

**REFLECTIONS ON THE
NATIONAL RESEARCH INTERNSHIPS PROGRAM**

Reflections on the National Research Internships Program

Australian Mathematical Sciences Institute

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1 Background

The origins of the AMSI National Research Internships Program (*NRIP* or *the Program*) lie in the Australian Council of Learned Academies (*ACOLA*) *Review of Australia's Research Training System*, the parallel *Watt Review on Research Policy and Funding*, an election commitment in 2016 and a government announcement in November 2016.

The *ACOLA Review* (see Appendix A) said that Higher Degree by Research (HDR) candidates “benefit from industry placements”, and “there would be value in a national industry placement scheme of significant scale and scope through a national coordinating body”, remarking that no “such at-scale system” then existed. The *Watt Review* (see Appendix A) also recommended “Australian Government funding ... to create a small Programme to support universities to increase numbers of industry placements for PhD students”.

In July 2017, Commonwealth funding was provided through this grant to expand the existing AMSI PhD internship program with a particular focus on supporting more women into STEM careers.

On November 18 2019, the Minister made a decision to reduce the size of the grant. He further advised that his Department would work with AMSI to revise the NRIP Conditions of Grant to reflect the reduced funding amount and ensure the program achieves its objectives. The Revised Conditions of Grant were signed by the Grant delegate, following consultation with AMSI and the University of Melbourne as lead agent, on December 3 2019.

This document provides summary information, explanations and reflections on progress in the Program and AMSI endeavours towards achieving the goals of the Program¹. It is based on data up to December 31st 2019, gathered via:

- Exit surveys issued to academic mentors, interns and industry partners;
- Impact statements by industry partners

This document should be considered in relation to Program Implementation Plans provided to the Department of Education prior to November 23 2019.

2 Summary

As detailed in section 3, there are many outstanding outcomes from the Program. Satisfaction ratings from interns, academic mentors and industry participants have been 99 to 100 per cent.

The internship has been *important* or *very important* to prepare for future employment according to 91 per cent of interns. Amongst *those seeking work* at the end of the internship², 69 per cent were offered paid employment and 47 per cent obtained it in industry in a position directly related to the study/discipline of their PhD.

¹ It was designed for use by the Delegate in considering whether to approve Annual Reports 1 and 2 and Interim Report 3 of the Grant, but also provides information that may be of broader interest.

² *Those seeking work* are all responding to the exit survey except those returning to study or not looking for work. The statistics in this sentence refer to all interns whereas the statistics in the next paragraph refer only to female interns.

Placement of women into STEM careers has received an important boost with 73 per cent of *those seeking work* offered paid employment at the end of internship. Further, 46 per cent were offered a job in an industry relevant to the study/discipline of their PhD.

The Program has furthered the goal of strengthening partnerships between universities and the broader community. Exit surveys of industry partners and academic mentors show that the Program is generating many new collaborations between universities and industry that have potential to continue. While 41 per cent of industry partners had previously had *little* or *no* experience working with universities, more than half intended to continue the collaboration after the internship. The Program is recommended to others by 99 per cent of industry partners, with 67 per cent highly recommending it.

The Program is very well regarded by academic mentors³ with *all* recommending the Program to others. The academic mentors concur with industry that the Program is generating many new relationships that have a potential to continue, with 75 per cent of academic mentors not having had a previous relationship with the industry partner. After completion of the internship, more than half of academic mentors intended to proceed with the industry collaboration.

Support for the work of the NRIP team in establishing and supporting the internships is very strong. Industry partners found the NRIP team support to be very good or excellent in 85 per cent of internships. The academic mentors rated the support from the team as very good or excellent in 89 per cent of internships. Of the interns, 92 per cent found the support to be very good or excellent.

The target of placing 1400 PhD students into internships has proven to be challenging, and at 31 December 2019, the total number of NRIP internships stood at 322. It was apparent then that several factors made the target of 1400 unattainable in the time frame. The major factors affecting this are the mismatch between internship opportunities and the number of qualified students, and the difficulties faced by universities in timely access to the Program.

There has, nevertheless, been an important shift in the mindset of a significant number of industry partners regarding the value of PhD-level problem-solving and the benefits of the Program to their industries. Universities have been slower to respond, though progress is being made.

The NRIP Program *is* creating the change desired by the Reviews cited in Appendix A. To realise the benefits of this work, it is recommended that the Program be continued as follows.

³ Each student in an NRIP placement with an industry partner has an academic mentor, usually from the PhD course in which they are enrolled. This person is often, but not always, the PhD supervisor of the student and their role is to supervise the research and education inherent in the internship.

3 The Program to Date

Additional Information on Performance

In terms of numbers alone, the NRIP Program has fallen well short of the yearly targets of 100 in 2017 and 200 in 2018.

With the benefit of hindsight, the overall target of 1400 placements by the end of 2020 has proved overly optimistic. The 1400 target was based on the previous take-up of the AMSI Intern Program and the Canadian MITACS⁴. There are substantial differences in the university research environments in Canada and Australia and it was difficult at the time of setting the target to predict the systemic challenges detailed in Section 0.

