

# Mapping the External Engagement of Australia's PhD Candidates

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## Executive summary

The 2015 ACOLA *Review of Australia's Research Training System* identified a strong need to increase and better support external engagement in research training. However, the review also identified an absence of baseline data on the current levels of engagement. External engagement is also poorly understood and narrowly conceptualised, often limited to formal resourcing and supervision arrangements in industries most relevant to science and medical research. External engagement must be understood from a broader perspective, including collaboration and exchange with government, community and not-for-profit sectors. External engagement activities also span a continuum from informal networking to formal research cooperation and co-funding of projects.

To fill this gap in baseline data on external engagement, the current project utilised a mixed-methods approach, surveying PhD candidates and supervisors at eleven universities, alumni at five universities and undertaking nine industry case studies. This report is dedicated to analysing the survey results received from over 3,700 PhD candidates. The views of supervisors, alumni and case studies are available in a supplementary report *PhD Supervisor, Alumni and Industry Perspectives on External Engagement*.

Taking a broad definition of external engagement activities and organisations, this research sought to provide data on:

- (1) the indicative numbers of PhD candidates engaged with external organisations;
- (2) the industry sectors with which they are engaged;
- (3) the extent of this engagement;
- (4) the broad fields of education by which engaged research is present;
- (5) the impact of this engagement on industry and external organisations; and
- (6) the career trajectories of PhD candidates.

Overall, our results confirm that external engagement is a minority activity amongst PhD candidates, but there is a range of activities and external resourcing arrangements which are currently unrecorded and potentially unrecognised by universities. External engagement is associated with a range of positive outcomes for PhD candidates. Those candidates engaged in deeper external engagements (i.e. paid/unpaid placements and collaborative research projects) report greater skills development, a wider range of career ambitions and increased motivation to complete their PhDs.

External organisations financially supported a minority of PhD candidates, but at rates considerably greater than otherwise reported. Of those of surveyed PhD candidates:

- 9% had received scholarships (living allowance/stipend);
- 6% were employed externally (incl. paid study leave);
- 7% had received grants (incl. research support, travel, conferences);
- 2% had received ARC Linkage scheme funds;
- 1% had received Cooperative Research Centre scheme funds; and
- 6% had received other financial support from external organisations.

While the above indicates limited external financial support, it exceeds estimates based on formal records. ACGR's survey of university central records (Stage 1 of the project) found less than 3% of research candidates (for whom records were held centrally) held scholarships funded by industry, engaged in approved internships in industry, or entered in IP agreements with external organisations. ACGR surmised that the levels of activity might be higher than central records indicate due records being held at school or department level. Our survey of PhD candidates demonstrates a greater level of external resourcing than previously estimated.

Most PhDs surveyed do not engage extensively with external organisations in formally recorded

ways and engagement varies by academic field. Only 2% of PhD candidates surveyed in humanities and social sciences (HASS) have external supervisors in non-university organisations, compared to 6% in science, technology, engineering and mathematics (STEM) and 8% in health sciences. PhD candidates are more likely to have informal advisors and collaborators in non-university organisations, but this only applies to a minority of candidates (14%). Nevertheless, few PhD candidates complete their research without external advice. Only 27% of PhD candidates surveyed reported no external contact or advice on their PhD from non-university organisations.

PhD candidates engage with external organisations across a range of activities and with varying levels of depth. Across all disciplines, candidates in our survey engaged with non-university organisations in the following ways:

- 21% engaged in research projects;
- 7% in paid/compulsory placements;
- 7% in unpaid placements;
- 18% wrote collaborative papers/dissertations;
- 39% attended lectures/seminars;
- 34% attended meetings/visits;
- 28% collected primary research data from external organisations;
- 20% utilised secondary data from external organisations; and
- 18% received advice on the structure of their PhD.

The above results underline the importance of utilising a broad definition when measuring external engagement, capturing the diversity of activities in different disciplines. While the ACOLA report and others have identified a relative weakness in Australian university-industry engagement on research training, the empirical basis for these claims is problematic. Even where data is internationally comparable, comparisons are generally drawn between universities and countries with different compositions of research students across disciplines. As this report shows, this has important implications because STEM and health PhD candidates are more likely to receive financial support and receive formal external supervision and placements, compared to HASS PhD candidates. This can easily skew international comparisons, as well as comparisons between Australian universities.

External engagement is associated with a range of knowledge and skills developments, particularly when PhD candidates engage in deeper external engagements (i.e. paid/unpaid placements and collaborative research projects). PhD candidates who reported deeper external engagements indicated that their contact with external organisations developed them in the following ways:

- 70% for contacts/networks outside the university;
- 68% for insight into relevant work;
- 60% for motivation to complete their PhD;
- 59% for practical skills;
- 46% for ideas that changed their PhD topic or methods;
- 38% for job opportunities after completing their studies;
- 33% for preparing for the transition from PhD to further employment; and
- 30% for ideas that changed their career plans.

PhD candidates with weaker external engagements were considerably less likely to report such developments. These results are consistent with other studies of PhD external engagement, but the relationship between external engagement and skills development remains an under-research area. PhD candidates with deeper external engagements were also more likely to report ambitions to work outside the public research sector post graduation, though they still retained strong commitments to an academic career. However, it is unclear how self-selection into external engagement may influence these findings.

Australian PhD candidates are well positioned to engage with external organisations, with 80% reporting professional experience prior to their PhD. Many candidates utilise this experience in their topic development, with 70% reporting that their PhD topic was influenced by prior working experience. This is a strong indication that PhD candidates engage with external organisations in ways not traditionally reported by universities. This was particularly the case for HASS PhD candidates, who are both more experienced and are more likely to collect primary data (36% of HASS PhDs) or secondary data (25%) from external organisations. These findings suggest many PhDs candidates, particularly in HASS, conduct research *on* industry rather than *with* industry. This finding was also corroborated in our PhD supervisor survey. Universities should consider how to better utilise PhD candidate prior professional experience and contacts in their supervisory arrangements and resourcing of their PhDs.

## 1. Introduction

The purpose of the project is to provide the Australian Council of Graduate Research with a robust, evidence-based appraisal of the present state of PhD candidate engagement with external organisations across the sector, as well as the potential impacts this engagement has had on graduates and external partners. The project explicitly defines external engagement broadly, including engagement with government, hospitals, schools, community organisations and the not-for-profit sector. This helps capture the range of external stakeholders who contribute and benefit from PhD training and graduates, beyond the traditional mining, technology and manufacturing sectors commonly associated with industry engagement. This broader definition is particularly relevant for PhD candidates in highly theoretical disciplines where the immediate benefits of the research are uncertain, and in the humanities and social sciences (HASS) where research often has community and social orientation. A key part of the project is also to theorise external engagement itself and the range of ways PhD candidates draw upon external expertise and collaboration.

The project uses a two stage, mixed-methods approach involving surveys of PhD students, PhD graduates and PhD supervisors, and selected case studies for industry impact. It seeks to identify six areas where baseline data on PhD engagement with industry are absent: (1) indicative numbers of current Australian PhD candidates engaged with industry; (2) the industries with which they are engaged; (3) the extent of this engagement; and (4) the broad fields of education by which engaged research is present. The project also seeks baseline data on: (5) the impact of this engagement on industry, and (6) the career trajectories of candidates. Due to the relatively small number of master by research students (10% of all Higher Degree by Research candidates in 2015), the shorter duration of their candidature, and complexity of disaggregating all responses for master versus PhD candidates, we have restricted our analyses to PhD data.

This report is dedicated to analysing the survey results received from over 3,700 PhD candidates. This includes a pilot survey of half of all PhD candidates currently enrolled at The University of Melbourne in 2016, and a full implementation for the population of PhD candidates at 10 other universities in 2017. The PhD candidate survey aimed to address the lack of baseline data for areas (1), (2), (3), and (4), and future career orientations of PhD candidates (6). The remaining areas of impact on industry (5) and actual career trajectories of graduates (6) are investigated through data from the PhD supervisor survey (at the same 11 universities), nine industry case studies drawn from the PhD supervisor survey, and a survey of PhD graduates at five universities (Curtin University, RMIT University, Victoria University and the University of Southern Queensland). The views of supervisors, alumni and case studies are available in a supplementary report *PhD Supervisor, Alumni and Industry Perspectives on External Engagement*. Therefore, the key deliverable we offer in this report is:

A report on levels of engagement with external organisations by PhDs

### 1.1 Background

In the Call for Expressions of Interest, ACGR outline the following problem:

**Problem:** The Australian Government seeks to increase the levels of industry engagement of HDRs, but it lacks baseline data on current levels of engagement.

The lack of baseline data on industry engagement and impact, effectively frame six research questions for this project:

1. How many current Australian PhD candidates are engaged with industry?
2. What industries are they engaged with?
3. What is the extent of this engagement?
4. What are the broad fields of education by which their research is categorised?

5. What is the impact of this engagement on industry?
6. What are the career trajectories of PhD candidates?

The ACGR has conducted a previous survey (referred to here as Stage 1 of the project) of member institutions to ascertain:

- The number of candidates who have entered into some form of student participation or IP agreement with the institution as a result of their research project involving a third party;
- The number of candidates holding scholarships that are managed by the university but fully funded by an industry sponsor (excluding international government sponsorships not tied to a specific industry);
- The number of candidates holding scholarships that are managed by the university and partially funded by an industry sponsor (excluding international government sponsorships not tied to a specific industry);
- The number of candidates who have participated in some form of approved internship program (including AMSI and ATSE programs);
- The number of candidates who have undertaken JRE cadetships.

Stage 1 aimed to address research questions 1 and 4, current levels of PhD candidate industry engagement by field of education. The Stage 1 results suggested only very small proportions – typically less than three per cent of research candidates – were involved in these activities. These findings do not accord with the level of activity that would be expected, and seem more likely to be indicative of low levels of information about activities available to central levels of university administration. The present study seeks to address this paucity of information.

In May 2016, ACGR retained the Melbourne Centre for the Study of Higher Education and the LH Martin Institute, both at the University of Melbourne, to conduct further investigation in to levels of industry engagement. Stage 2 involved a scoping study of engagement activities and a pilot survey of PhD candidates and PhD supervisors at The University of Melbourne in 2016, with an interim report completed for ACGR in October 2016. The pilot was mostly successful, but revealed a few areas in need of refinement prior to a full implementation of a national study in 2017 (Stage 3). Most notably, the term “industry engagement” was replaced with “external engagement” in the title of the project and the body of the survey questionnaires. It also included broadening the definition of “industry” from “firm or public sector organisation” to “non-university organisation” to capture not-for-profit and community organisations. These changes sought to better capture the breadth of external organisations engaging with PhD candidates, as well as minimise non-response bias from PhD candidates who do not consider themselves engaged with “industry” (narrowly defined), but who are engaged with external organisations more broadly.

The remainder of this report will present the results from the PhD candidate survey (Section 2). In addition to the final report, each participating university will have access to an anonymised unit-record data file for the PhD survey, facilitating comparisons between each university and the average for the sector.

The project and data protocols were approved by the Human Ethics Advisory Group at the Melbourne Graduate School of Education.



## 2. Study of PhD candidate perceptions of external engagement

The survey of PhD candidates sought to provide baseline data on the proportion of PhD candidates engaged with industry, the industries with which they are engaged, the extent of this engagement, and the broad field of the PhD candidates. The survey also includes information about intended career trajectories of PhD candidates and general satisfaction with their PhD candidature. This addresses five of ACGR's six research questions:

1. How many current Australian PhD candidates are engaged with industry?
2. What industries are they engaged with?
3. What is the extent of this engagement?
4. What are the broad fields of education by which their research is categorised?
6. What are the career trajectories of PhD candidates?

