REVIEW OF AUSTRALIA'S RESEARCH TRAINING SYSTEM – CONSULTATION RESPONSE FORM

Please read the submission guidelines before completing and submitting this form. This form should be submitted through the consultation website. **Submissions should be evidence based, provide examples where possible, and address the consultation questions.**

YOUR DETAILS

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EXECUTIVE SUMMARY

Please provide an executive summary of no more than 300 words of your submission

The ATN has often said that there must be a rebalancing of the national research agenda to underpin Australia's economy and future prosperity. Research must be considered in the global context, but there must also be consideration given to employability of HDRs both in industry[1] and academia. This speaks to both the ability for graduates to be prepared for employment in a range of sectors, and the need for Australia to ensure that research human capital is placed in the right areas to enable an effective innovation system.

The ATN are strong advocates of ensuring that research graduates are trained for diverse careers. It is particularly important that we inspire research graduates to seek employment beyond academia, and that we create new pathways to enable these graduates to be employed in industry or create their own enterprises.

The ATN acknowledges that this review runs concurrent with the Ian Watt review on Research Policy and Research Block Grant arrangements, and sits in the context of the Government's broader Industry Innovation and Competitiveness Agenda.

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[1] For the purposes of this submission, 'industry' is broadly defined as 'end-users', including businesses, NGOs, public services, state-owned enterprises, and private entities.

It is timely to review research training in parallel with these related reviews, strategies and initiatives to ensure that it continues to play its role in sustaining Australia's capacity for innovation[2].

RESPONSES TO CONSULTATION QUESTIONS

PRODUCING HIGH QUALITY RESEARCHERS

Question 1 - What are the research skills and experiences needed to be an effective researcher?

The current Higher Degree by Research (HDR) training system in Australia produces graduates with a unique skillset, whose defining feature is the creation of new knowledge. Therefore, at the conclusion of their research degree, HDR students must have developed highly specialised skills, knowledge and expertise relating to their specified field of research.

The Australian research training system produces a great number of talented researchers, but more needs to be done to ensure that our future research workforce are able to understand and connect with the wider world and the end-users of the knowledge that they create.

Both fundamental and applied research have huge potential value to Australia and the world. Currently, the balance between the two is under close political and policy-setting scrutiny. To be an effective researcher, individuals must both understand, and have experienced firsthand, that fundamental and applied research are inextricably linked: that research can be conceived, designed and applied to answer real-world problems, and that the process of striving to understand the world and answer real-world problems will lead to deeper and more sophisticated discoveries in fundamental research.

A key ambition for Australia's research training system should be to ignite passion in participants- for them to emerge from their training having seen for themselves, and thus come to deeply believe, that research makes a difference to our society. It is this passion in action which will mean we achieve real value in our return on investment in research and research training in Australia.

It should be noted that the highly developed critical thinking and data analytic skills that the Higher Degree by Research (HDR) training system provides are crucial elements that underpin the development of real-world innovative technologies and solutions, alongside scholarly and academic professional pursuits. To that end, the ATN are not advocating for change in the quality aspect of research training. However, the ATN believes that while the integrity of the research scholarship should remain intact, research training should also, where possible, equip graduates with the appropriate and relevant employability skills in order for graduates to become effective researchers throughout their careers. These skills include the ability to communicate research to both technical and non-technical audiences, sound business and financial management skills and knowledge, and higher order project management skills.

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[2] Palmer,2013, http://www.cshe.unimelb.edu.au/research/policy_dev/docs/Tert_Edu_Policy_Aus.pdf

It is also important to provide opportunities for research students to better connect with industry and other non-academic enterprises during their studies. This will ensure that research graduates are able to integrate into industry and society the exciting new knowledge coming out of the research sector, and can use their knowledge of the challenges and opportunities facing the world beyond their institution to inspire and shape their research endeavours.

Question 2 - What broader transferable qualities do HDR graduates need to develop to succeed in a wide range of career pathways? Should these skills be assessed, and if so, how?

In answering this question, the ATN is responding to the issue of transferrable *skills* and their assessment, as well as desirable *qualities* in HDR graduates.

It has been well noted that the majority of PhD graduates will not go on to a career in academia. As such, the ATN firmly believes that HDR training should be a process designed to both train researchers, and to train people to think and operate *like* researchers (to create, analyse and apply new knowledge and approaches) in non-academic careers. The HDR training system should be designed to provide the intellectual challenge of contributing to the generation of new knowledge in a field of interest, in coexistence with a professional education experience that prepares graduates for a diverse range of careers.