Statistical modelling on the intern data to the end of June 2018 led to the conclusion that 700 is an achievable target with substantial changes in program delivery.

There have also been encouraging signs that the Program is creating broad-based, significant change in the PhD internship environment. A broader range of universities have begun to access NRIP opportunities and the overall female participation rate in the Program rose from 22 per cent in 2017 to 50 per cent in 2019.

AMSI strongly supports the Program focus on increasing female participation in STEM careers. The target of 50 per cent female STEM interns is being approached with great focus from the NRIP team, a substantial marketing effort and STEMFEST special events in 2018 and 2019.

The target of 50 per cent female STEM interns, together with the cap on international participation in the Program, has reduced the size of the available pool of PhD students to meet all the KPIs. Nevertheless, in 2019 the Program has managed to deliver significantly increased gender balance in STEM areas, particularly in some areas with historically low female participation.

In the Natural and Physical Sciences, 18 out of 41 internships (44 per cent) were filled by women, compared to 47 per cent of HDR completions in these areas (according to 2018 Higher Education statistics). In Information and Computing Sciences, female Program participation was 50 per cent (10 out of 20 internships) compared to 29 per cent of HDR completions in Information Technology. Engineering typically has low female participation (26 per cent of HDR completions in 2018), however in 2019, 18 out of 48 internships in Engineering and Technology (38 per cent) were carried out by women. In the area of Agriculture and Environmental Studies, female participation amounted to 74 per cent of internships, compared to 50 per cent HDR completions. Overall, in 2019 female representation in STEM NRIP internships (49 per cent) outperformed female participation in the combined HDR completions in STEM (44 per cent of STEM HDR completions) for the first time.

⁴ <https://www.mitacs.ca/en/research-internship>

Benefits of the Program have emerged that were not directly reflected in the KPIs. These include:

3.1.1 Improving recognition of benefits of PhD skills

The ACOLA and Watt reviews refer to the importance for Australia of better understanding of the value of PhD level research skills. Comments to NRIP staff suggest the Program has been successful in moving industry partners from initial scepticism to recognition of the benefits of PhD level research skills. The outcomes of about three quarters of intern projects (74 per cent) were implemented by the industry partners. Many industry partners expressed sincere appreciation of the skill sets, attitudes and commitment of the interns, with 85 per cent indicating that the intern's expertise was an important factor in increasing the likelihood of a successful internship.

3.1.2 Improving university processes for PhD student industry experience

Progress has been made within several universities towards smoother and more efficient internal processes to facilitate industry experience for PhD students. Some universities have adopted their own internship schemes modelled on NRIP. Of the academic mentors, 87 per cent indicated that the Program has been successful in facilitating job readiness of PhD graduates for industry and/or resulted in employment for the student. According to academic supervisors, the internships provided added value to the student's PhD program by providing students the opportunity to apply their research skills in industry situations (81 per cent), by developing new technical competencies (74 per cent) as well as soft skills to improve work-readiness (67 per cent).

3.1.3 Developing links with Australia's top employers of PhDs

The partnership of NRIP with over 22 per cent of Australia's Top 50 Employers of PhD graduates outside universities and research institutes shows that the Program is successful in developing closer links with the employers that matter most for PhD graduates⁵.

⁵ The CSIRO Ribit/AMSI study *Advancing Australia's Knowledge Economy: Who are Australia's Top PhD Employers?* (McCarthy and Wienk) is available at https://amsi.org.au/wp-content/uploads/2019/04/advancing_australias_knowledge_economy.pdf

3.1.4 *Research for the common good*

In line with the original intent of the *ACOLA Review*, the Program has been successful in producing significant research for the common good of many communities⁶. The Program has also made contributions to Australia's national security through dozens of defence science and industry internships.

Six NRIP internship projects illustrate the diversity of objectives serving the common good⁷:

- Life Saving Victoria and Swinburne University of Technology have the overall objective of providing evidence-based recommendations to the National Aquatic Industry Safety Committee as to the most appropriate ratio of pool lifeguards to patrons in public swimming pools to maximise safety
- The Tropical Mind and Brain Foundation and James Cook University aim to collect and initially analyse baseline data for the Townsville Mentally Healthy City Project, a crucial step for this 12-month universal mental health initiative
- CSL Limited, the University of Melbourne and RMIT University helped explore the expression of various cytokines, their receptors and related molecules in the blood of asthmatic donors
- Environment Protection Authority, Victoria and Newcastle University aimed to characterise the major sources of microplastics entering aquatic environments in Victoria to better regulate and mitigate plastic pollution
- The Western Bulldogs Community Foundation and Victoria University researched a program that focuses on sport, not as a competitive activity, but as a cultural process. The program aims to provide settlement support to promote economic, social and personal wellbeing, independence and community connectedness. It is delivered across 35 different venues in collaboration with English language school settings. It is therefore ideally suited to integrate with the curriculum to provide young people with cultural tools to learn about themselves, meanings of sports, and to negotiate home and receiving community culture
- The NSW Office of Environment and Heritage and The University of New England will focus on a series of clearly defined elevation, topography and geological transects across Kosciuszko National Park with the aim of determining key features relating to the nature, distribution and vulnerability of these unique soils

⁶ 23 community benefit internships are described in <https://www.dropbox.com/s/vcp5u13c79roh9y/NRIPpercent20Reportingpercent20-percent20percent27Forpercent20thepercent20Commonpercent20Goodpercent27.pdf?dl=0>

⁷ The tense in each project reflects its status as completed, current or about to start at the time of writing

Impact on Students, Academic Mentors and Industry Partners

The positive impact of the Program for both students and industry partners is clear from the testimonials from both parties at the conclusion of internships - these are overwhelmingly positive and supportive. The Program continues to receive positive media coverage in a wide range of quarters.

