



# Design Options for the Future Doctorate

## Final Report 2018

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## Executive summary

This report delivers both research-driven education options for building the quality of the doctorate in Australia, and resources to inform institutions and candidates. The report stems from a commissioned project shaped by a growing perception that the Australian doctorate, while effective, is not optimised to best serve future interests of students, academia or industry.

This project was advanced as an education-focused re-thinking of the doctorate. Working from current policy and practice, the project was delivered to help Australian universities fashion targeted and effective futures for research and professional doctorates. The project engaged leaders in the field, and it extended prior institutional, national, scholarly, and international investigations into the doctorate as well as academic and professional work. It involved research and environmental reviews, proposals for policy and strategy, surveys and interviews, and consultation with Australian and institutional stakeholders.

This project was designed in 2014 and commissioned in late 2015 with work taking place across 2016 and 2017. Of course, Australian universities are engaged in ongoing renovation of their doctoral programs. The 2016 ACOLA review and subsequent national and institutional actions have been a great spur to progress. Working within existing funding over the last two years much has already been achieved at a sector level including the development of a series of good practice principles and advice by the Australian Council of Graduate Research (ACGR), the national peak body. But there remains ample room for ongoing thinking about how to reframe the Australian doctorate in ways that increase internal productivity and external impact, and also inspire even greater confidence in its future.

This design of this project was intended to encompass quality-assured and productive options that produced better doctoral outcomes for:

- students, through the quality of their research education and experiences, and clearer career pathways;
- universities, in efficiency of selection and load, with an eye to maintaining or increasing rates of completion without diminution in quality of projects; and
- Australia's knowledge industry and the broader workforce.

This project was designed and delivered using a project logic focused on doctoral outcomes and capabilities which are developed through student experiences and program designs. This logic framed four guiding research questions: What are the desirable and actual learning and professional outcomes of doctoral education? What generic and specific capabilities equip doctoral graduates for professional success? What essential and optimal training experiences are required to develop capabilities? What suite of design options best equips the sector for steering the future of doctoral education in Australia?

As the project logic and guiding research questions convey, this project focused on design of future practice rather than investigation or evaluation of current practice. Design thinking serviced a useful epistemology and methodology. The first stage involved empathising with

current circumstances to identify problems and different concerns. The next stage involved determining and defining key concepts, creating a point of view based on needs and insights. Then, ideation involved brainstorming possible futures, generating as many ideas as possible which were distilled into an architecture for framing innovation over the next decade or more.

Accordingly, the project embraced an eclectic suite of specific research activities. These included project initiation, background research, environmental analyses, validating design options, and reporting and dissemination. Ongoing stakeholder liaison included team meetings, national emails and newsletters, several rounds of consultation and formal interviews, a national survey, and project management reporting.

The main outcome of this project was to produce a doctoral design architecture. This doctoral design architecture took shape over two years. It took account of the contextual and conceptual reviews, stakeholder consultations, graduate and expert interviews and surveys, and further regional discussions. The goal was to produce a simple yet powerful architecture to help ensure the future doctorate is internally coherent, externally transparent, and nuanced to individual and institutional contexts.

The doctoral design architecture is depicted in the following figure. The structural facets are shown in the two left columns and include three phases titled ‘successes’, ‘experiences’ and ‘preparations’. The functional facets are shown on the two right columns and pertain to activities undertaken by students and universities both for themselves and on behalf of other stakeholders. A series of reasonably standard business rules can knit these functions together, linking the outset to the fruition of doctoral study.

### The doctoral design architecture

Structure		Function	
Phase	Focus	Student	University
Successes	Academic	Produce outputs and outcomes	Provide assessment and guidance
	Professional	Engage in job and build career	Guide, support and engage through alumni activities
	Personal	Personal and social experiences	Engage and enrich through alumni activities
Experiences	Development	Build generic research, education and leadership capabilities	Provide development courses and guidance
	Research	Engage in research training and experiences	Provide support, advisors and opportunities
	Foundation	Study discipline foundations	Provide education and guidance
Preparations	Onboarding	Identify readiness and needs	Design services and infrastructure
	Application	Provide education and demographic profile	Articulate programs and infrastructure
	Awareness	Explore futures and opportunities	Market programs, experiences and outcomes

The architecture is designed to give life to dynamic design options for future doctorates. It represents an advance because it codifies doctoral structures and functions, providing a touchstone for future change. It has potential to help clarify and align successes with

experiences and preparations. Such clarifications can avoid dashed expectations, dropout and burnout, and support prudent management of costs and returns.

Importantly, the design architecture does not define one or more specific reductive models for the doctorate in any declarative way. It looks beyond tinkering with existing supplier-centric formats. Importantly, the architecture is not intended as a permissive excuse for extrapolating existing diversified practice. Rather, it is a general frame for gathering, analysing and reporting information in ways that inform ongoing improvements in practice, and while including those improvements underway, is aimed at a longer horizon. It advances an efficient and robust means for matching students with doctoral programs. The simplicity of the logic is both its value and its risk. In paving a way to enhance the success of doctoral programs, it risks disrupting established arrangements. Given the distribution of research resource capabilities, however, clarification rather than disruption is a more likely outcome.