Data for each research question is presented in a disaggregated format by broad academic field (HASS, STEM and Health), addressing the fourth question's reference to engagement by field of education. Given that this survey is of PhD candidates, the career trajectories are anticipated, rather than actual.

The following section presents an overview of the theoretical approach, institutional sampling, survey implementation, sample characteristics, and results. Additional tables are available providing results by university group.

### 2.1 Theoretical approach

Industry and external engagement is poorly understood and narrowly conceptualised, particularly within research training schemes. At the research training stage, external engagement involves four partners: the firm or other external organisation, the university, the research supervisor(s), and the research candidate. Research students are core to this engagement because they perform three important roles: (1) producers of knowledge in collaborative projects; (2) transferrers of knowledge between external organisations and universities; and (3) vital parts of the network configurations between industry and universities (Thune, 2009).

There is no single model for external engagement, it can span a continuum from informal networking with no resource commitments, to formal research cooperation and collaboration involving extensive time and sharing of resources (Himmelman, 1995; RMIT, 2015). While greater positive effects have been found for deeper engagement activities, such as joint research projects and practice periods versus shorter forms of engagement (Thune & Støren, 2015), the outcomes are shaped by various nuances in the research training process. For example, the level of engagement and its effects can depend on who supervises the research (industry/external organisation, university or both), who defines the research problem (the student, the university supervisor or external partner), who owns the data, how disputes are negotiated and the physical location of the candidate (Thune, 2009, 2010).

The outcomes on student experience and careers are likely the result of an interaction between the types of engagement, the intensity and the preconditions to the engagement. Important preconditions include the industry sector of the engagement, the history of the partnership and the discipline of the research (i.e. whether industry external engagement is a "normalised practice"), as well as the previous professional experience of the candidate within the industry sector. In her review of studies of doctoral student engagement with industry, Thune (2009) summarises and conceptualises the university-industry interface along these three dimensions: preconditions, interaction and outcomes. This is relevant to our broad definition of external engagement and is presented in *Figure 1*.

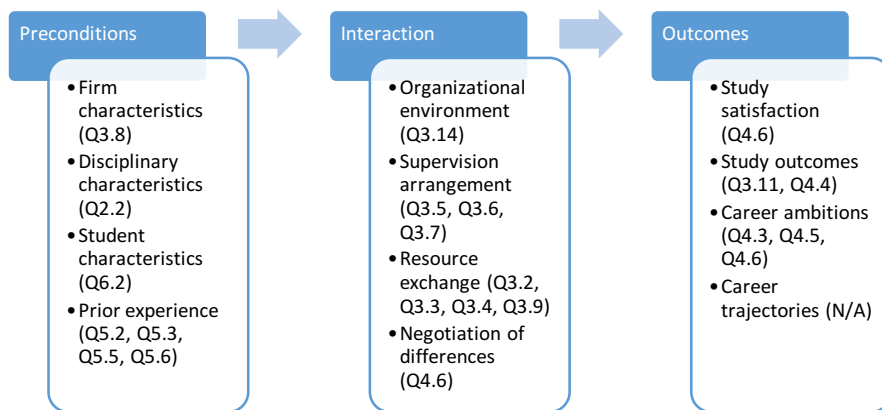


Figure 1. Main variables investigated in research on doctoral students on the university-industry interface

The survey instrument is mapped to Thune’s framework and we list in parentheses the survey questions relevant to each element of Thune’s framework. The variable reference in parentheses can be matched to the SPSS and Excel data files available to ACGR and participating universities. A copy of the PhD candidate questionnaire, including the variable references, is in Appendix A. Note that we do not include any variables for “career trajectories” because the survey was completed by current PhD candidates. Therefore, we are limited to the intended careers or “career ambitions” of PhDs, and whether external engagement is associated with different ambitions. The relationship between external engagement and actual careers, post-PhD completion, is part of Section 4 of this report (“Study of PhD alumni perception of external engagement”).

## 2.2 Institutional sampling

The project team sought to implement the survey at a representative sample of 12 institutions reflecting the diversity of Australia’s university sector. All Australian universities were invited by ACGR to participate in the project, but only 11 institutions offered to fully participate. Therefore, all 11 were included in the study, rather than a stratified random sample of 12 institutions.

The participating institutions are listed below in Table 1 based on key institutional strata of size (total students), research intensity (research block grant funding and total HDR population), region (metro, regional and remote students) and affiliation (Group of 8 [Go8], Australian Technology Network [ATN], Innovative Research Universities [IRU], Regional University Network [RUN] and unaffiliated). Our ratings for high/large indicate location in the top quartile of the indicator (i.e. in the top 10 Australian universities), medium indicates middle two quartiles (11th to 30th), and low/small indicates bottom quartile (31st to 42nd). Overall, the sample includes institutions in all quartiles on size, research intensity and region, and all affiliation groups. However, the sample underrepresents remote and regional universities. Due to the small number of RUN and unaffiliated universities in the sample (3 in total), these will be aggregated into a category of “other” for later results in order to maintain institutional anonymity.

The University of Melbourne (UoM) participated in the 2016 pilot, surveying half of the PhD population, but declined to participate in the full implementation for the remaining half of the population in 2017. The pilot results are included in this report for questions which were comparable. The change in terminology from “industry engagement” to “external engagement”, and from “firms/public sector organisations” to “non-university organisations” for key questions, may affect the Go8 results by slightly under estimating external engagement at UoM due to the narrower definition used. Please refer to the interim report for the sampling details at UoM.

Table 1. Participating PhD candidate survey institutions by key institutional strata

	Size	Research intensity		Region	Affiliation
		Research Block Grant	HDR population		
<b>The University of Melbourne *</b>	Large	High	Large	Metro	Go8
<b>The University of New South Wales</b>	Large	High	Large	Metro	Go8
<b>Curtin University</b>	Large	Medium	Large	Metro	ATN
<b>Griffith University</b>	Large	Medium	Medium	Metro	IRU
<b>RMIT University</b>	Large	Medium	Medium	Metro	ATN
<b>Australian National University</b>	Medium	High	Large	Metro	Go8
<b>University of South Australia</b>	Medium	Medium	Medium	Metro	ATN
<b>La Trobe University</b>	Medium	Medium	Medium	Metro / Regional	IU
<b>Victoria University</b>	Medium	Medium	Medium	Metro	Unaffiliated
<b>University of Southern Queensland</b>	Medium	Low	Small	Regional	RUN
<b>University of Canberra</b>	Small	Low	Small	Metro	Unaffiliated

Note: \* Pilot only

### 2.3 Survey implementation

The ten universities participating in the full implementation (i.e. all other than UoM) surveyed their entire PhD populations with a standardised, anonymous online survey via the Qualtrics online platform. With small variation, the survey was open for three weeks from 13 June 2017 to 4 July 2017. Reminder emails were sent after one week (20 June 2017) and two weeks (27 June 2017). As an incentive to participate, universities offered a prize (gift cards or iPad). The prizes were drawn on 10 July 2017, one week after the close of the survey.

Universities had three implementation options. Four universities provided the project team with PhD candidate contact emails for survey distribution (Option 1), four universities administered the survey themselves by emailing unique survey URLs to their PhD candidates (Option 2), and two universities administered the survey themselves by emailing a unique institutional URL to their PhD candidates (Option 3). For universities where the project team implemented the survey (Option 1), the university's dean of graduate research (or equivalent) informed the PhD candidates one week in advance of the survey invitation, endorsing the project and informing PhD candidates to expect an email from the University of Melbourne project team. The survey implementation options are summarised below in Table 2.

Table 2. Survey implementation options

<p><b>Option 1.</b> Participating universities provide UoM with a list of email addresses for all PhD candidates, UoM administer the survey on their behalf</p>
<p><b>Option 2.</b> UoM provides participating universities a spreadsheet of unique survey invitation URLs, which participating universities email to all PhD candidates</p>
<p><b>Option 3.</b> UoM provides a unique institutional survey invitation URL, which participating universities email to all PhD candidates</p>

#### 2.4 Sample characteristics and response rates

The project had a target sample size of 3,000 to 5,000 respondents across twelve institutions, with a response rate of 25%. This was deemed sufficient for drawing reliable estimates of external engagement across different disciplines. With ten universities participating in the full implementation, the target sample size was lowered proportionately.

In 2017, there were 15,613 PhD candidates enrolled in the ten participating universities. All PhD candidates were sent survey invitations and 3,323 responses were received with at least half of the survey questions completed. A further 448 respondents completed half of less of the survey, but these are excluded from analysis. Therefore, the project achieved a total useable response rate of 21% across the entire population (3,323 responses / 15,613 invitations). On average, universities achieved a response rate of 24%. The average response rate is higher than the total response rate because smaller universities achieved higher response rates than larger universities. UoM did not participate in the full implementation, but the pilot survey was comparable on most questions. Adding the UoM pilot data to the full implementation data brought the total number of responses to 3,712.

The target response rate of 25% was not met at most universities. This can be partly attributed to the survey implementation methods. The four surveys implemented by the project team (Option 1) generated the most consistently high response rates. The University of New South Wales (UNSW) was the only university not to achieve the target response rate (achieving 15%) amongst this group. UNSW experienced unique difficulties because survey invitations and reminders from the project team were sometimes filtered into junk email. The project team assisted PhD candidates at UNSW who received the notification email from the dean of graduate research but could not locate the survey invitation in their inbox. However, it is not known how many PhD candidates could not complete the survey due to this problem and it certainly would have negatively affected response rates. These strict junk mail settings were not a problem at other universities.

Griffith University sent survey invitations to some master by research HDR candidates who were not part of the target survey population. These master candidates are included in the numerator for survey invitations even though they were not relevant to the study. Some master by research candidates contacted the project team. They were advised not to complete the survey. Therefore, Griffith University's response rate is underestimated due to the inclusion of master by research candidates in the denominator of survey invitations.

Surveys implemented by the universities with unique survey invitation URLs (Option 2) achieved mixed results. The University of South Australia (UniSA) achieved a high response rate (51%). This was partly due to additional reminders and other correspondence between the dean of graduate research and PhD candidates. The other three universities utilising this method did not meet the target 25% response rate, but came close. The project team cannot be certain that all email invitations and reminders were sent, but this survey implementation method was less likely to generate the junk email problems experienced at UNSW.

Finally, the two universities utilising an open URL (Option 3) generated the lowest response rates (11-12%). This was the least preferred method of the project team because it did not allow respondents to save and later complete their surveys. It also did not allow targeting of non-respondents and partial respondents in the reminder emails. ANU and Curtin University were two of the largest universities in the project. Therefore, the low response rate at these institutions lowered the total response rate across the entire sample. Had the project been restricted to universities with unique URL survey invitations (Options 1 and 2) the overall response rate would have met the 25% target. The response rate by institution and survey implementation options are shown below in Table 3.

Table 3. Response rates by institution and survey implementation option.

	Invitations	Responses	Response rate	Survey option
Griffith	1,845	574	31%	(1)
RMIT	1,849	551	30%	(1)
UNSW	3,266	495	15%	(1)
USQ	736	214	29%	(1)
Canberra	528	103	20%	(2)
La Trobe	1,287	237	18%	(2)
UniSA	947	485	51%	(2)
VU	611	143	23%	(2)
ANU	2,600	292	11%	(3)
Curtin	1,944	229	12%	(3)
UoM	1,923	389	20%	(4)
Total	17,536	3,712	21%	

Notes: (1) Administered by UoM; (2) Administered by participant university; (3) Administered via open URL, (4) Pilot survey in 2016 administered by UoM to half of all PhD candidates. UoM results include responses with less than 50% of questions answered.