Two case studies taken from the CSIRO Ribit/AMSI study *Advancing Australia's Knowledge Economy: Who are Australia's Top PhD Employers?*⁵ illustrate these positive impacts.

Fuel loss in underground fuel storage

Fuel loss in underground fuel storage at service stations is important for economic, environmental and regulatory reasons. PhD student, Roshan Kumar, at La Trobe University researched this with industry partner Environmental Monitoring Solutions (EMS). With the guidance of his academic mentor, Luke Prendergast, Roshan utilised machine learning and software development skills. Erica Scott, EMS Operations Manager, appreciated the outcome: "Roshan's project not only achieved its aim of identifying influences of known fuel system losses, but uncovered new information leading directly to broader benefits in terms of environmental impact". Roshan summarised the benefits: "The internship provided me with an opportunity to hone my programming skills and learn new concepts, while attempting to manage the complexities of real-world situations. It was a great transition from the academic environment, which makes the education experience more wholesome".

Asset management, visualisation and machine learning

Hosna Tashakkori, a PhD student at the University of Melbourne, was recruited as an intern by global engineering and infrastructure company, Aurecon, to conduct research on three client projects across asset management, 2D and 3D information visualisations and machine learning. Hosna summarised her learning: "The most important thing I learnt in my internship was how to work in an agile and changing business environment, to be bold in presenting innovative solutions but at the same time understanding that any solution developed to an industry problem, no matter how good it is, needs to be applicable and practical for delivery". Slaven Marusic, Aurecon Digital Insights Leader commented on the Program: "The most valuable part... has been the opportunity to source research expertise, from across multiple disciplines to meet some of the most complex challenges in industry. Internship project outcomes are having an immediate impact with our clients and within Aurecon."

The value of linkages forged via the Program for both the university and PhD supervisor goes beyond the immediate outcomes for intern and industry partner. The PhD supervisor benefits by the possibility of new research contracts through the connection with the industry partner. Knowledge of a PhD supervisor's industry connections can be a potential attractor of future PhD students. The industry partner gains access to the PhD supervisor

and their research group, thus facilitating possible future mutually beneficial interactions. Most of the internships involve interactions that were made possible exclusively through the NRIP facilitation.

The next three subsections provide further details of the benefits of the program for industry partners, interns and academic mentors. Together they show that support from all parties is very strong.

3.1.5 Industry partner benefits

Business outcomes⁸

About three quarters of internships (74 per cent) have resulted in outcomes that were implemented by the industry partner. Industry partners typically reported multiple positive impacts resulting from the internship. Most frequently, internships resulted in significant progress towards a research problem (64 per cent of internships), followed by improvement of an existing process (42 per cent) or enhancement of a product or service (38 per cent). In 27 per cent of cases the internship led to the implementation of an entirely new process, and in 25 per cent to a new product or service.

Knowledge transfer

In addition, impact statements provided by industry partners at the completion of intern projects uncovered knowledge transfer as another key benefit of internships. Business access to new and state-of-the-art knowledge translated into software scripts, data interfaces, help documents for employees, or transferred through participation in research workshops and team discussions complemented and added to in-house skills and knowledge at the industry partner.

Recruitment

With 40 per cent of interns going back to university for continued study after the internship, the use of the program by industry partners as a possible recruitment vehicle is somewhat limited. In 71 per cent of cases, no hires were made as a result of the internship. However, in the 29 per cent of cases where hires were made, the position usually went to the former intern. This happened in 25 per cent of cases, with the position newly created for the intern in 18 per cent.

Collaboration with universities

In 41 per cent of internships the industry partner had little or no previous experience working with university-based researchers, even though 75 per cent of industry partners indicated they were already moderately (25 per cent) or very (50 per cent) active in Research and Development. However, after completion of the internship 54 per cent intended to collaborate further on the current research project or new collaborative ventures. Where industry partners had worked extensively with university-based researchers before, the wish to continue collaborating was as high as 63 per cent. However,

⁸ The data in this section on industry partner benefits result from 153 industry partner exit surveys of internships with start and end dates between 01/01/2017 and 31/12/2019, as well as analysis of 50 randomly selected impact statements supplied to AMSI after internship completion. The figures reported in this section provide an update to those reported in the previous version of this document.

even from internships where no previous collaboration with a university existed, 51 per cent resulted in the intention on the part of the industry partner to continue working together.