As such, HDR programs should encompass a broader range of professional and transferrable skills than is current standard practice.

As mentioned in the discussion paper, the ATN Industry Doctoral Training Centre (IDTC) offers a unique approach to HDR training in Australia. The key intent of the program and model is to produce highly skilled researchers who are prepared equally for a career in academic research or for pathways into industry. Notably, every student in the program has an industry partner and their research is centred on addressing an industry problem. However, as well as the industry-driven research project, additional technical and professional/transferrable skills are taught via coursework, along with a cohort training approach whereby students in the IDTC join together two to three times a year for conferences, training and other activities.

Transferrable qualities or 'soft-skills' that IDTC graduates are required to develop include negotiation skills, networking, and the ability to communicate research to both technical and non-technical audiences.

The IDTC model acknowledges that despite HDR training being traditionally thought of largely as an individually-driven and at times solitary endeavour, work today in both academia and business requires a more broad range of skills to operate successfully. The ATN, in addition to its strong advocacy of the IDTC model as a successful approach that teams industry and academia, also believes that much more should be done to incorporate many of the elements of the IDTC model into the standard PhD program in Australia.

An example delivery model for achieving broad reach in teaching these transferrable skills is the ATN's e-Grad School Australia (eGSA), an online graduate school headquartered at ATN member university, Queensland University of Technology (QUT). The eGSA provides HDR students (both PhDs and Masters) training in professional skills with short, online modules such as *Project Management*, *Leadership and Communication*, *Research Commercialisation*, *Entrepreneurship*, *Public Policy*, *Global Sustainability*, *Developing Your Career and Career Portfolios*, *Critical and Creative Thinking* and *Practice Led Research*.

The eGSA has been successful since its inception in 2003, with over 8000 HDR students completing eGSA training courses across Australia and New Zealand. Those who successfully complete the modules are awarded Completion Certificates. Based on survey results from students who have taken eGSA courses in the past 8 years, more than half cited wanting more than research skills from their higher research degree as the top reason for taking eGSA course(s). Other reasons for undertaking courses included: addressing skills gap, improving CV/career prospects, and learning specific skills.

Research training could also beneficially involve discipline-specific technical skills, as valued by particular industry sectors. For example, IDTC research students in the fields of mathematics and statistics recently received cohort training in '*R programming language*' as part of their cohort experience. 'R' is the language and software environment for statistical computing/graphics commonly used by academic statisticians, and increasingly being used as standard in industry. While it is not expected that students will develop advanced proficiency in these technical skills, exposure to industry standards and industry practice during research training is beneficial.

There are many qualities that are important to nurture and grow in HDR graduates, which will broaden their appeal to employers and enrich their research or other careers. Relevant qualities include: individuals who are comfortable with the concept of career mobility (moving between traditional research sectors, industry, the public sector etc); an appetite for innovation and the associated judgement of risk; commitment to the principles and practices of knowledge transfer; a collaborative attitude and approach to research and other professional practices (sharing knowledge and resources); and an appreciation and degree of comfort with the cultural differences between business and academic environments.

Question 3 - What other broader capabilities should HDR graduates develop during their research training?

See response to Question 2.

Question 4 - What skills and capabilities do employers in Australia need from HDR graduates?

ATN's engagement with industry has revealed that employers greatly value graduates that are job-ready and can 'hit the ground running'. This expectation is increased when it comes to HDR graduates, who command higher salaries commensurate with their high level qualifications, but who may not in practice have the familiarity and confidence to operate at full professional capacity on entrance to the workforce.

In 2012, the Business/Higher Education Roundtable (B-HERT) held workshops bringing together business and university representatives to discuss the value of HDR graduates. The report of the workshops [3] highlighted teamwork, communication, interpersonal and negotiation skills, strong analytical and critical thinking skills, data analysis, predictive modelling and decision-making as desirable capabilities needed by HDR graduates.

With the rapid pace of change in how enterprises and thus jobs and the workforce are structured, future careers and job requirements will look very different to today. Communication skills will remain important, alongside increasingly sophisticated abilities to filter and manage high volumes of information.

It is of importance to note that skills in not just using, but building digital technology, including programming and coding will become paramount across a diverse range of professions. The capacity to manage large and complex data sets will be required across a far wider range of sectors and by a far greater proportion of employees.