To evaluate the representativeness of the sample relative to the population, the project team sought 2017 PhD candidate data from participating universities on key strata of field, gender and residency status. For universities where population data was not provided or where the provided data was not in the format required, Australian Government data for research higher degree candidates was used from the most recent year available (2015). This Australian Government data includes master by research candidates, which comprised 14% of all equivalent full-time HDR candidates, and is two years lagged.

Based on the population data we have available, the sample of PhD candidates broadly represents the population in most academic fields. The main difference is an underrepresentation in society and culture (15% of sample, 22% of PhD population) and an overrepresentation in health sciences (21% of sample, 13% of population). There are some discrepancies in the reporting of academic fields of research. PhD candidates reported their field of research in response to a question “In what field of research is your PhD?” based on 12 two-digit field of research codes (followed by a narrower four-digit category). Institutions report population on the same two-digit field of research codes, but it is likely that some PhD candidates nominated a field different from the field nominated for them by the university. This accounts for why “11 - Food, Hospitality and Personal Services” and “12 - Mixed Field Programmes” contain respondents but no population data according to universities.

The sample also broadly reflects the PhD population on gender and residency, with females and Australian domestic PhDs somewhat overrepresented in the sample. Group of 8 (Go8) universities were underrepresented in the sample, comprising 44% of all survey invitations but only 32% of respondents. This could be indicative of self-selection bias if PhD candidates at Go8 universities were less inclined to respond to the survey due to being less engaged with external organisations. This is a possibility, but the survey distribution methods, unique problems at UNSW and the inclusion of pilot data (which did not include survey incentives) would have also contributed to the relatively lower response rates at Go8 universities. The PhD sample characteristics compared to the PhD population data at all universities is shown for field, broad field, gender and residency status in Table 4. Results for each institution are available upon request.

Table 4. Characteristics of the sample of PhD candidates relative to population on key strata

<b>Characteristic</b>	<b>Sample %</b>	<b>Population %</b>	<b>Diff. %</b>
<i>Field</i>			
01 - Natural and Physical Sciences	15%	18%	-3%
02 - Information Technology	4%	3%	1%
03 - Engineering and Related Technologies	15%	18%	-3%
04 - Architecture and Building	2%	2%	0%
05 - Agriculture, Environmental and Related Studies	5%	3%	2%
06 - Health	21%	13%	8%
07 - Education	7%	6%	2%
08 - Management and Commerce	8%	7%	0%
09 - Society and Culture	15%	22%	-8%
10 - Creative Arts	6%	6%	0%
11 - Food, Hospitality and Personal Services	0%	0%	0%
12 - Mixed Field Programmes	2%	0%	2%
<b>Total</b>	<b>100%</b>	<b>100%</b>	
<i>Broad Field</i>			
HASS	37%	42%	-5%
Health	21%	13%	8%
STEM	41%	45%	-3%
<b>Total</b>	<b>100%</b>	<b>100%</b>	
<i>Gender</i>			
Female	56%	48%	6%
Male	43%	52%	-7%
I do not wish to disclose	1%	0%	1%
<b>Total</b>	<b>100%</b>	<b>100%</b>	
<i>Residency category</i>			
Australian domestic	72%	66%	4%
International	28%	34%	-4%
<b>Total</b>	<b>100%</b>	<b>100%</b>	
<i>Institutional group</i>			
Group of 8	32%	44%	-13%
ATN	34%	27%	7%
IRU	22%	18%	4%
Other	12%	11%	2%
<b>Total</b>			

## 2.5 Results

### 2.5.1 Preconditions for engagement

Before examining the extent to which PhDs are engaged with industry and other external organisations, it is important to recognise that PhD candidates enter research training with a variety of life and work experiences. Combined with different disciplinary characteristics, these factors influence their propensity to engage with external organisations in their research. Therefore, the extent of external engagement must be understood with reference to the preconditions for engagement.

Overall, the preconditions for external engagement among Australian PhD candidates appears strong, with most entering PhD candidature after years of professional experience and utilising this experience in how they define their PhD topics. The majority (80%) of PhD candidates report professional work experience between the time of their bachelor degree graduation and PhD enrolment, ranging from 88% in HASS and 83% in health, to 71% in STEM. This correlates with the average age of survey respondents by discipline, with HASS respondents being roughly four years older (average age of 40) than health (36 years) and STEM (33 years). Prior experience does not differ greatly between university types, though prior professional work experience was more common for unaffiliated universities (91%). Prior professional work experience by field is shown below in Table 5.

Table 5. Prior professional work experience of PhD candidates (%)

“Between the time of your bachelor degree and PhD enrolment, did you work in any professional roles (including self-employment)?” (REF: Q5.2)

	HASS	Health	STEM	All
Yes	88%	83%	71%	80%
No	12%	17%	29%	20%

PhD candidates are most likely to have prior professional experience within the “Education and Training” sector (33%), followed by “Trade and Services” (30%) and “Professional, Scientific and Technical Services” (19%). Two thirds of respondents (65%) had prior professional experience outside the education sector and 15% had experience only in the education sector (of whom 30% were enrolled in education PhDs), with the remaining 20% having no prior professional experience. Prior professional experience is strongly shaped by disciplinary background, with almost half of all HASS PhD candidates (49%) reporting experience in education and training, compared to 24% in Health and 23% in STEM. Such positions likely include university research or teaching assistant positions prior to PhD enrolment, as well as primary and secondary education which would be more common for HASS PhD candidates. Almost half of all health PhD candidates (49%) reported experience within the health sector, while STEM PhDs were more likely to have experience in agriculture and related primary industries (23%, which includes agriculture, mining, manufacturing, electricity and construction) and professional services (24%). The results for prior professional experience by sector is shown below in Table 6. The percentages exceed 100% because some PhD candidates report professional experience across multiple sectors.

Table 6. Industries of prior professional work experience of PhD candidates (%)

“During this period between the time of your bachelor degree and PhD enrolment... did you work in the following industries?” (REF: Q5.3)

Sector	HASS	Health	STEM	All
Education and Training	49%	24%	23%	33%
Professional, Scientific and Technical Services	14%	16%	24%	19%

Health Care and Social Assistance	7%	49%	3%	15%
Public Administration and Safety	9%	2%	2%	5%
Trade and Services	45%	20%	23%	30%
Agriculture, Mining, Manufacturing, Electricity and Construction	7%	2%	23%	13%

Note: Trade and services includes: wholesale trade, retail, accommodation/food, transport, media/communications, finance/insurance, real estate, administrative support, art/recreation and other services.

In the year prior to PhD enrolment, most employed PhD candidates were working in positions which required higher education either at the same level they already held (42%) or at a higher level (18%). The remaining respondents reported that their work either required higher education at a lower level (17%) or higher education was only an advantage, not a requirement of their job (16%). Few were employed in positions where higher education was irrelevant to their tasks (8%). There were few noticeable differences across academic fields, though HASS PhD candidates were more likely to have been in positions where higher education was not a direct requirement. There were no differences by institutional type in the relevance of higher education to a PhD candidate's prior position. The results for relevance of higher education to employment prior to PhD enrolment are shown by field in Table 7.

Table 7. Requirements and relevance of higher education for position in the year prior to PhD enrolment (%)

"How would you characterise the work tasks of this position?" (REF: Q5.5)				
	HASS	Health	STEM	All
The work required higher education, but at a higher level	17%	18%	18%	18%
The work required higher education at the same level	38%	46%	45%	42%
The work required higher education, but at a lower level	19%	15%	15%	17%
The work did not require higher education, but it was an advantage to have it	18%	14%	14%	16%
Higher education was irrelevant	8%	7%	8%	8%

PhD candidates also reported annual income in the year prior to their PhD enrolment, which are presented in Table 8. Of those disclosing income (i.e. excluding those selecting "I do not wish to disclose"), around half of HASS (49%) and Health PhD candidates (51%) earned more than \$50,000 in the year prior, compared to 28% of STEM candidates. These results should be treated with caution due to the inclusion of part-time employed and candidates who moved from countries with lower average incomes.

Table 8. Income of PhD candidates in the year prior to enrolment (%)

"What was your approximate annual income in the year prior to your PhD enrolment (\$ AUD)? (include all jobs) (REF: 5.6)"				
	HASS	Health	STEM	All
less than \$20,000	21%	23%	37%	28%
\$20,001 - \$50,000	25%	24%	26%	25%
\$50,001 - \$80,000	19%	24%	14%	18%
\$80,001 - \$110,000	18%	18%	7%	13%
\$110,001+	8%	6%	4%	6%
I do not wish to disclose	9%	5%	12%	9%

### 2.5.2 Interaction – extent, depth and industries of engagement



### External resourcing of PhD candidates

External organisations which invest financial and in-kind resources to collaborative projects are generally more committed to producing mutually beneficial outcomes (Thune, 2010, p. 480). Therefore, one of the core survey sections sought information on how PhD candidatures are financed. Just over one quarter of respondents (27%) reported some form of industry-related support, including employment (6%), scholarships (9%), grants (7%), ARC Linkage (2%), ARC CRC funding (1%) or other financial support from non-university organisations (6%). Taken collectively, 31% in health, 29% in STEM and 21% in HASS had received at least one source of industry-related funding or support. STEM and Health PhDs were also more likely to report multiple sources of industry-related funding compared to those in HASS. The proportion of all PhDs reporting different sources of funds is shown by field in Table 9. Those who did not respond to this question were assumed to not have any sources of research funding and support, which may underestimate actual levels of funding.

Table 9. PhD funding from industry-related(\*) and other sources (%)

“Have you received financial support (excluding tuition fee waivers) for your PhD from any of the following sources (select all that apply):” (REF: Q3.2)

Type of Funding	HASS	Health	STEM	All
Australian university/PRI scholarship (living allowance/stipend)	49%	55%	62%	56%
Australian university/PRI grant (incl. research support, travel, conferences)	21%	18%	19%	19%
Australian university/PRI employment (incl. paid study leave)	7%	9%	6%	7%
Overseas university/PRI/government scholarship or employment	6%	4%	7%	6%
* Non-university employment (incl. paid study leave)	6%	7%	4%	6%
* Non-university organisation funded scholarship (living allowance/stipend)	5%	11%	10%	9%
* Non-university grant (incl. research support, travel, conferences)	4%	10%	9%	7%
* ARC Linkage scheme funds	2%	1%	4%	2%
* ARC Cooperative Research Centre scheme funds	1%	1%	3%	1%
* Other financial support from non-university organisations	5%	7%	6%	6%

\* Denotes an industry-related funding source

PhD candidates receiving non-university employment, scholarships, grants or other financial support, were also asked to estimate the amount of financial support during their candidature thus far, as well as whether the funds were primarily for their own use (as opposed to their supervisor or research team use). The quantum of external funding ranged widely from less than \$1,000 for 12% of candidates with funding, to in excess of \$80,000 for roughly one quarter (24%). Funding was overwhelmingly either primarily (83%) or mostly (11%) to support the candidate themselves. The results for the amounts of external funding and primary recipient are shown by field in Table 10 and Table 11.