Industry partner satisfaction

Given the clear benefits, industry partners' satisfaction with the NRIP program is extremely high:

1. In 99 per cent of internships, industry partners were satisfied with the Program.
2. In 94 per cent of internships industry partners intended to use the Program again.
3. 99 per cent would recommend or even highly recommend (in 67 per cent of cases) the Program to others.

3.1.6 Intern benefits

Improved work-readiness⁹

While many interns indicated they had had some prior professional work experience, a significant minority of interns – 25 per cent – indicated that the internship was their first work experience in an industry setting. A further 26 per cent had only had work experience as a tutor or lecturer. For many, an internship was therefore their first introduction to industry and a possible professional career.

Most interns reported multiple employment-related reasons to embark on an internship, such as gaining industry experience (73 per cent), professional development (72 per cent), development of technical skills (69 per cent) and so forth. However, the opportunity to apply their research in a “real-world” industry situation (71 per cent) or to work on an interesting research problem (62 per cent) also appealed to many PhD candidates. The possibility of financial support was important for only 32 per cent of interns. Note that only 23 per cent reported that the internship was recommended by their academic supervisor.

Interns and industry partners agreed that internships developed workplace skills in multiple ways:

- 86 per cent of interns and 73 per cent of industry partners agreed that internships provided understanding how the interns' skills are relevant in industry;
- 64 per cent of interns and 73 per cent of industry partners indicated that the internship fostered understanding of commercial imperatives such as meeting deadlines and managing stakeholders;
- Development of other workplace skills reported by the majority of interns and industry partners included working in a multidisciplinary team, communicating with management and so forth.
- Nearly 91 per cent of interns found the internship important (37 per cent) or very important (53 per cent) to prepare for future employment.

Employment

⁹ The data in this section on intern benefits result from 139 intern exit surveys of internships with start and end dates between 01/01/2017 and 31/12/2019. The figures reported in this section provide an update to those reported in the previous version of this document. .

Only 60 per cent of interns were available for employment immediately after the internship, with 40 per cent returning to study. However, of those available for employment, 69 per cent of interns had found it at the time they completed the exit survey, 47 per cent in a non-academic position related to the intern's study or discipline.

The former interns in employment found that the internship had helped them to obtain their current position in multiple ways. More than 82 per cent reported that it had benefited them by providing industry experience. According to 72 per cent of former interns, the internship helped them to identify transferable skills, and according to 65 per cent it provided networking opportunities. The majority of interns agreed that it had increased their competitiveness against other candidates and had helped them to gain confidence.

Intern satisfaction

The Program has been overwhelmingly popular with students, who mostly expressed exceedingly positive feedback:

1. *all* but two expressed satisfaction with the Program resulting in an overall satisfaction rate of 99 per cent.
2. 96 per cent of interns indicated that the internship had met (58 per cent) or exceeded (38 per cent) their expectations
3. 96 per cent said that the internship was an enjoyable experience
4. 85 per cent of interns would highly recommend the Program to others, with the remaining 15 per cent recommending it.

3.1.7 Academic mentor benefits

University outcomes¹⁰

Academic mentors regarded the enhanced PhD student employment outcomes to be the most important benefit for the university, with 87 per cent reporting improved student work-readiness, student employment or both. In 41 per cent of internships, academic mentors even reported student-related outcomes to be the *only* university benefits.

According to the mentors, the most important ways that internships added value to PhD programs was through the opportunity for students to apply research skills in an industry situation (81 per cent), and through development of new technical (76 per cent) and soft skills (67 per cent).

Other benefits recognised by academic mentors that were not directly related to the student were the opportunity to collaborate with industry, either in a new collaboration (32 per cent) or by sustaining an existing relationship (25 per cent).

Collaborations with industry

For academic mentors, the internship for the most part provided a new introduction to industry, as in 75 per cent of internships the academic mentor had no relationship with the

¹⁰ The data in this section on academic mentor benefits result from 103 academic mentor exit surveys of internships with start and end dates between 01/01/2017 and 31/12/2019. The figures reported in this section provide an update to those reported in the previous version of this document.

industry partner yet. After completion of the internship 53 per cent of academic mentors intended to continue collaborating on either the current research project or new collaborative projects. Of the academic mentors without a previous relationship with the industry partner 44 per cent intended to continue collaborating after the internship, increasing to 75 per cent if a relationship with the industry partner already existed.

Professional benefits to academic mentors

About 83 per cent of academic mentors benefited professionally in some way by assuming the mentorship. The intern project contributed to the mentor's research track record in 37 per cent of internships. Recognition of the mentorship in the academic's teaching record or performance appraisal also occurred in 43 and 27 per cent of internships. To academic mentors, there was not one clear professional benefit shared by most, although most did report one or two positive impacts to their own career. However, 17 per cent of academic mentors participated in the program despite not perceiving any professional benefit to themselves, in order to support the students' employment or work-readiness.