The ATN also acknowledges that, given that the median age for new postgraduates was 34 years of age in 2011,[4] some students are likely to have come to a HDR program with a wide range of previous experiences, and an array of the skills mentioned above, alongside other relevant professional attributes.

Question 5 - What research skills and capabilities are needed to ensure Australia's research system remains internationally competitive?

For an internationally competitive research system, global collaboration will remain crucial- it strengthens the quality, depth and relevance of research outcomes, drives improved rankings and ensures our national borders are porous, to attract, develop and retain outstanding talent from around the world.

Any national research system must be strategically aligned to matters of national priority. In Australia, we have a designated set of National Research Priorities to guide this effort. It should be noted here that our Australian priorities are, in large part, not unique to Australia – they receive the

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[3] Business/Higher Education Roundtable (B-HERT), 2012, **Research Skills for an Innovative Future: Business Views and Needs - Final Report**
[4] Postgraduate Destinations Report 2011 Tables & Figures

focus of researchers and governments worldwide, so structuring our research system to address them should yield dividends both domestically, and in our international standing.

Question 6 - What research skills and capabilities are needed from HDR graduates to ensure Australia is ready to meet current and future social, economic and environmental challenges?

In order to meet the challenges of a growing knowledge economy, research training (where possible) should be aligned to areas of national priority. As identified in a Deloitte Access Economics study commissioned by the Chief Scientist[5], the areas of science, technology, engineering and mathematics (STEM) are key skill areas needed by business and industry.

Highly developed knowledge in predictive modelling, optimising logistics, analysing customer trends, and harnessing the potential of big data will become increasingly important in an economy disrupted by technology. For example, in the financial services industry, digital transformation is driving a technology spending growth of 4.9 per cent in the Asia Pacific[6], as organisations seek to understand how to best adapt to the needs of technology savvy customers.

Skills in mathematics and statistics are at the heart of this transformation, and although not immediately apparent, also underpin innovation activities in other sectors. For example, the Red Cross is an industry partner in the ATN's Industry Doctoral Training Centre, with a PhD student currently involved in a research project investigating mathematical modelling to improve blood supply. This example highlights how STEM skills will become critical in improving Australia's capacity for innovation given their cross-disciplinary potential.

The situation is similar in other developed economies. In a study by the McKinsey Global Institute, it is estimated that by 2018, the US economy will have a shortage of 140,000 to 190,000 people with the analytical expertise of mathematics and statistics and a shortfall of another 1.5 million managers and analysts with the skills to understand and make decisions.

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[5] Office of the Chief Scientist, 2015, STEM skills in the workforce: what do employers want?
[6] Forrester Research, 2014, Predictions 2015: Mobile Customer Experience Will Fuel Digital Transformation In Asia Pacific

Question 7 - What features of the research training system should be retained to ensure our graduates are internationally competitive?

The ATN recognises that the PhD is a globally recognised qualification, and as such, the quality aspect of the research training system should be preserved, as highlighted in the response to Question 1. High quality scholarship, the publication and dissemination of research findings, and support to build networks in global academies of discipline specialists should remain important elements of research training.

Question 8 - How should the research training system be structured to produce high quality researchers who can contribute to Australia's future prosperity and wellbeing?

As previously discussed, the ATN advocates for greater integration of industry experience into the training of research students. This can be achieved by:

- **Co-creation of research projects with industry** – this gives research students the experience of communicating and working across industry and academia. Industry presence in a project can also lead to work integrated learning opportunities. This is also a way of showcasing the potential value of these graduates to a broader range of potential employers than those that they might otherwise interface with.

- **Incentivising businesses to offer work experience/placements** for research students (these could be aligned to short-term projects). In the Deloitte Access Economics survey[7], while employers reported to valuing work placements for preparing students for work, only 140 of 502 respondents offered structured placements. Successful work experience/internships with industry have the potential to create long-term relationships and more easily allow research graduates pursue a career in either academia or industry;

- **Adjusting and revitalising R&D tax incentives** and other grants/offsets available to incentivise industry to undertake joint research with publicly funded research organisations, and for employers to engage newly qualified researchers into their enterprises; and

-**Standard contracts** that facilitate the set-up and monitoring of research and research training activities occurring collaboratively between industry enterprises and research institutions.