Table 10. Total amount of external funding and support (%)

“Roughly what is the total funds received from external non-university/PRI organisations sources for your PhD (over all years enrolled)?” (REF: Q3.3)

	HASS	Health	STEM	All
Less \$1,000	18%	11%	5%	11%
\$1,000 - \$1,999	7%	3%	5%	5%
\$2,000 - \$4,999	7%	8%	8%	8%
\$5,000 - \$9,999	6%	9%	8%	8%
\$10,000 - \$19,999	7%	13%	9%	9%
\$20,000 - \$39,999	11%	14%	17%	14%
\$40,000 - \$79,999	15%	12%	16%	15%
\$80,000 - \$99,999	6%	9%	13%	10%
More than \$100,000	15%	15%	8%	12%
Unsure	8%	6%	9%	8%

Table 11. Primary recipient of the industry funding and support (%)

“Were these funds primarily for you or for your supervisor/research team?” (REF: Q3.4)

	HASS	Health	STEM	All
Primarily for me	88%	84%	80%	83%
Mostly for me	10%	11%	11%	11%
Mostly for supervisor/team	1%	2%	5%	3%
Primarily for supervisor/team	1%	3%	4%	3%

### External PhD supervision

One of the clearest examples of external engagement is through formal supervision arrangements with another organisation. Research supervisors have a clear role in guiding the research project questions, methodologies and assessing the quality of the PhD dissertation. Unsurprisingly, 98% of PhD candidates have formal supervisors at their own university of enrolment, with most of the remaining 2% having formal supervisors at another university or public research institute. Therefore, external supervision is overwhelmingly on a co-supervision basis with a university-based supervisor, which is consistent with the Higher Education Standards Framework.

Bearing in mind that respondents to the survey may be more likely to be engaged externally than those who did not, the extent of external (co-)supervision is rare. Few PhD candidates have formal supervision arrangements with non-university organisations (5%), with such formal supervision almost non-existent in HASS (2%) and only somewhat more common in STEM (6%) and Health (8%). There are few differences in formal supervision arrangements by university groups, though formal co-supervisors at universities (other than the one where the candidate is primarily enrolled) is more common in Go8 universities (32%) compared to others (18-20%).

Informal advisory or collaborative arrangements with external organisations is far more common, though still very much a minority activity affecting only 14% of all PhD candidates. This type of semi-formal or informal external engagement is more common in STEM (16%) and Health (18%) compared to HASS (10%), but given the almost non-existent formal non-university supervision in HASS, it may be considered a relatively important method of external engagement in this field. There are minimal differences in informal supervision or collaborative arrangements with external organisations by university groups. The proportion of PhD candidates with formal and

informal industry supervision is shown below by academic field in Table 12 and by university group in Table 13.

Table 12. Formal PhD supervision arrangement by academic field (%)

“Where are your formal PhD supervisors and other advisors/collaborators on your PhD located? (select all that apply)”  
(REF: Q3.5)

	HASS	Health	STEM	All
Own university - Formal PhD Supervisor	98%	97%	98%	98%
Own university - Other advisors/collaborators	29%	30%	33%	31%
Another university/PRI - Formal PhD Supervisor	9%	21%	13%	13%
Another university/PRI - Other advisors/collaborators	16%	28%	28%	23%
Non-university organisation - Formal PhD Supervisor	2%	8%	6%	5%
Non-university organisation - Other advisors/collaborators	10%	18%	16%	14%

Note: "Non-university" refers to all external organisations other than universities or public research institutes. This includes private sector, public sector, not-for-profit and community based organisations.

Table 13. Formal PhD supervision arrangement by university group (%)

“Where are your formal PhD supervisors and other advisors/collaborators on your PhD located? (select all that apply)”  
(REF: Q3.5)

	ATN	Go8	IRU	Other
Own university - Formal PhD Supervisor	98%	97%	99%	97%
Own university - Other advisors/collaborators	28%	37%	30%	24%
Another university/PRI - Formal PhD Supervisor	13%	14%	12%	12%
Another university/PRI - Other advisors/collaborators	19%	32%	20%	18%
Non-university organisation - Formal PhD Supervisor	5%	6%	3%	4%
Non-university organisation - Other advisors/collaborators	14%	14%	14%	14%

Of the 5% of all PhD candidates with formal supervisors at non-university organisations, most discuss their PhD with these supervisors either fortnightly (29%) or monthly (23%), with a small minority reporting weekly discussions (13%). This represents relatively weaker intensity of supervision compared to the frequency of discussions with formal university supervisors. Across all PhD candidates, most discussed their PhD with their formal university supervisor at their own university on a weekly (28%) or fortnightly basis (37%). Likewise, informal supervision and advisory arrangements tend to be less intense. Of the 14% of all PhD candidates with informal advisors at non-university organisations, less than half discussed their PhD on a weekly (10%), fortnightly (14%) or monthly (21%) basis. Nevertheless, given that many external supervisors and advisors will be employed in institutions where PhD training is a very minor activity, the frequency of the interactions with PhD candidates should not be undervalued. Further, frequency of interactions should not be assumed to be a proxy for quality or value of interactions for PhD candidates. External engagement may be for a specific purpose, rather than requiring routine advice or monitoring. The frequency of PhD discussions with external formal supervisors and informal advisors is shown by field in Table 14 and Table 15, respectively.

Table 14. Frequency of PhD discussions with formal supervisors at non-university organisation(s) (%)

“How frequently do you discuss your PhD with your formal PhD supervisor(s)... in non-university organisation(s)?” (REF: Q3.6)

	HASS	Health	STEM	All
At least weekly	0%	10%	18%	13%
Fortnightly	30%	32%	27%	29%
Monthly	22%	27%	20%	23%
1-3 months	17%	19%	23%	21%
Less than once every 3 months	30%	12%	12%	15%

Table 15. Frequency of PhD discussions with informal advisors at non-university organisation(s) (%)

“How frequently do you discuss your PhD with your other advisors/collaborators... in non-university organisation(s)?” (REF: Q3.7)

	HASS	Health	STEM	All
At least weekly	10%	4%	12%	10%
Fortnightly	9%	22%	13%	14%
Monthly	28%	17%	19%	21%
1-3 months	27%	27%	28%	27%
Less than once every 3 months	26%	29%	28%	28%

### Industries of PhD engagement

In terms of formal supervisory and informal advisory arrangements, the main industry sectors of external PhD supervision are health care (5% of all PhD candidates), trade and services (5%), and professional science services (4%). There are clear differences across academic fields. Most notably, 17% of health PhD candidates held a supervisory or advisory arrangement with a health care firm. However, generally the results confirm what was already clear, that few PhDs have external advisory or collaborative arrangements. The results for the proportion of all PhD candidates with non-university PhD supervisors or advisors is shown by industry sector and field in Table 16.

Table 16. Industries of external non-university PhD supervisors, advisors and collaborators (%)

“Which industries are your external non-university PhD supervisors, advisors and collaborators located?” (REF: Q3.8)

Sector	HASS	Health	STEM	All
Education and Training	3%	1%	1%	2%
Professional, Scientific and Technical Services	2%	2%	7%	4%
Health Care and Social Assistance	2%	17%	2%	5%
Public Administration and Safety	1%	0%	1%	1%
Trade and Services	4%	5%	6%	5%
Agriculture, Mining, Manufacturing, Electricity and Construction	1%	1%	6%	3%

It is worth briefly contrasting the results from Table 16 with the earlier results for sector of professional experience in Table 6. Figure 2 shows the proportion of PhD candidates with relevant professional experience in each sector versus the proportion with external supervision or advisory arrangements in the same sector. For example, 19% of all PhD candidates enter their PhD with professional experience in professional, scientific and technical services, but only 4% have any form of PhD advisory arrangement with someone in this sector. Overall, it appears that the potential for utilising professional experience and contacts within industry sectors is not being translated into PhD advisory arrangements.

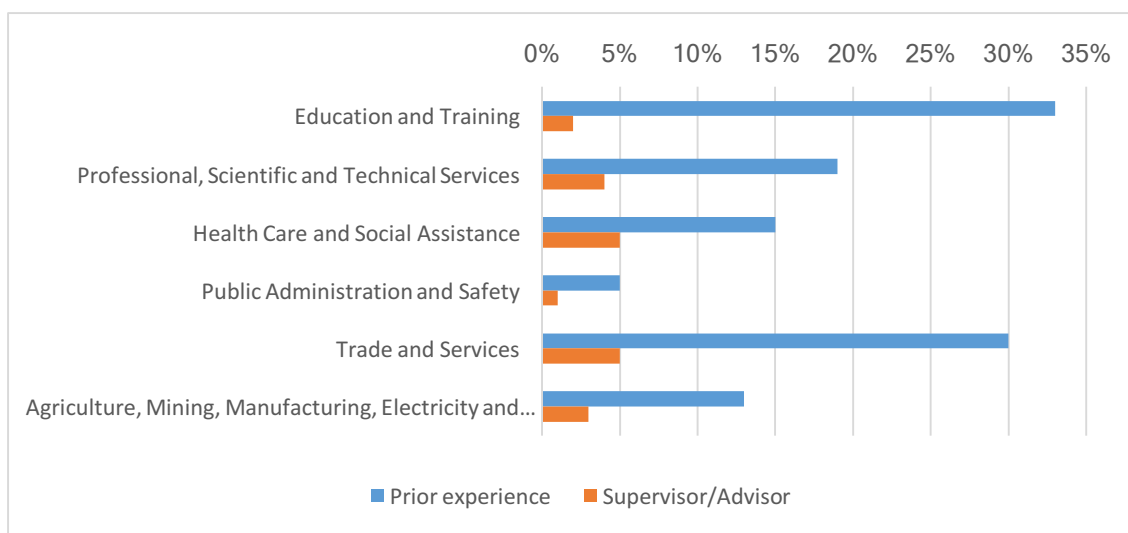


Figure 2. Proportion of PhD candidates with prior professional experience versus the proportion with non-university PhD supervisors, advisors and collaborators, by sector (%)

### External engagement activities

External engagement includes a range of activities beyond resourcing and supervision, including ad hoc or institutionalised networking, research collaboration and research placement activities. From our PhD candidate survey, the most common externally-related activities were those with the least depth or commitment from the organisation or the PhD candidate.

More than one third of PhDs have participated in lectures/seminars held by an external non-university organisation (39%) or participated in meetings/visits/excursions organised by or to an external non-university organisation (34%). Deeper forms of engagement were less common, such as paid or compulsory work placements/internships (7%) or voluntary placements/internships (7%). It should be noted that some PhDs will be in the early stages of their candidature and not have participated in such activities for this reason.

Somewhat surprisingly, a significant minority of PhD candidates had participated in a research project (21%), written a paper/dissertation in collaboration (18%) or received advice on the structure of their PhD project from an external non-university organisation (18%). This result is intriguing because it is higher than the proportion reporting supervisors or advisors from these sectors (16% in Table 12. Formal PhD supervision arrangement by academic field (%)). This suggests PhDs are likely to be engaged with industry on research projects not directly related to their PhD topics. Alternatively, PhD candidates may simply underestimate the extent to which they receive external advice.

More than one quarter of PhD candidates collect primary data (28%) or utilise secondary data (20%) from an external non-university organisation. This is one of the few areas of engagement which is more common in HASS, with 36% collecting primary data for their PhDs and 25% utilising secondary data from external organisations. This compares to less than one quarter in most other fields. This is an important finding, suggesting HASS PhDs conduct research *on* industry, rather than *with* industry, and accords with the finding in the supervisor survey which found 47% of HASS supervisors with at least one student “Conducting research *about an industry* or community organisation in which that organisation may be involved, and from which it may benefit.” (see the supplementary report: *PhD Supervisor, Alumni and Industry Perspectives on External Engagement*).

Table 17 shows the proportion of PhD candidates in each field participating in each of the activities organised by, or in collaboration with, external non-university organisations. Due to PhD candidates often nominating multiple activities, Table 18 shows the proportion engaged in at least one external

engagement activity. Table 19 shows these results by university group. While there is some evidence that Go8 candidates are less engaged externally, these are attributable to greater proportion of HASS PhD candidates at the Go8 universities.