Academic mentor satisfaction

Academic mentors have been very supportive of the Program and have been highly satisfied with it:

1. *all* expressed satisfaction with the Program in the exit survey
2. 95 per cent of academic mentors would use the Program again
3. *all* would *recommend* the Program to others and 75 per cent would *highly recommend* it

3.1.8 Benefits of the NRIP program structure

The service provided by the NRIP Program encompasses a framework to enable and streamline PhD industry placements, with the following features:

- Recruitment assistance across all universities
- A contractual, administrative and financial framework
- Academic mentoring of the intern in addition to industry partner supervision
- Dedicated Program staff to support the process in all stages
- Financial incentives for industry partners and payments to interns and academic mentors.

The exit surveys and individual feedback from participants in the Program provide some evidence of the advantages of the setup of the NRIP Program and the characteristics contributing to successful and rewarding internships.

The framework provided by the Program model and the financial incentives in the form of a subsidy, rebate or voucher scheme were regarded by industry partners to be important or very important factors in their decision to proceed with an intern project, in 60 and 59 per cent of internships respectively. In 48 per cent of internships the industry partner also regarded the access to the program's university network as important or very important. Only in 31 per cent of cases did the industry partner consider the R&D tax incentive to be important for their decision.

For 49 per cent of academic mentors the prospect of receiving the \$5,500 academic mentor payment was important or very important in their decision to take on the mentorship, with an additional 33 per cent rating it somewhat important.

The Program's initial project planning process to manage expectations and provide a clear strategy for the internship was strongly supported. The industry partners found this process to be effective (65 per cent) or very effective (31 per cent) in 96 per cent of cases. According to the academic mentors, the planning process was effective or very effective in 96 per cent of internships as well, with 55 per cent even rating it as very effective.

The interns highly appreciate the guidance and support received from both industry supervisors and academic mentors. Of the interns, 96 per cent indicated that the support they received from their academic mentor met or exceeded their expectations, while in 93 per cent of internships the support from the industry supervisor met or exceeded expectations.

To industry partners, factors which increased the likelihood of a successful internship were first and foremost the expertise of the intern (in 85 per cent of cases) followed by the delivery of results in a short-term, tightly focused project (69 per cent). A third factor of relevance was the time spent by the intern onsite at the industry partner (69 per cent).

Throughout the whole process, the professional support delivered by the Program team is highly regarded. Industry partners found this support to be very good or excellent in 85 per cent of internships. The academic mentors rated the support from the team as very good or excellent in 89 per cent of internships. Of the interns, 92 per cent found the support to be very good or excellent.

Systemic and other challenges

This section details challenges that are specific to NRIP as well as challenges that arise from the higher education system in Australia.

3.1.9 Ambitious initial target

Because students complete an internship just once and only students with a strong chance of completing their PhD are selected, the size of the pool of potential interns is about the same as the number of completions in a year. Given the Program design to focus on domestic STEM students, the pool of potential interns should be compared to the estimated total number of domestic STEM PhD completions in a year. This is

estimated to be 2988¹¹. In this light, the placement of 521¹² domestic STEM internships in 2020 would require 17per cent of the pool of domestic STEM students to undertake an AMSI internship.

3.1.10 Current levels of female STEM participation in PhD programs

Modelling¹¹ suggests that about one in five of the pool of potential domestic female STEM PhD students would need to undertake an internship to meet the implied target of 280¹² domestic female STEM internships in 2020. Further, the data shows that in 2019 43 per cent of all NRIP placements are female STEM, even though just 27 per cent of postgraduate research completions in the most recent available year, 2017, were female STEM, illustrating the success of the marketing cited in Section 4.4. Given only 33 per cent of the combined 2017 completions in Natural and Physical Sciences, Information Technology and Engineering and Related Technologies were female, it would be necessary to have many internships in Health to reach the 50 per cent female STEM target. PhD students in Health often already have industry partnerships with hospitals, public health institutions or medical research institutes. Hence, their appetite for an internship is more limited, and the industry partner opportunities are also similarly limited.

3.1.11 Slow take-up of NRIP in some universities

Traditionally, PhD research has been focused on academic objectives as noted by the reviews described in Appendix A. The Program was set up to offer a broader opportunity to PhD students during their PhD. All universities maintain their focus on the academic quality of the PhD thesis and many on timely completions, so many have been slower to embrace the aim to broaden the post-PhD opportunities available to students through internships. The 2017 Scholarships Guidelines¹³ which govern the \$1bn of Research Training Program funding oblige universities to have an RTP Scholarships Policy which includes “arrangements for optional industry placements, research internships, professional practice activities or other similar enrichment activities undertaken as part of a HDR, including information on any impacts on duration in relation to subparagraph 1.6.5 and RTP Stipend rates in relation to subparagraph 1.6.10”. The understanding and implementation of this obligation varies very widely across universities. This has proved a barrier in implementation of the Program.

¹¹ The modelling data sources are completions and enrolments data from 2017, and available at the following websites: <https://www.education.gov.au/student-data>, <https://docs.education.gov.au/node/51321>, <http://highereducationstatistics.education.gov.au/>.

¹² The target in the original Conditions of Grant was 700 internships in 2020 with 93per cent (current percentage from Table 1) in STEM and a cap of 20per cent of international students. This makes a target of 521 = 700 x 0.8 x 0.93 domestic STEM PhD students. With 50per cent to be female STEM, this makes a target of 280 = 350 x 0.8 female domestic students.