The doctoral design architecture is intentionally parsimonious and powerful. It can be applied at national, institutional and individual levels. National application reflects a broad, policy level implementation of the architecture in ongoing reform. Within universities the architecture can be deployed quickly as an audit or interpretative tool to identify areas of strength and areas in need of improvement. Though analysing existing broad practice is necessary, the main purpose of the architecture is to design better doctoral experiences and outcomes for individual students and their universities. The phased structure helps ensure that a student and a university have addressed all facets of the doctorate in ways which are coherent and aligned with external circumstances. Marketing science, and in particular the subfield of experience design, reveals a dynamic and promising approach for ensuring quality experiences and outcomes. These kinds of design can be given life in software platforms with transformative value for higher education.

Integrated review of the insights accumulated from the project revealed four main findings from which are derived 12 ideas for improvement. These are presented in the following table with respect to overall observations on the Australian doctorate, then in terms of outcomes, experiences and preparations. The improvements are numbered for ease of reference.

### Main project findings and improvements

Finding	Improvements
The Australian doctorate is generally in good shape with sustained demand, good experiences, and productive outcomes, however there are opportunities for clarifying its educational characteristics.	<ol style="list-style-type: none"> <li>1. Australia should sustain national investment in doctoral education and increase financial and broader contributions from business and industry.</li> <li>2. Adopting a doctoral design architecture will enhance education coherence, alignment and confidence, thereby increasing productivity for students, universities and broader communities.</li> <li>3. There is enormous value in building a software platform that provides information, enhances transparency for all stakeholders, and progresses program, education and research design.</li> </ol>
Doctoral education yields productive outcomes for students, universities and broader communities, though there are several	<ol style="list-style-type: none"> <li>4. As doctoral output requirements vary and are not always relevant or well supported, there is a need for more clarity, consistency and alignment of outcome requirements and assessment standards in particular.</li> <li>5. As the role of doctorate is evolving in a dynamic labour market, universities should keep contact with doctoral alumni to engage their expert contribution and in ongoing professional development.</li> </ol>

Finding	Improvements
opportunities for improvement.	6. There is a lack of information about the broad personal and social outcomes of doctoral education, and universities should encourage doctoral alumni to sustain lifetime contact.
Students report good doctoral experiences, though there remain several opportunities for improvement.	<p>7. Research training is highly varied and opportunistic and even with careful milestone articulation the single generalist academic program can be confusing or insufficient, so a journey map should be produced which helps students and universities map out expectations and plan supports and opportunities to ensure necessary experiences and outcomes.</p> <p>8. To help students develop the professional capabilities required for dynamic and advanced roles universities should provide development courses and guidance in research management, education practice, and leadership, and they should provide industry training experiences in line with the new guidelines developed by ACGR in response to the ACOLA review.</p> <p>9. As students come to doctorates from a wide range of backgrounds and vary in their foundation knowledge and skills, universities should engage students in foundation programs which ensure necessary foundations and build peer cohorts.</p>
Given changing individual, university and broader contexts there remain many opportunities to reform how people and universities prepare for doctorates.	<p>10. Doctoral education is becoming more significant and student cohorts are diversifying and expanding, so universities and students must work closely to design pathways and supports that help students succeed.</p> <p>11. High admission rates and lack of common admission processes raise questions about efficiency and standards, so there is a need for more systematic and transparent doctoral admission practices that take account of capacity to succeed.</p> <p>12. There is a need to provide better and more consistent information on doctoral education to help prospective students identify options, learn how best to engage, and shape expectations.</p>

Almost by definition, Australia’s university sector is ready for such medium-term growth as the project was launched with the sector’s current circumstances in view, which served as the platform for designing the architecture. These ideas are not designed in response to contemporary contingencies, or for near-term implementation. However, they do flow from internal and intra-university communication on the nature of the doctorate, and from deep engagement in government policy dialogues and implementations. Indeed, there is broad recognition across government, universities and industry that Australia needs a more coherent approach to doctoral training. This recognition should include an acknowledgement of the resource, funding and sector-wide coordination required to appropriately support changes. Across key stakeholders there is a widespread desire for greater strategic clarity that best harnesses available resources and innovations.

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# Chapter 1: Setting the scene

## *Framing perspectives*

Doctoral training continues to grow in scale and scope. Programs and approaches have diversified to suit different professional, industry, institutional and individual needs. Doctoral training provides new links for Australia into international research environments, generates key research outcomes for universities, and makes an extensive broader contribution to socioeconomic prosperity.

But in recent years it has not been uncommon to hear that the Australian doctorate has grown in uncertain ways, creating unproductive complexities which threaten the quality of experiences and outcomes. There can be various kinds of confusion between research and professional doctorates, stimulated by lack of information about a growing and diverse range of students, and by views indicating that the lack of design carries risk that doctoral programs could become ad hoc and their training components lack coherence. There are perceptions of widening gaps between aspirations and aims of doctoral training, and actual practices and delivery. Some opine that funding algorithms have driven a shift towards ‘safe projects,’ and even ‘safe students’. Concerns about the teaching load of doctoral students, and how to prepare students for a diverse array of future roles, further highlight the unease expressed by different commentators indicating that the Australian doctorate may not be well aligned with workforce needs. There remain longstanding worries about how to prepare, provide and assure quality supervision.