Table 17. Engagement with non-university organisations during PhD, by field and type (%)

"Have you participated in any of the following activities during your PhD? (select all that apply)" (REF: Q3.9)				
	HASS	Health	STEM	All
* Research project in collaboration	15%	26%	24%	21%
* Paid or compulsory work placement/internship	8%	8%	6%	7%
* Voluntary work placement/internship (unpaid)	8%	7%	5%	7%
Written a paper/dissertation in collaboration	14%	22%	21%	18%
Participated in lectures/seminars	41%	39%	36%	39%
Participated in meetings/visits/excursions	31%	36%	36%	34%
Collected primary research data from an external non-university organisation	36%	30%	21%	28%
Utilised secondary data from an external non-university organisation	25%	18%	16%	20%
Advice on the structure and design of my research project	14%	23%	18%	18%

\* Denotes a deeper industry-related activity

Table 18. Depth of engagement with non-university organisations during PhD by field (%)

"Have you participated in any of the following activities during your PhD? (select all that apply)" (REF: Q3.9)				
	HASS	Health	STEM	All
No external engagement	26%	25%	28%	26%
Some external engagement	50%	42%	43%	45%
Deeper external engagement	24%	34%	29%	28%

Table 19. Depth of engagement with non-university organisations during PhD by university group (%)

"Have you participated in any of the following activities during your PhD? (select all that apply)" (REF: Q3.9)				
	ATN	Go8	IRU	Other
No external engagement	24%	34%	24%	25%
Some external engagement	47%	36%	47%	52%
Deeper external engagement	30%	30%	29%	23%

### Research problem development

Although not many PhDs in our sample are engaged directly with industry or community organisations, many report that their PhD topic is oriented towards industry or society. When asked to characterise their PhD topic/problem on a scale of 1 to 5 from (1) "very much" to (5) "not at all", 48% reported their PhD addressed an industry problem or was commercially-oriented. As may be expected, industry and commercial orientation was strongest in STEM (58%), but somewhat surprisingly a significant minority of HASS PhD candidates (44%) characterised their research this way, more than in health (36%). Again, this suggests a significant share of PhDs, in all fields, are interested in and researching topics relevant to industry (broadly defined), but are not actually engaging with industry partners as collaborators.

There are some noticeable differences between Go8 universities and others, with only 38% of Go8 PhD candidates reporting commercial orientation compared to over 50% in most other universities. This pattern is also consistent within academic fields, such as HASS, where only 28% of Go8 PhD

candidates report commercial orientation compared to 53% in ATN, 42% in IRU and 54% in other universities.

Another important result is the relatively high proportion of socially oriented (64%) and applied/practically oriented (78%) PhD projects. Again, we would anticipate that the impact of these projects would be strengthened through a greater use of formal and informal external supervisory arrangements. Self-reported PhD topic characterisations are shown by field in Table 20 and by university group in Table 21.

Table 20. PhD topic/problem characterisation by field (%)

“How would you characterise your PhD topic/problem:” (REF: Q3.16) (% “very much” or 2, 5-point scale)

	HASS	Health	STEM	All
Basic/theoretical;	42%	36%	48%	43%
Applied/practically-oriented;	76%	80%	79%	78%
Aimed at addressing an industry problem or commercially-oriented;	44%	36%	58%	48%
Socially-oriented/intended for the betterment of society;	75%	74%	49%	64%
Multi-/interdisciplinary	63%	61%	58%	60%

Table 21. PhD topic/problem characterisation by university group (%)

“How would you characterise your PhD topic/problem:” (REF: Q3.16) (% “very much” or 2, 5-point scale)

	ATN	Go8	IRU	Others
Basic/theoretical;	43%	43%	43%	44%
Applied/practically-oriented;	80%	75%	79%	80%
Aimed at addressing an industry problem or commercially-oriented;	58%	38%	43%	57%
Socially-oriented/intended for the betterment of society;	65%	60%	68%	67%
Multi-/interdisciplinary	63%	59%	60%	61%

We also asked respondents who the main influencers were for the development of their PhD topic. These results are presented by field in Table 22. The majority reported their “own research interests” as a strongest influence (87%), followed by previous work experience (70%) and their university supervisor (69%). Few reported departmental priorities (25%) or people outside the university/public research sector (33%) having strong influence. One quarter were working on pre-defined topics as part of a larger research project (25%).

Table 22. Factors influencing PhD topic/problem development (%)

“To what extent did the following influence your PhD topic/problem:” (REF: Q3.15) (% very much” or 2, 5-point scale)

	HASS	Health	STEM	All
Own research interests	94%	84%	83%	87%
Prior working experience	73%	75%	65%	70%
University supervisor(s)	55%	73%	79%	69%
Departmental priorities	17%	27%	30%	25%
People outside the university/public research sector	36%	32%	30%	33%
The topic was pre-defined as part of a larger research project	12%	27%	35%	25%

The importance of these results are that most PhD candidates develop topics based on their own research interests, particularly in HASS. If external engagement were to be increased through greater alignment with existing industry partnerships or collaborations at the

supervisor/departmental level it may conflict with the traditionally self-directed nature of PhD topic development. On the other hand, many PhDs choose topics that are of both personal interest and relevant to prior work experience. The challenge for universities is to either offer greater support/encouragement for aligning PhD topics to existing industry experience, or selecting candidates who have backgrounds aligned to existing industry partnerships or collaborations.

While not directly related to mapping the extent of industry engagement we also asked PhD candidates to what extent they felt engagement with non-university organisations is valued by their PhD supervisor, department, university and disciplinary community. This is an important organisational and disciplinary contextual variable according to Thune’s (2009) framework. The proportion reporting “very much” or “2”, on a scale of 1 to 5, is presented in Table 23 by field and for type of influencer. The same results are reported by university group in Table 24. Most PhD candidates reported that their PhD supervisor values external engagement (63%), with only marginally fewer agreeing within HASS disciplines (59%). PhD candidates feel external engagement is less supported by their department (47%), university (49%) and disciplinary communities (49%), with the lowest level of support in HASS. In other words, it appears that external engagement is perceived to be most valued at the local level and less so at higher levels or degrees of separation. There were few differences across university groups, though support at Go8 universities was slightly weaker and ATN support slightly higher in most categories, a pattern consistent also within academic fields.

Table 23. Perceived value of external engagement by actor and field (%)

“To what extent is engagement with external non-university organisations valued by your?????” (REF: Q3.14) (% very much” or 2, 5-point scale)

	HASS	Health	STEM	All
PhD Supervisor	59%	64%	65%	63%
Department	42%	51%	51%	47%
University	44%	53%	52%	49%
Disciplinary community	49%	52%	48%	49%

Table 24. Perceived value of external engagement by actor and university group (%)

“To what extent is engagement with external non-university organisations valued by your:” (REF: Q3.14) (% very much” or 2, 5-point scale)

	ATN	Go8	IRU	Other
PhD Supervisor	67%	59%	62%	62%
Department	49%	47%	47%	44%
University	52%	46%	51%	45%
Disciplinary community	50%	47%	52%	49%

Finally, we sought to understand whether the financial support from external sponsors or clients influenced PhD candidate research activities. PhD candidates were asked to agree or disagree with the statement “External sponsors or clients have no influence over my research activities”, on a scale of 1 to 5. The purpose of this was to gauge the level of external influence, rather than whether the influence was positive or negative. Across all PhD candidates, 45% “strongly agreed” or “agreed” that external sponsors or clients had no influence on their research activities, with a further 26% neutral and the remaining 30% disagreeing. For those PhDs who had received external support (i.e. employment, scholarships, grants, ARC Linkage, ARC Cooperative Research Centre (CRC) funding, or other financial support from non-university organisations), the influence was somewhat higher with 38% agreeing to no influence from external partners, 26% neutral and 37% disagreeing. Within academic fields, HASS PhDs receiving external support were most likely to report that external



sponsors or clients influenced their research activities (42%) versus those in STEM (30%) or health (32%). However, HASS was also the group least likely to receive external support (21% of respondents compared to 29% in STEM and 31% in health).

We also examined whether depth of external engagement activities related to perceived external influence. PhD candidates with deeper external engagement were more likely to disagree that there was no influence on their research activities (38%), compared to those with only some external engagement (27%) or none at all (23%). These patterns were similar across academic fields. Overall, these results suggest that external engagement and support moderately impacts PhD research activities. While this may be considered a positive outcome in the sense that PhDs may be more likely to pursue research of interest to external organisations, such external influence may affect the disinterested nature of PhD research. The proportion of PhDs “strongly disagreeing” or disagreeing (on a scale of 1 to 5) that external sponsors or clients have no influence over their research activities is presented in Figure 3 for those receiving external support and by depth of external engagement.

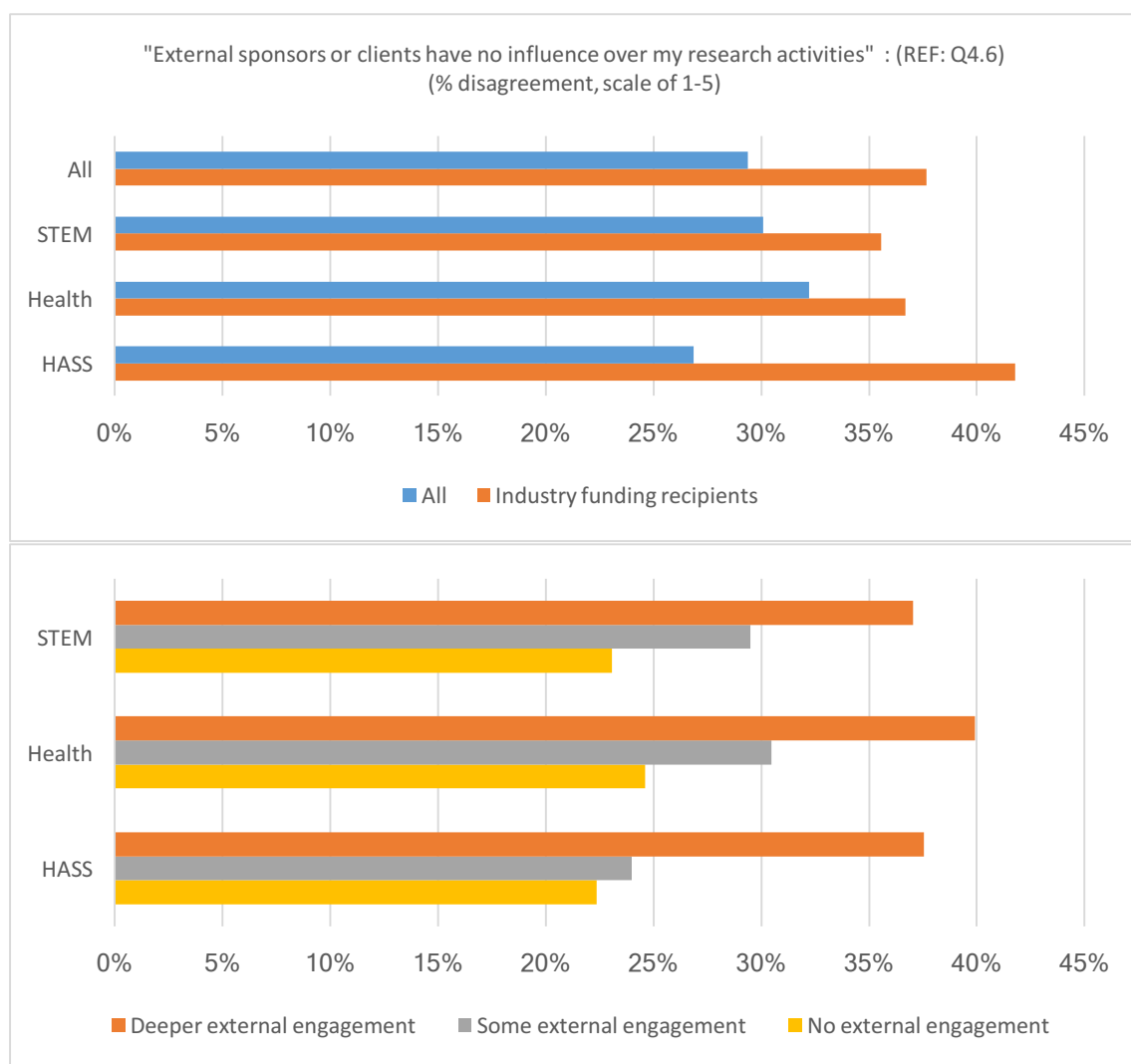


Figure 3. Influence of external sponsors or clients on PhD research activities (% disagreement)

### *2.5.3 Outcomes – relationship between external engagement and satisfaction, skills and career ambitions*

In this final section, we present results for how external engagement is associated with PhD candidate study satisfaction, outcomes, and career ambitions. International studies have shown mixed results for whether external collaboration during the PhD affects training experience or study outcomes (Thune, 2009). Previous studies in Australia also find few differences between industry-funded and government-funded PhDs in terms of overall experiences (Harman, 2002). Nevertheless, one of the main justifications for encouraging external engagement is to broaden the skills development of PhD candidates, better preparing them for careers outside academe or for greater external engagement and service if they remain within academe.