¹³ <https://www.legislation.gov.au/Details/F2016L01602>

3.1.12 Different levels of support for NRIP in the one university

Approval and implementation processes within the university can involve multiple staff in different parts of the institution, ranging well beyond the PhD supervisor and academic mentor. Variable support for the Program within an institution causes friction that can make the Program difficult to operate. In several cases, there has been strong support at one level of the university, but other levels have not been as supportive.

3.1.13 Competition from some university programs

At least two universities have set up programs for PhD internships that do not charge any fee to the industry partner for administration, but the industry partner does not receive the rebate on the scholarship component. Such university schemes effectively operate in competition to the Program.

3.1.14 Differing PhD Regulations in different universities

The 31 universities that have engaged with the Program have differing approaches to industry placements for their PhD candidates. The differences include approaches to the questions of timing, duration, approvals, motivation and incentive. In some cases, internal rules can vary among schools and faculties of the same university. Following considerable concern and confusion amongst universities, faculties and PhD supervisors, the Department and AMSI sent detailed advice on 5 July 2019 to universities on opportunities and policies on internships in the Research Training Program¹⁴. It will take some time for the various parts of universities to absorb this advice and adopt it in their regulations and processes.

3.1.15 Completion policies of some universities do not assist NRIP

Some universities have policies that focus on completion of the PhD within four years despite absence of such regulation or explicit financial incentive in the Research Training Program. These policies, combined with the financial pressure of the fixed duration of most PhD scholarships, can inhibit students in taking up the NRIP opportunity.

3.1.16 Discipline norms can reduce the potential pool of interns

In some of the more experimental disciplines, the role of the PhD researcher as one contributor in a broader research group may restrict student access, because of issues of timing and the availability of a suitably qualified academic mentor. PhD supervisors want the best for their students, and this can lead to a focus on completion of their PhD in the minimum time required to produce a high-quality thesis. Since published research is important for research careers, making the time to publish can mitigate against the PhD supervisor encouraging the student to take an internship. Only 23 per

¹⁴ This advice was sent through the Australian Council of Graduate Research in an email from their executive officer. The document was originally generated by AMSI but checked and revised by the Department of Education.

cent of interns have indicated they took on an internship on the recommendation of their academic supervisor.

3.1.17 Application of the Fair Work Act 2009 to NRIP in light of recent cases

Outside the PhD, there have been a number of recent high-profile cases and media coverage on student internships. Concern has centred on whether in some cases internships may constitute an employment arrangement under the Fair Work Act 2009. These cases have prompted some industry and university partners to raise queries regarding the NRIP Program. This has created delay and loss of placements.

3.1.18 Delays in the program

With any new program of such an ambitious scale and complexity, there have inevitably been delays in implementation. These have contributed to the number of internships being lower than might otherwise have occurred.

3.1.19 Desire of universities to be paid for their administrative costs

Some universities report that they have no capacity to conduct any necessary liaison with AMSI in administration of the internship. In some cases, they have requested additional payment to compensate for administrative burden, overlooking the fact that RTP and RSP funding could be used to cover any costs.

3.1.20 Block allocation not successful

A pilot project to allocate batches of internships to participating universities was trialled from November 2018 to April 2019. Twenty-one universities made a commitment to work with AMSI to produce 197 internships. Initial feedback on the 5 resulting internships indicated that the timelines were too short and that there was some resistance from PhD supervisors, while middle managers were reluctant to facilitate due to the administrative burden placed upon them, consistent with the challenges reported in 4.3.5, 4.3.6, 4.3.7 and 4.3.11.

3.1.21 Business Developers' challenging role

The success of the NRIP Program rests significantly on a cohort of committed and enthusiastic Business Developers (BDs). Their job involves bringing together both the supply and demand ends of complex and often ambiguous business and higher education landscapes. It can take a BD over a year in discussion with an organisation to place an intern. It can also take a BD considerable time to develop networks and understand university processes including the culture of the PhD.

3.1.22 Matching opportunities to student availability

This is a constant source of challenge for the potential intern and PhD supervisor, industry partner and NRIP staff alike. Factors which influence availability of students

include the need for concentrated research in the PhD, as well as policies in universities that may support these legitimate aims of students and PhD supervisors. Most interns tend to time the internship towards the end of the PhD, with 60 per cent of former interns becoming available for employment after completion of the internship.

Other Achievements Relevant to the KPIs

3.1.23 An expanding framework of MOUs and partnerships

The NRIP delivery team constantly tests and adjusts its methodology. A central feature of this transformation in the last 12 months has been many MOUs with defence and research organisations as well as partnerships with employers who have the capacity to take PhD students in batches, with some bodies even incentivising their members to access Program benefits through voucher programs. Partners that have committed to ongoing involvement in the Program include the Victorian Comprehensive Cancer Centre, the Defence Science and Technology Group, Aurecon, Telstra and CSL.

3.1.24 Collection and analysis of valuable business intelligence

Program management information is now being effectively captured, analysed and applied through a specially developed database. This information includes participating students, academic PhD supervisors, parent university and geographic location, as well as industry/government agency partner details, impact of the internship and testimonials from student and industry sponsor alike.