In terms of structure, models such as Cisco's AUSTEM 2020 are worth considering for scalability to increase Australia's capacity in science, technology, engineering and mathematics (STEM). Technology company Cisco has committed to a projected $21 million investment in the Cisco Networking Academy® program over five years to train some 100,000 students via public-

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[7] Deloitte Access Economics, 2015, Australia's STEM Workforce: A survey of Employers, http://www2.deloitte.com/au/en/pages/economics/articles/australias-stem-workforce-survey.html

partnerships with not-for-profit higher education providers and schools in industry relevant, job-ready technology skills.

This initiative will see:

•   5,000 students connected to STEM career and job opportunities by 2020 through the 'Find Yourself in the Future' program to be offered to Cisco® Networking Academy students, who are coming up to the final stages of studies and making plans for entry into the job market;

•   500 students participating in the Cisco Live Melbourne 2015 Student Summit engaging existing and new STEM students in how technology will shape the future; and

•   an AUS2020 mentoring commitment with 20 per cent of Cisco Australia staff providing 20 hours of mentoring to existing and prospective tertiary education and school STEM students, totalling some 5,000 mentoring hours per year.

Another example is the Australian Mathematical Sciences Institute's AMSI Intern program, which links postgraduate students and their university supervisors with industry partners through a 4-5 month research-focused internship.

The ATN believes that Government should consider funding APA scholarships for four years. Currently, funding allocated by Government to support HDR training via the Research Training Scheme (RTS) grants students exemption from tuition fees to study for up to four years full-time equivalent for a research doctorate degree and up to two years full-time equivalent for a Masters degree by research. Yet the standard APA scholarship funding for a PhD is only for three years. In order to successfully accommodate industry experience through work placements/internships, and/or additional training and education in generic and transferrable skills, it may mean that HDR degree durations are increased up to four years.

Further to the current Australian research training system encouraging PhD students to be trained within three and three and a half years, there are additional structural factors placing pressure on the students, supervisors and universities to have doctorates completed within the given timeframe. For example, student completions account for 50 per cent of the performance index in the allocation of funding from the Research Training Scheme.[8] While the ATN acknowledges that encouraging the successful completion of research degrees is important, there should be flexibility in the system to allow for ancillary training to occur.

The former Commercialisation Training Scheme (CTS) could be reinstated to act as a specific scholarship to support HDR students taking time out of their research program to engage in skills training relevant to specific areas of industry and business. The CTS previously provided training to assist research students with the skills required to commercialise their research. Training was provided in the areas of:-

-        Commercialisation know-how (a strategic understanding of commercialisation processes);

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[8] The ATN will take up the matter of research funding further in the Watt review of Research Funding and Policy Arrangements

- Technical commercialisation skills (e.g. intellectual property management, financial management, project management and market research); and

- Organisational behaviour skills (e.g. leadership, teamwork and presentation skills).

(The ATN provides many of these skills through the ATN e-Grad school.)

Creating HDR programs that resonate with industry and respond to corporate concerns, such as being able to commit to the longer timeframes of research projects, and ensuring that students are a good fit for their organisations, are important considerations. Flexibility of approach will be important, e.g. offering the opportunity to pause Research Training Scheme participation in order to complete a period of placement in industry, with scholarships in place to incentivise such undertakings.

Question 9 - How can entry and exit pathways to and from research training be better structured?

The ATN advocates for the introduction of support mechanisms to ensure that the 'human capital' of researchers produced from the research training system is strategically mobilised.

Given that research and knowledge transfer between industry and academia is a big contributor to innovation, more should be done to provide clear employment pathways and incentives for industry to employ HDR graduates.

One way of enabling mobility of researchers between academia and industry is to provide financial incentives for businesses to hire recent HDR graduates that offset hiring expenses and salaries that constrain the hiring of more highly qualified, and thus more expensive staff.

More could also be done to communicate the value of HDR graduates to industry. Increased emphasis on the transferrable skills and capabilities mentioned previously would only add to the value proposition for research graduates.

More diversity in pathways to HDR education should be encouraged. Examples like Kristin Carson, current Young South Australian of the Year, show that individuals can successfully undertake HDR degrees and move onto promising careers in research, when they come through non-traditional pathways, such as working at entry-level support roles in research organisations. Alternately, as demonstrated by the ATN's Industry Doctoral Training Centre, industry-based employees can successfully undertake HDR programs, sponsored and supported by their employers, and undertake research investigations that are of benefit to their organisations.