#### *Study satisfaction*

When asked to agree or disagree (a scale of 1-5) to the statement "Overall, I am satisfied with the quality of my PhD experience", 80% of PhD candidates indicated satisfaction, 10% were neutral and 10% were not satisfied. Though not directly comparable, these results are rather more positive than earlier studies of Australian HDRs and PhDs in 2001 and 2010 (Edwards et al., 2011; Harman, 2002). The positive results were uniform across academic fields and differed little between those with external organisation funding and those without. PhD candidates with deeper engagement with external organisations were slightly more positive (82% satisfied), compared to those with some external engagement (80%) or none (79%), but overall the main results are high satisfaction across the board. These results should be treated with some caution due to non-response bias (e.g. satisfied PhDs may be more contactable or inclined to answer the survey), but there is no clear indication of any positive or negative impacts of external engagement. These results are presented in Figure 4 below.

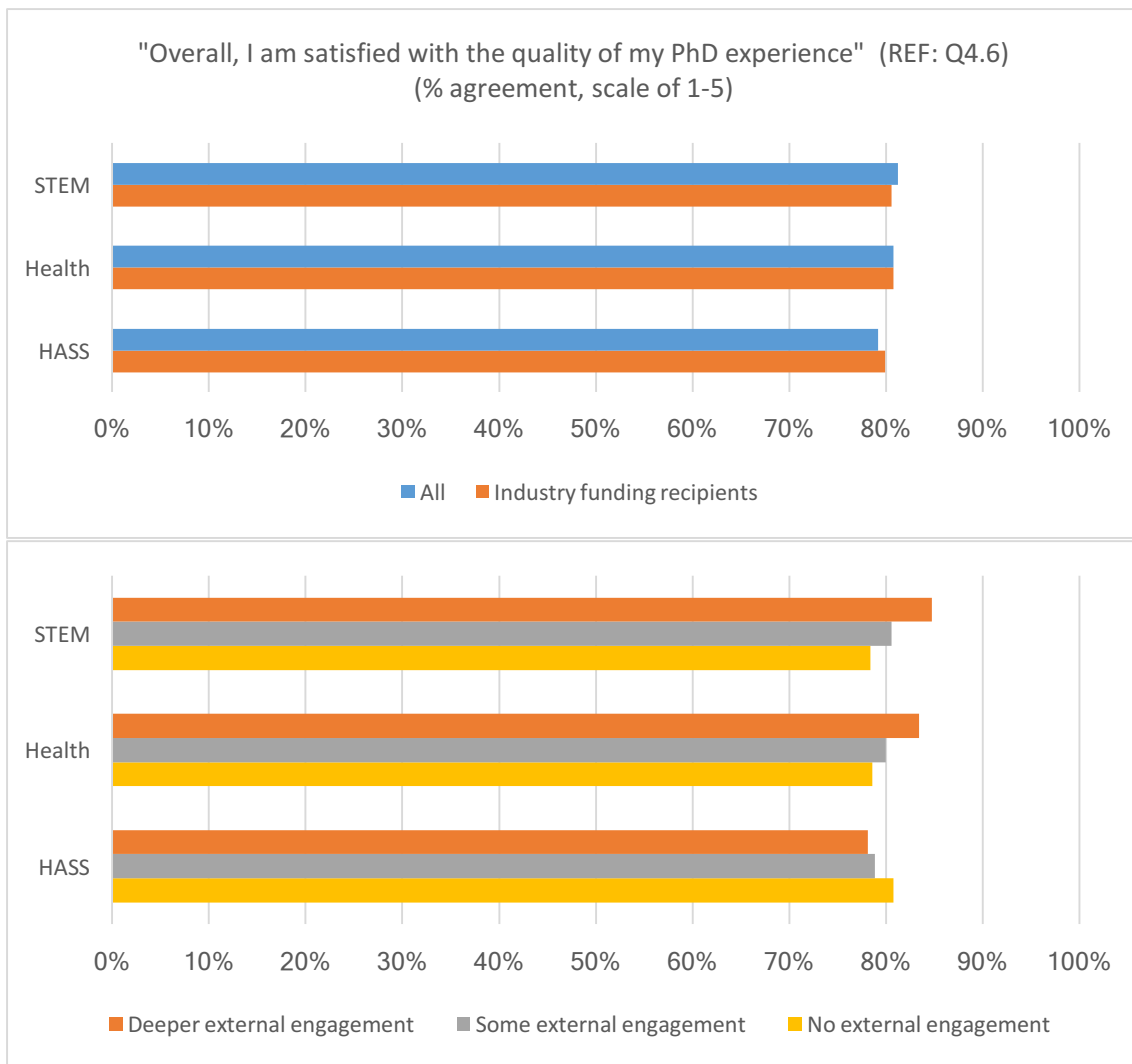


Figure 4. PhD candidate satisfaction with quality of their experience (% agreement)

### Study outcomes

Deeper external engagement activities appear to develop stronger skills, networks and other insights into post-PhD careers, compared to the more limited external engagement activities. PhD candidates who reported some external engagement (48%, 1,677 respondents) and deeper external engagement (24%, 1,039 respondents) were asked to assess "To what extent has your contact with external non-university organisations during your PhD provided": practical skills; insight into relevant work; contacts/networks outside the university; motivation to complete PhD; ideas that changed PhD topic or methods; ideas that changed career plans; job opportunities after completing studies; preparedness to cope with the transition from PhD to further employment. Across all categories, those with deeper engagements were more likely to report "To a high degree" or "To a fairly high degree". The proportion reporting "high" or "fairly high" development on each attribute is shown in Figure 5 by depth of external engagement. Note that those with higher levels of engagement are more likely to have been enrolled for longer periods and this association does not imply external engagement is the only factor influencing the results.

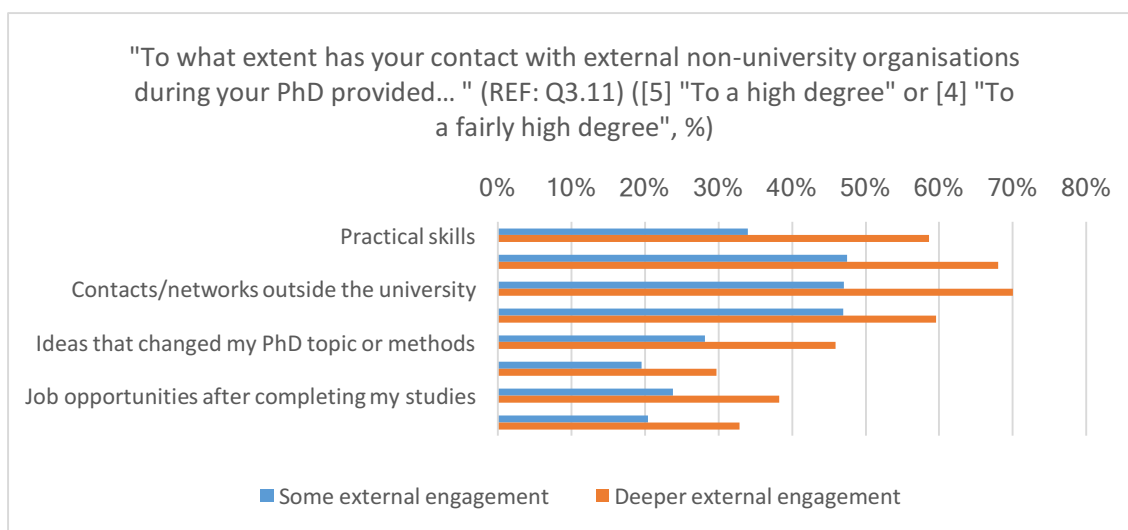


Figure 5. PhD skills, knowledge and outcomes from external engagement activities (% high/fairly high degree)

External engagement can also help prepare PhD candidates for careers in different sectors. When asked to assess to what extent their PhD has provided training/foundation for a career in the private, public, university and research institute sectors, those with deeper engagements were more likely to report “A great deal” or “A lot” (on a scale of 1-5). Nevertheless, it is clear that irrespective of external engagement the PhD training is most likely to be assessed positively for university (69%) and research institute (61%) careers, compared to public sector (26%) or private sector careers (33%). PhD candidates were also asked to assess how their PhD training has provided a foundation for “Setting up your own enterprise”, with this category receiving uniformly low results (15%). Therefore, although the external engagement activities provide positive insights, networks and practical skills, from the perspective of the PhD candidates, the PhD itself is not preparing them well for career pathways outside the university or research institute sector. The results for career pathway development are shown in Table 25 below by depth of engagement. Again, PhD candidates with higher levels of external engagement may differ from others in important ways, including experience and motivation, and the association does not imply causation.

Table 25. PhD training as a foundation for the different career paths (%)

“To what extent has your PhD provided you training/foundation for the following career paths:” (REF: Q4.4) ([5] "A great deal" or [4] "A lot", %)

	No external engagement	Some external engagement	Deeper external engagement	All
Private sector	23%	25%	31%	26%
Public sector	30%	32%	39%	33%
University	68%	67%	72%	69%
Research institute	59%	60%	65%	61%
Setting up your own enterprise	14%	14%	16%	15%

### Career ambitions

ACGR identified a lack of baseline data on the career trajectories of PhD candidates. Although it is not possible to know actual career trajectories through a survey of PhD candidates, we did ask current PhD candidates to anticipate career trajectory, including combinations across sectors. In response to the question “Ideally, where would you prefer to work in the first five years after your PhD?” 76% reported university, 48% public research institute, 29% public sector, 32% private sector research, 16% other private sector and 22% their own enterprise.

PhD candidates who had no external engagement activities were more likely to nominate university as an ideal career (81%), compared to those with some external engagement (77%) or deeper engagement (70%). We cannot identify a causal relationship between external engagement and ideal careers. It is probable that those PhD candidates who choose to engage more with external organisations were more intrinsically motivated to do so beforehand or have other important differences in their backgrounds, but on a descriptive level externally engaged PhD candidates have broader career ambitions, albeit with still very strong inclinations towards academe. The proportion of PhD candidates nominating each sector as an ideal career pathway five years after PhD graduation is shown by depth of engagement in Figure 6.