3.1.25 Marketing and communications success

AMSI's team of marketing professionals has produced impressive, measurable results. The NRIP marketing efforts, focusing especially on attracting female STEM PhD students to the Program, have been very successful. At the end of the Open up Your World campaign, which ran from 1 April 2019 to 8 August 2019, the following statistics were collected about website visits:

1. 70,879 sessions, 46 per cent increase on last year
2. 43,898 new users, 43 per cent increase on last year
3. 27,035 returning visitors, 50 per cent increase compared to same time last year
4. just 11.4 per cent left the site straight away, compared to 63 per cent last year
5. the most visited pages were available internships 37 per cent, followed by the APR homepage 18 per cent
6. the gender split in visitors was even.

Next Program Implementation Update

The next Program Implementation Update will include plans on the following items.

3.1.26 Increase training of Business Developers on academic culture and processes

Business Developers (BDs) come from a variety of backgrounds. An essential requirement is that they be able to encourage involvement of industry partners in the Program, developing a research project relevant to the industry partner, discussing the best discipline fit and explaining the benefits of hosting a PhD student in their organisation to conduct the research. Many of the BDs have limited exposure to the specific academic culture and processes of PhDs in the universities where they are working. The academic culture varies widely across disciplines as do the local processes. These local processes and cultures often affect the timing of internships, the attitudes of students, PhD supervisors, faculty and central deans of graduate studies and administrative areas. More professional development, from experienced professional trainers, on academic motivations, goals, attitudes, culture and processes will assist in meeting the systemic challenges documented in Section 3.

3.1.27 New methods for business development

The proposed methods include the use of contractors, multiple internships within one research collaboration, and possibilities for re-investment of rebates in collaborative research. Some recent trials with using contractors rather than BDs to help place interns have not been as successful as first hoped with the contractors finding the challenges very difficult. The Program already has a number of memoranda of understanding with external agencies such as the Defence Science Institute. Typically, these involve an industry partner or partners and established research connections in universities. These connections can be used to locate multiple internships over a period with the one research connection, opening up opportunities for research teams to work on larger scale and challenging industry relevant problems through multiple internships. One other possibility to be implemented is simplification of processes for the industry partner to re-invest their rebate in further research – this could provide incentives to facilitate more collaboration, especially when an internship has been very successful.

3.1.28 Work further with universities on intern policies and practice for PhD students

The requirements of the Research Training Program through the Commonwealth Scholarships (Research) Guidelines (2017), especially clause 1.6.45 (11) concerning internships for research higher degree students, have recently been further explained in detailed advice on 5 July 2019 to universities on opportunities and policies on internships.¹⁴ AMSI will work with all universities to help them apply the advice given the substantial opportunities that the Program offers to universities, PhD supervisors and students, since it is clear that further work is needed to overcome systemic challenge 3.3.6. AMSI will investigate whether it is possible to have one point of contact in each university with sufficient authority to facilitate problem resolution. Ideally, the Department could request

universities to include NRIP internships as part of their required regular reporting on internships.

3.1.29 Review the Conditions of Grant, operational processes and guidelines

One of the aims of the revisions is to make very clear the position that the internship does not constitute an employment relationship under the *Fair Work Act 2009*. In particular, the revisions of the operational processes and guidelines will ensure that each internship is being conducted, on the ground, in a way that minimises the risk that it could be construed as an employment relationship. Implementation of these recommendations will provide the best assurance to industry partners and universities that the NRIP-sponsored PhD research conducted in the internship is fully compliant with the *Fair Work Act 2009*.

3.1.30 Retain Staff in 2020

It is important that the current staff who are very experienced remain with the program throughout 2020. Various ways to keep staff engaged in the program for the whole of its duration will be planned and implemented in 2020.

Appendix A — Academic and Government Background

In 2015, the Australian Council of Learned Academies (ACOLA¹⁵) was commissioned by government to conduct a *Review of Australia’s Research Training System*¹⁶, whose terms of reference included that it should:

- ensure that Australia’s HDR training models are comparable with the best in the world
- ensure that research graduates are equipped for and achieve employment outcomes in a range of sectors, including academic teaching, research and industry
- provide greater opportunity for industry relevant HDR training, including through
 - support for industry relevant research projects and experience
 - access to industry and business relevant skills within HDR training Programs, such as entrepreneurial skills.

The review worked in tandem with a review of *Research Policy and Funding Arrangements*¹⁷ whose aims included that it should:

- ensure the quality and excellence of Australian university research and research training
- provide incentives to universities to increase and improve engagement and collaboration with business and other end users.

Among other recommendations, the ACOLA *Review*¹⁶ identified in Key Finding 6 that:

“HDR candidates benefit from industry placements, and there would be value in building a national industry placement scheme of significant scale and scope through a national coordinating body. No such at-scale Australian placement system currently exists, although there are several small-scale, unaligned schemes. Other countries have been successful in developing large-scale industry placement systems, from which Australia can learn international best practice. Placements should not be mandated, but every HDR candidate who wishes to undertake a placement should be encouraged to do so. Placement schemes must balance the interests of HDR candidates appropriately with their industry partners and enhance the HDR training Program.

