pathway to a PhD. See Macquarie University (2015)

⁵³ For example see Australian National University (2015b)

⁵⁴ Roberts Review (2002)

⁵⁵ See Macquarie University (2015)

⁵⁶ A typical pathway to a PhD in the US is outlined by UCLA Anderson (2015)

⁵⁷ Devlin, M. (2010)

⁵⁸ Department of Education and Training (2013a)

⁵⁹ Definitions on each of the non-traditional background groups can be found in Department of Education and Training (2013a)

⁶⁰ Regional and remote is define using the MCEETYA classification. See Department of Education (2013a) for further details

⁶¹ The national science and research priorities are: food, soil and water, transport, cybersecurity, energy, resources, advanced manufacturing, environmental change, and health.

⁶² A description of the Field of Education (FoE) codes is available from the Australian Bureau of Statistics (2001)

⁶³ Department of Innovation, Industry, Science and Research (2011)

⁶⁴ Department of Innovation, Industry, Science and Research (2011)

⁶⁵ Bell et al (2009)

⁶⁶ For example a recent report from the Australian Academy of Science highlights the persistence of such issues as well as potential responses. See Australian Academy of Science (2015)

⁶⁷ Council of Australian Postgraduate Associations (2012)

⁶⁸ Higher Education Standards (2015)

⁶⁹ Australian Council of Graduate Research Inc (2014)

⁷⁰ Graduate Careers Australia (2013)

⁷¹ Economic and Social Research Council (2015) *PhD submissions rates*. ESRC: Swindon.

⁷² Details of the calculation methodology are outline at Department of Education and Training (2015a)

⁷³ Department of Education and Training (2015b)

⁷⁴ Department of Education and Training (2015c)

⁷⁵ Deloitte Access Economics (2011)

⁷⁶ Details of the funding provided through the university research block grants is available from Department of Education and Training (2015d)