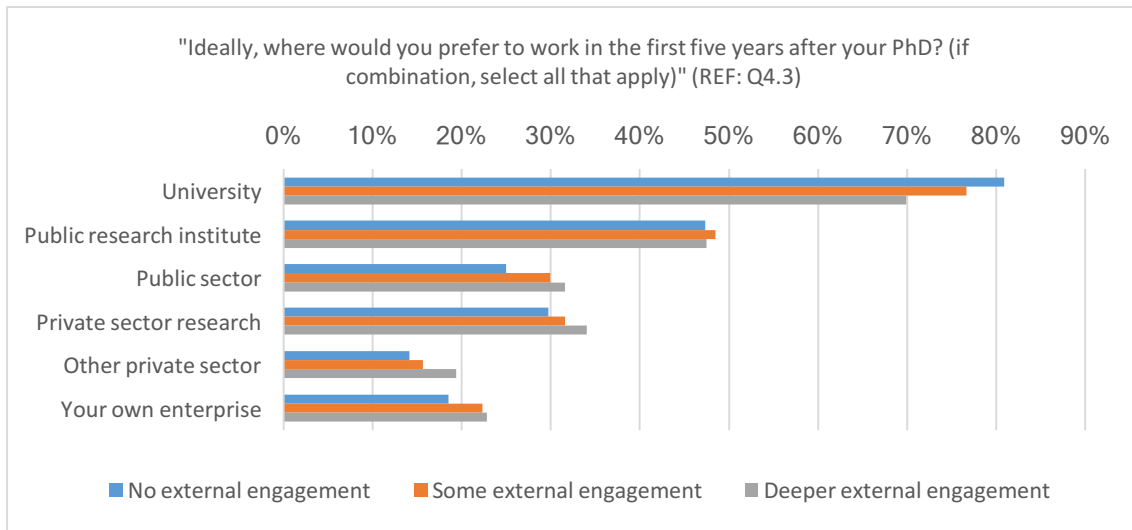


Figure 6. Ideal career pathway post-PhD by depth of external engagement (% nominated)

Given the anticipated dominance of academia as an ideal career pathway, we also asked PhD candidates whether their interests in academic careers had increased over the course of their candidature. In response to the statement "Since commencing my PhD, I am now more interested in an academic career", 30% of PhD candidates "strongly agreed" and 31% "somewhat agreed" (on a scale of 1-5), with a further 21% neutral. Only 8% "strongly disagreed" and 11% "somewhat disagreed" with this statement. In effect, PhD candidates appear to grow more interested in academic careers as they progress in their PhDs, with relatively few differences across academic fields. Those with deeper external engagement are somewhat less likely to agree with the statement (58%) compared to those with some external engagement (60%) or none (63%), but these differences are quite small and possibly attributable to other characteristics, such as experience in the PhD. The proportion of PhD candidates agreeing that they are now more interested in academic careers is shown by academic field and level of external engagement in Figure 7.

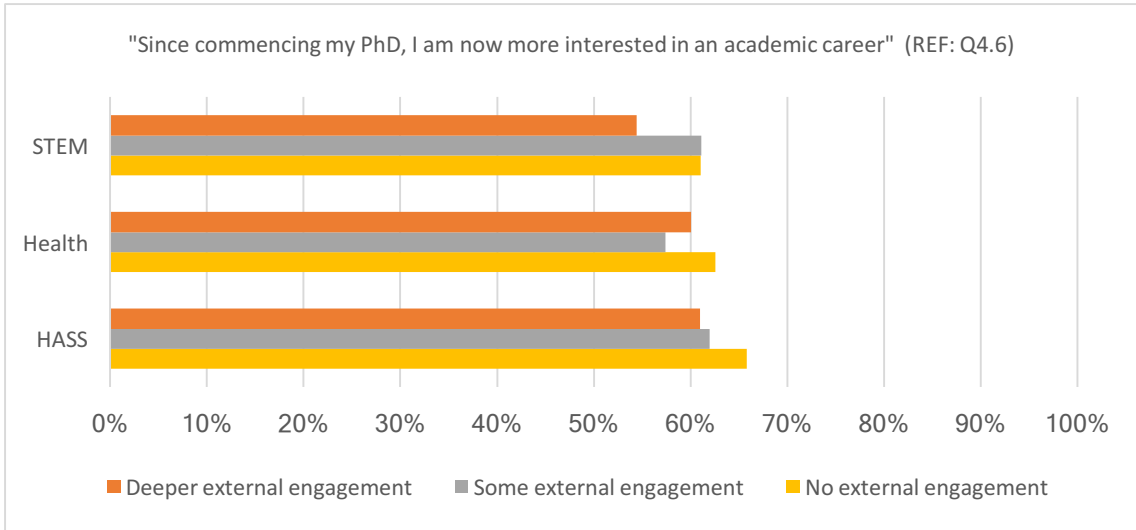


Figure 7. Interest in academic careers since commencing PhD (% agreement)

Finally, we sought to understand what career pathways PhD candidates thought were likely for them in the short term (3 years) after PhD graduation. When asked "How likely is it that, in the first three years after completing your PhD, you will work in" different sectors, 81% considered university employment "Extremely likely" or "Somewhat likely", on a 4-point scale. This declined somewhat with depth of external engagement, from 85% with no external engagement to 78% with deeper engagement, but the overall conclusion must remain that externally engaged PhDs remain motivated and optimistic about academic careers. Nevertheless, across all the categories of industry other than public research institutes, PhD candidates with external engagement were more optimistic about their career prospects. The proportion of PhD candidates considering it likely they would be employed in different sectors in the first three years after completing their PhD is shown by level of external engagement in Figure 8.

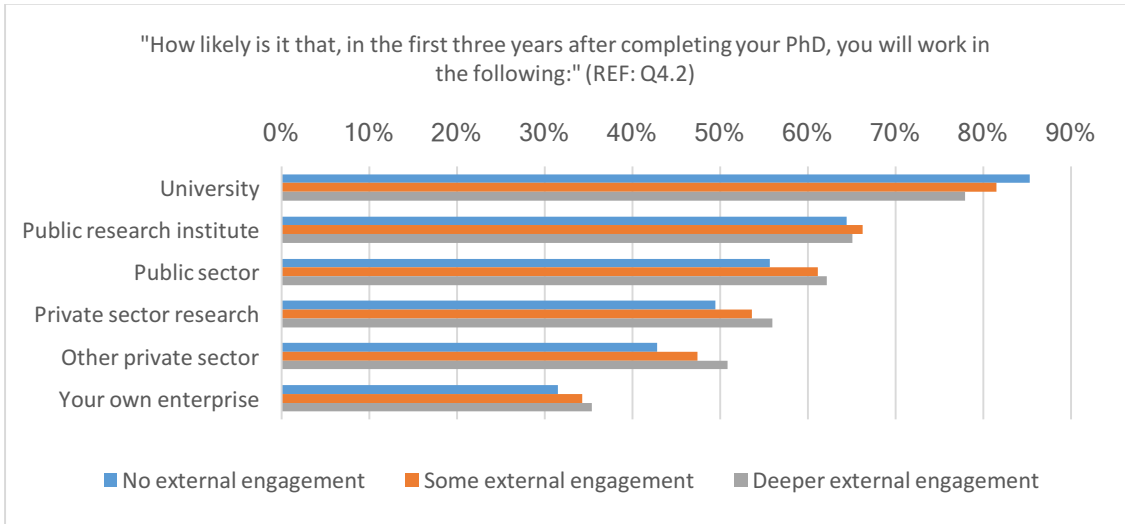


Figure 8. Likely career pathway post-PhD by depth of external engagement (% nominated)

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## Appendix A – PhD Survey - Mapping External Engagement



Variable  
Reference  
for Excel  
and SPSS

## ***PhD Survey - Mapping External Engagement***

**Note: The formatting and the dynamic “logic” of the survey is not shown (e.g. certain questions are skipped, reduced or edited depending on earlier answers from the respondent)**

### **PhD Background**

Q2.2\_1  
& Q2.2\_2

1. In what field of research is your PhD?

Q2.3

2. In what year did you enroll in your PhD?

Q2.4

3. For most of your PhD, have you been enrolled full-time, part-time or a combination?

- Full-time
- Part-time
- A combination of full-time and part-time

Q2.5

4. Is your PhD on track for on time completion?

- Definitely yes
- Probably yes
- Probably not
- Definitely not
- Unsure

Q2.6

5. What is your country of citizenship?

Q2.7

6. Are you currently enrolled as an international or domestic PhD candidate?

- Australian domestic
- International

## Funding, supervision and external engagement

Q3.2\_364  
Q3.2\_365  
Q3.2\_366  
Q3.2\_367  
Q3.2\_368  
Q3.2\_369  
Q3.2\_370  
Q3.2\_371  
Q3.2\_372  
Q3.2\_373

1. Have you received financial support (excluding tuition fee waivers) for your PhD from any of the following sources (select all that apply):

**Note:** "Non-university" refers to all external organisations other than universities or public research institutes (PRIs). This includes private sector, public sector, not-for-profit and community based organisations.

- Australian university/public research institute (PRI) scholarship (living allowance/stipend)
- Australian university/PRI (incl. paid study leave)
- Australian university/PRI grant (incl. research support, travel, conferences)
- Overseas university/PRI/government scholarship or employment
- ARC Linkage scheme funds
- ARC Cooperative Research Centre scheme funds
- Non-university organisation funded scholarship (living allowance/stipend)
- Non-university employment (incl. paid study leave)
- Non-university grant (incl. research support, travel, conferences)
- Other financial support from non-university organisations

Q3.3

2. Roughly what is the total funds received from external non-university/PRI organisations sources for your PhD (over all years enrolled)?

- Less \$1,000
- \$1,000 - \$1,999
- \$2,000 - \$4,999
- \$5,000 - \$9,999
- \$10,000 - \$19,999
- \$20,000 - \$39,999
- \$40,000 - \$79,999
- \$80,000 - \$99,999
- More than \$100,000
- Unsure

Q3.4

3. Were these funds primarily for you or for your supervisor/research team?

- Primarily for me
- Mostly for me
- Mostly for supervisor/team
- Primarily for supervisor/team

Q3.5\_1\_1  
 Q3.5\_1\_2  
 Q3.5\_2\_1  
 Q3.5\_2\_2  
 Q3.5\_3\_1  
 Q3.5\_3\_2

4. Where are your formal PhD supervisors and other advisors/collaborators on your PhD located? (select all that apply)

**Note:** "Non-university" refers to all external organisations other than universities or public research institutes. This includes private sector, public sector, not-for-profit and community based organisations.