Question 10 - How can barriers to participation in HDR programs be overcome so that more candidates from non-traditional backgrounds, including indigenous students, undertake research training?

Given that entry requirements for most HDR degrees in Australia includes some form of prior education at a tertiary institution (usually the completion of Bachelor degree with Honours or equivalent), the issue of barriers to participation in HDR programs needs to be looked at as a pipeline issue.

In considering approaches to removing barriers to participation in research training by underrepresented groups, it is clear that different strategies can be undertaken at different levels to:

1. Increase the chances of candidates from non-traditional backgrounds to view higher education as a legitimate prospect during early years;

2. Provide incentives and support for different pathways to research training, including returning to education; and

3. Support students from non-traditional backgrounds who are enrolled, to remain in the higher education system.

The ATN will speak to each of these in turn, focusing on participation of indigenous students

Firstly, critical support must be given at the secondary school and pre-undergraduate level to create the aspiration for individuals from non-traditional backgrounds to pursue a higher education and/or research degree. Initiatives such as the 'Bridges to Higher Education'[9] – made possible by the Commonwealth Government's Higher Education Participation and Partnerships Program (HEPPP) – provides one such opportunity, and the ATN supports possible expansion of this program nation-wide.

ATN member university, University of Technology Sydney (UTS) participates in 'Bridges to Higher Education', engaging with primary and secondary schools, TAFE and community partners in the Greater Western Sydney area to reach out to those who are underrepresented in higher education.

A KPMG independent evaluation found that every dollar invested in disadvantaged areas over the duration of the three-year initiative (2012 to 2014) generated an estimated $6.00 return to the community, including those in Greater Western Sydney, the Aboriginal and Torres Strait Islander community and remote and rural areas. The total return to these areas was found to be in the order of $54 million. At the student and community level, other significant outcomes were achieved including:

• 97% students seeking information about university options after participating in Bridges;

• 93% students reported to being better prepared for university;

• 70% students reported to having improved motivation to continue to year 12; and

• 83% students had greater school engagement (reported by teachers).

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[9] http://www.bridges.nsw.edu.au/

In addition to barriers to participation *prior* to commencing higher education, there are challenges involved with improving the attrition rates of students from non-traditional backgrounds enrolled in higher education[10]

In relation to intentions for leaving university early, students who were from low—SES backgrounds, non-metro regions and indigenous groups were more likely to cite financial difficulties, family responsibilities, health or stress, workload difficulties and the need to be in paid work as reasons for considering early departure from university, compared to the more commonly cited reasons by high SES, metro and non-Indigenous students, whose top reasons included boredom, lack of interest, change of direction, career prospects, other opportunities and gap year/deferral.

The Review of Higher Education Access and Outcomes for Aboriginal and Torres Strait Islander People (2012) aimed to increase participation of Indigenous students and staff in line with the representation of the Indigenous Population in Australia, with an initial target of 2.2% based on 2006 Census data.[11] Key recommendations from the Review included using that population parity rate[12] as the target universities should adopt for the proportion of domestic students undertaking higher degrees by research or research training programs.

The NHMRC provides a strategic example framework of improving the health of Indigenous people through research, with one of the key areas of action aimed at "increasing participation by Aboriginal and Torres Strait Islander researchers in NHMRC programs and in health and medical research generally." [13] Some of these initiatives include NHMRC funded research conducted by UniSA researchers which brought together experienced health researchers to support indigenous scholars complete PhDs in strategic areas of community Indigenous Health. [14] These indigenous scholars undertook coursework to increase their research skills as part of a bespoke PhD. The project acknowledged that the research transfer, mentorship and capacity building are important considerations in improving access outcomes.

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[10] National Centre for Student Equity in Higher Education (NCSEHE), 2015, Completing University in a Growing Sector: Is Equity an Issue?

[11] Review of Higher Education Access and Outcomes for Aboriginal and Torres Strait Islander People: Final Report, 2012, https://docs.education.gov.au/system/files/doc/other/heaccessandoutcomesforaboriginalandtorresstraitislanderfinalreport.pdf

[12] Proportion of the population aged between 15 and 64 years that is Aboriginal and/or Torres Strait Islander according to ABS population statistics

[13] NHMRC 2010. The NHMRC Road Map II: A strategic framework for improving the health of Aboriginal and Torres Strait Islander people through research.

[14] https://devl.ands.org.au/minh/registry/registry_object/view/115161

Further supporting information not covered in your answers to the consultation questions should be provided here