¹⁵ The Australian Council of Learned Academies consists of the Australian Academy of Science, the Australian Academy of Humanities, the Australian Academy of Social Sciences and the Australian Academy of Technology and Engineering

¹⁶ The review is at <https://acola.org/wp-content/uploads/2018/08/saf13-review-research-training-system-report.pdf>.

¹⁷ The review was conducted by Dr Ian Watt AO and assisted by an expert working group comprising Professor Peter Coaldrake AO, Vice-Chancellor of the Queensland University of Technology, Professor Edwina Cornish AO, Provost and Senior Vice-President of Monash University, Professor Sandra Harding, Vice-Chancellor of James Cook University, Mr Connor King, Executive Director of the Innovative Research Universities group, and Professor Steven Schwartz AM, Executive Director of the Council for the Humanities, Arts and Social Sciences, and former Vice Chancellor of Macquarie, Brunel, and Murdoch universities.

The report is at https://docs.education.gov.au/system/files/doc/other/main_report_final_20160112.pdf.

With a majority of HDR graduates moving into careers outside university research, providing candidates with an opportunity to collaborate with industry partners can help improve their future employability while giving industry an insight into the benefits of employing researchers. Industry placement schemes for HDR candidates are already a common approach to this within Australia and overseas, but existing Australian programs are generally small in scale and scope.

There can be significant barriers to delivering meaningful industry placements from the perspective of both HDR candidates and industry partners, and a larger-scale national scheme would help to overcome these. A national placement scheme run by a dedicated intermediary organisation would help to facilitate the process of matching industry partners with HDR candidates, relieve administrative burdens for both universities and industry partners, and provide a simple, uniform default approach to intellectual property issues.

Such approaches have been successfully developed internationally; with examples such as Canada's Mitacs Accelerate Program now supporting over 3000 HDR candidates in industry placements per year. To be broadly successful, a national industry placement scheme must be open to all disciplines and industry sectors" (*ibid*¹⁶ pp. xiv-xv).

AMSI had placed 44 such interns through such a scheme in the years 2008-2010, with a strong emphasis on the mathematical sciences. With the backing of the financially-invested member universities, the Program was expanded to permit students from all disciplines and all sectors, which saw the placement of a further 136 interns from 2011 to 2016, 85 per cent of which were in STEM.

The *Review of Research Funding and Training Arrangements* included Recommendation 11 that:

"Australian Government funding of \$12.5 million per annum be provided to create a small Programme to support universities to increase numbers of industry placements for PhD students. The Programme should commence in 2017 and the Department of Education and Training should develop the details of the new Programme arrangements in consultation with the university and business sectors." (*ibid*¹⁷ p. vii).

A commitment was made during the election campaign by PM Malcolm Turnbull: "Women make up only around one quarter of the STEM workforce and with 75 per cent of the fastest-growing industries requiring STEM skills, it's clear there's still work to be done. To support more women to be able to take advantage of those opportunities the Coalition has committed \$28.2 million to provide 1,400 internships for PhD researchers ... The Coalition's \$28.2 million evidence-based STEM internships investment is proven to work and will help the Australian Mathematical Sciences Institute expand its PhD internships to a national-scale Programme, supported by industry, with a particular focus on women researchers."¹⁸

¹⁸ <https://www.malcolmturnbull.com.au/media/supporting-more-women-and-girls-into-stem-careers>

This was followed up by a Government commitment in November 2016¹⁹ to fund the \$28.2m Program to deliver 1400 PhD internships using the AMSI model.

The number of 1400 internships is the target for the grant *Supporting more women in STEM careers: Australian Mathematical Sciences Institute (AMSI) National Research Internships Program*, which was signed on 27 May 2017, with initial funding arriving in July 2017.

The Government provided a legislative basis for research internships within higher degrees by research as detailed below.

The Government's Research Training Program supports the provision of the PhD degree at all Australian universities through the *Higher Education Support Act 2003*²⁰. The *Commonwealth Scholarships Guidelines (Research) 2017*²¹ provides the legislative basis for the provision of funding to this Program.

Under clause 1.6.45 of that policy "A HEP is responsible for the administration of RTP Scholarships and must make information about the processes, policies and conditions of scholarships readily and publicly available in an RTP Scholarship Policy. A HEP must make judgements, and provide support to students awarded RTP Scholarships, in accordance with its RTP Scholarship Policy."

Clause 1.6.45(11) provides that "A HEP's RTP Scholarship Policy must specifically identify... arrangements for optional industry placements, research internships, professional practice activities or other similar enrichment activities undertaken as part of a HDR, including information on any impacts on duration in relation to subparagraph 1.6.5 and RTP Stipend rates in relation to subparagraph 1.6.1

¹⁹ <https://amsi.org.au/wp-content/uploads/2016/11/tick-for-acolas-research-training-reform-proposals.pdf>

²⁰ <https://www.legislation.gov.au/Details/C2018C00312>

²¹ <https://www.legislation.gov.au/Details/F2016L01602>