	Formal PhD supervisor(s)	Other advisors/collaborators
Own university	<input type="checkbox"/>	<input type="checkbox"/>
Another university or public research institute	<input type="checkbox"/>	<input type="checkbox"/>
Non-university organisation	<input type="checkbox"/>	<input type="checkbox"/>

Q3.6\_1  
 Q3.6\_2  
 Q3.6\_3

5. How frequently do you discuss your PhD with your formal PhD supervisor(s)?

	At least weekly	Fortnightly	Monthly	1-3 months	Less than once every 3 months
Own university	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Another university or public research institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-university organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3.7\_1  
 Q3.7\_2  
 Q3.7\_3

6. How frequently do you discuss your PhD with your other advisors/collaborators?

	At least weekly	Fortnightly	Monthly	1-3 months	Less than once every 3 months
Own university	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Another university or public research institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-university organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3.8_1	<p>7. Which industries are your external non-university PhD supervisors, advisors and collaborators located? (hold "Ctrl" to select all that apply)</p> <p><input type="checkbox"/> Agriculture, Forestry and Fishing</p> <p><input type="checkbox"/> Mining</p> <p><input type="checkbox"/> Manufacturing</p> <p><input type="checkbox"/> Electricity, Gas, Water and Waste Services</p> <p><input type="checkbox"/> Construction</p> <p><input type="checkbox"/> Wholesale Trade</p> <p><input type="checkbox"/> Retail Trade</p> <p><input type="checkbox"/> Accommodation and Food Services</p> <p><input type="checkbox"/> Transport, Postal and Warehousing</p> <p><input type="checkbox"/> Information Media and Telecommunications</p> <p><input type="checkbox"/> Financial and Insurance Services</p> <p><input type="checkbox"/> Rental, Hiring and Real Estate Services</p> <p><input type="checkbox"/> Professional, Scientific and Technical Services</p> <p><input type="checkbox"/> Administrative and Support Services</p> <p><input type="checkbox"/> Public Administration and Safety</p> <p><input type="checkbox"/> Education and Training</p> <p><input type="checkbox"/> Health Care and Social Assistance</p> <p><input type="checkbox"/> Arts and Recreation Services</p> <p><input type="checkbox"/> Other Services</p>
Q3.8_2	
Q3.8_3	
Q3.8_4	
Q3.8_5	
Q3.8_6	
Q3.8_7	
Q3.8_8	
Q3.8_9	
Q3.8_10	
Q3.8_11	
Q3.8_12	
Q3.8_13	
Q3.8_14	
Q3.8_15	
Q3.8_16	
Q3.8_17	
Q3.8_18	
Q3.8_19	
Q3.9_1	<p>8. Have you participated in any of the following activities during your PhD? (select all that apply)</p> <p><input type="checkbox"/> I have written a paper/dissertation in collaboration with an external non-university organisation</p> <p><input type="checkbox"/> I have participated in lectures/seminars held by a lecturer from an external non-university organisation</p> <p><input type="checkbox"/> I have participated in a research project in collaboration with an external non-university organisation</p> <p><input type="checkbox"/> I have participated in meetings/visits/excursions organised by or to an external non-university organisation</p> <p><input type="checkbox"/> I have had a paid or compulsory work placement/internship in an external non-university organisation</p> <p><input type="checkbox"/> I have had voluntary work placement/internship in an external non-university organisation (unpaid)</p> <p><input type="checkbox"/> I have collected primary research data from an external non-university organisation for my PhD</p> <p><input type="checkbox"/> I have utilised secondary data from an external non-university organisation for my PhD</p> <p><input type="checkbox"/> I have had advice on the structure and design of my research project from an external non-university organisation</p>
Q3.9_2	
Q3.9_3	
Q3.9_4	
Q3.9_5	
Q3.9_6	
Q3.9_7	
Q3.9_8	
Q3.9_9	

<p>Q3.10_1 Q3.10_2 Q3.10_3 Q3.10_4 Q3.10_5 Q3.10_6 Q3.10_7 Q3.10_8 Q3.10_9</p>	<p>9. Do you have any plans to participate in any of these activities during your PhD? (select all that apply)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Write a paper/dissertation in collaboration with an external non-university organisation</li> <li><input type="checkbox"/> Participate in lectures/seminars held by a lecturer from an external non-university organisation</li> <li><input type="checkbox"/> Participate in a research project in collaboration with an external non-university organisation</li> <li><input type="checkbox"/> Participate in meetings/visits/excursions organised by or to an external non-university organisation</li> <li><input type="checkbox"/> Paid or compulsory work placement/internship in an external non-university organisation</li> <li><input type="checkbox"/> Voluntary work placement/internship in an external non-university organisation (unpaid)</li> <li><input type="checkbox"/> Collect primary research data from an external non-university organisation for my PhD</li> <li><input type="checkbox"/> Utilise secondary data from an external non-university organisation for my PhD</li> <li><input type="checkbox"/> Receive advice on the structure and design of my research project from an external non-university organisation</li> </ul>																																																						
<p>Q3.11_1 Q3.11_2 Q3.11_3 Q3.11_4 Q3.11_5 Q3.11_6 Q3.11_7 Q3.11_8</p>	<p>10. To what extent has your contact with external non-university organisations during your PhD provided...</p> <table border="1" data-bbox="368 976 1385 1827"> <thead> <tr> <th></th> <th>To a high degree</th> <th>To a fairly high degree</th> <th>To a small degree</th> <th>Not at all</th> <th>I do not know</th> </tr> </thead> <tbody> <tr> <td>Practical skills</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Insight into relevant work</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Contacts/networks outside the university</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Motivation to complete my PhD</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Ideas that changed my PhD topic or methods</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Ideas that changed my career plans</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Job opportunities after completing my studies</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> <tr> <td>Prepared me to cope with the transition from PhD to further employment</td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> <td><input type="radio"/></td> </tr> </tbody> </table>		To a high degree	To a fairly high degree	To a small degree	Not at all	I do not know	Practical skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Insight into relevant work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Contacts/networks outside the university	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Motivation to complete my PhD	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Ideas that changed my PhD topic or methods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Ideas that changed my career plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Job opportunities after completing my studies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Prepared me to cope with the transition from PhD to further employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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<p>Q3.12.0</p>	<p>11. Can you think of other ways in which your contact with external organisations during your PhD has benefited you?</p>																																																						

Q3.13_1 Q3.13_2 Q3.13_3	12. How long was your external non-university engagement? (If multiple engagements, provide total. If ongoing, specify anticipated duration)					
		Less than one month	Up to three months	3 to 6 months	More than 6 months	
	Research project (in collaboration with an external non-university organisation)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	Paid/compulsory work placement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	Voluntary work placement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Q3.14_1 Q3.14_2 Q3.14_3 Q3.14_4	13. To what extent is engagement with external non-university organisations valued by your:					
		Very much	2	3	4	Not at all
	PhD supervisor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Department	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	University	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	Disciplinary community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Q3.15_1 Q3.15_2 Q3.15_3 Q3.15_4 Q3.15_5 Q3.15_6	14. To what extent did the following influence your PhD topic/problem:					
		Very much	2	3	4	Not at all
	Own research interests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Prior working experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	University supervisor(s)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Departmental priorities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	People outside the university/public research sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	The topic was pre-defined as part of a larger research project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Q3.16_1 Q3.16_2 Q3.16_3 Q3.16_4 Q3.16_5	15. How would you characterise your PhD topic/problem:					
		Very much	2	3	4	Not at all
	Basic/theoretical;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Applied/practically-oriented;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Aimed at addressing an industry problem or commercially-oriented;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Socially-oriented/intended for the betterment of society;	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	Multi-/interdisciplinary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Q3.17\_1  
Q3.17\_2  
Q3.17\_3  
Q3.17\_4  
Q3.17\_5

16. How important were the following as motivations for your PhD topic addressing an industry or commercially-oriented problem:

	Very much	2	3	4	Not at all
Employment prospects outside academe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment prospects within academe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial motivations (salary)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supervisor advice/influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### PhD satisfaction and career goals

Q4.2\_1  
Q4.2\_2  
Q4.2\_3  
Q4.2\_4  
Q4.2\_5  
Q4.2\_6

1. How likely is it that, in the first three years after completing your PhD, you will work in the following:

	Extremely likely	Somewhat likely	Somewhat unlikely	Extremely unlikely
University	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public research institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Private sector research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other private sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your own enterprise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4.3\_1  
Q4.3\_2  
Q4.3\_3  
Q4.3\_4  
Q4.3\_5  
Q4.3\_6  
Q4.3\_7

2. Ideally, where would you prefer to work in the first five years after your PhD? (if combination, select all that apply)

- University
- Public research institute
- Public sector
- Private sector research
- Other private sector
- Your own enterprise
- None of the above

Q4.4\_1  
 Q4.4\_2  
 Q4.4\_3  
 Q4.4\_4  
 Q4.4\_5

3. To what extent has your PhD provided you training/foundation for the following career paths:

	A great deal	A lot	A moderate amount	A little	None at all
Private sector employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public sector employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Research institute employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Setting up your own enterprise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4.5

4. Regarding your own preferences towards future academic work, do your interests lie primarily in teaching or in research?

- Primarily in teaching
- In both, but leaning towards teaching
- In both, but leaning towards research
- Primarily in research
- Neither - I wish to move outside academic work

Q4.6\_1  
 Q4.6\_2  
 Q4.6\_3  
 Q4.6\_4  
 Q4.6\_5  
 Q4.6\_6

5. Please indicate your agreement with the following statements:

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
'My main PhD supervisor has been very supportive during my studies'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
'Overall, I am satisfied with the quality of my PhD experience'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
'Since commencing my PhD, I am now more interested in an academic career'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
'I think it will be pretty easy to get an academic job'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
'External sponsors or clients have no influence over my research activities'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
'High expectations of useful results and application are a threat to the quality of research'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## Previous employment

Q5.2

1. Between the time of your bachelor degree and PhD enrollment, did you work in any professional roles (including self-employment)?

- Yes  
 No

Q5.3\_1

2. During this period between the time of your bachelor degree and PhD enrollment, how many years did you work in the following industries?

Q5.3\_2

Q5.3\_3

Q5.3\_4

Q5.3\_5

Q5.3\_6

Q5.3\_7

Q5.3\_8

Q5.3\_9

Q5.3\_10

Q5.3\_11

Q5.3\_12

Q5.3\_13

Q5.3\_14

Q5.3\_15

Q5.3\_16

Q5.3\_17

Q5.3\_18

Q5.3\_19

	Less than one year	1-2 years	3-4 years	5-8 years	9 or more years
Agriculture, Forestry and Fishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manufacturing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electricity, Gas, Water and Waste Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Construction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wholesale Trade	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Retail Trade	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accommodation and Food Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport, Postal and Warehousing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information Media and Telecommunications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial and Insurance Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rental, Hiring and Real Estate Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional, Scientific and Technical Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Administrative and Support Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public Administration and Safety	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Education and Training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health Care and Social Assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arts and Recreation Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5.4	<p>3. Specifically in the year prior to your PhD enrollment, typically how many days per week were you employed in your main job?</p> <ul style="list-style-type: none"> <li><input type="radio"/> Less than one day per week</li> <li><input type="radio"/> 1 day</li> <li><input type="radio"/> 2 days</li> <li><input type="radio"/> 3 days</li> <li><input type="radio"/> 4 days</li> <li><input type="radio"/> 5 days (full-time)</li> <li><input type="radio"/> More than 5 days</li> <li><input type="radio"/> Not applicable, I was not working.</li> </ul>
Q5.5	<p>4. How would you characterise the work tasks of this position?</p> <ul style="list-style-type: none"> <li><input type="radio"/> The work required higher education at the same level</li> <li><input type="radio"/> The work required higher education, but at a higher level</li> <li><input type="radio"/> The work required higher education, but at a lower level</li> <li><input type="radio"/> The work did not require higher education, but it was an advantage to have it</li> <li><input type="radio"/> Higher education was irrelevant</li> </ul>
Q5.6	<p>5. What was your approximate annual income in the year prior to your PhD enrollment (\$ AUD)? (include all jobs)</p> <ul style="list-style-type: none"> <li><input type="radio"/> less than \$20,000</li> <li><input type="radio"/> \$20,001 - \$30,000</li> <li><input type="radio"/> \$30,001 - \$40,000</li> <li><input type="radio"/> \$40,001 - \$50,000</li> <li><input type="radio"/> \$50,001 - \$60,000</li> <li><input type="radio"/> \$60,001 - \$70,000</li> <li><input type="radio"/> \$70,001 - \$80,000</li> <li><input type="radio"/> \$80,001 - \$90,000</li> <li><input type="radio"/> \$90,001 - \$100,000</li> <li><input type="radio"/> \$100,001 - \$110,000</li> <li><input type="radio"/> \$120,001 - \$130,000</li> <li><input type="radio"/> \$130,001 - \$140,000</li> <li><input type="radio"/> \$140,001 - \$150,000</li> <li><input type="radio"/> \$150,001+</li> <li><input type="radio"/> I do not wish to disclose</li> </ul>
<b>Personal background</b>	
Q6.2	1. What is your gender?
Q6.3	2. What year were you born?
Q6.4	3. In what year did you complete your highest qualification (prior to PhD)?