Such discontent is not unique to contemporary practice in Australia, nor is it nationally entrenched or terminal. Doctoral programs yield excellent outcomes which have profound impact on research and broader communities. By many measures the doctorate in Australia is doing better than ever before, and as shown by ACOLA’s 2016 Review of Australia’s Research Training System (McGagh et al., 2016). But this is no reason for complacency. Many indicators suggest work needs to continue to bring more coherence. Much work is underway through the implementation plan that outlines 18 actions for the higher education, government and industry sectors to respond to the ACOLA review’s findings in five priority areas: pathways to training; industry-university collaboration, including placements; equity, including Indigenous participation; quality of the HDR training system; and data and evidence to better monitor HDR system performance. Higher education institutions and the Australian Council of Graduate Research (ACGR), the national peak body, have actively responded to address these priorities. Nonetheless, the process of reframing needs to continue for the Australian doctorate in ways that increase internal productivity and external impact, and also inspire even greater confidence in its future. These ideas signal opportunities for ongoing enhancement and development.

This project was seeded and shaped by the broad view that despite much growth, the doctorate remains in need of design, and particularly design with an education focus. It flowed from widespread belief that improved design carries potential to continue to build greater internal coherence and better align programs with people and external

circumstances. Such design might affirm existing arrangements or identify options for improving practice, but most particularly it should enhance transparency, and hence clarity. Response to the ACOLA review picked up many areas of reform, but there is still much to be done.

The doctorate is of substantive and increasing national and global importance, signalling amplified interest from business and government. Better integrating the needs of students, universities and employers is particularly pressing in view of reconfigurations taking place across the world. It is essential that Australian universities can attract leading international candidates, and that doctoral programs and graduates are internationally competitive. Australia needs a doctoral training system that produces excellent scholars and researchers, as well as people who contribute in many different ways, from creating new markets to leading through the public sector.

### ***Focus and approach***

Ultimately, the project objective was to support the modernisation and realignment of doctoral education in Australia. The focus of this project was to develop a sustainable and internationally informed education design for advancing doctoral education in Australia. This design was intended to encompass quality-assured and productive options that produced better outcomes for:

- students, through the quality of their research education and experiences, and clearer career pathways;
- universities, in efficiency of selection and load, with an eye to maintaining or increasing rates of completion without diminution in quality of projects; and
- Australia's knowledge industry and the broader workforce.

To guide this inquiry the study responded to these four guiding research questions:

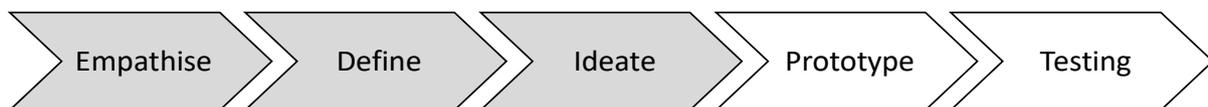
1. What are the desirable and actual learning and professional outcomes of doctoral education?
2. What generic and specific capabilities equip doctoral graduates for professional success?
3. What essential and optimal training experiences are required to develop capabilities?
4. What suite of design options best equips the sector for steering the future of doctoral education in Australia?

To answer these questions, the team deployed a project logic that has been deployed in other high-impact national projects regarding professional and academic work, and education design and evaluation (Coates & Goedegebuure, 2012; Edwards, Bexley & Richardson, 2011; Coates & Richardson, 2012; Richardson & Coates, 2014; Coates, 2017). This compelling logic focuses on the outcomes and capabilities that are developed through student experiences and program designs (Figure 1).



**Figure 1: Project logic**

As the guiding research questions and project logic convey, this project focused on design rather than investigation or evaluation. Design thinking (DMI, 2018) offered a useful epistemology and methodology. Design thinking can be described as an interactive five stage process, depicted in Figure 2. The first stage involves empathising with current circumstances to identify problems and different concerns. The next stage involves determining and defining key concepts—creating a point of view based on needs and insights. Then, ideation involves brainstorming possible futures, generating as many ideas as possible. The scope of the current project stopped short of the prototyping stage, intending to provide a framework and schematic that institutions can use in their efforts to reshape and test program designs. The following chapters are structured by reference to the first three stages.



**Figure 2: Report structure**

Like any practice, process or product, the doctorate can be designed in a host of ways and it is important to clarify this study’s boundaries and assumptions. This study was not intended to criticise or evaluate or increment contingent policies or practices, but rather to chart a feasible path for the next ten years. Through a well-designed national survey, the project does tackle matters like pathways and admissions, national funding arrangements, and research outcomes. However, it was not intended or implemented to produce generalisable national estimates. It sought graduate and expert input for key directions in programmatic design. The project advances a doctoral architecture but does not develop or test any prototype, and so in this way can complement many initiatives underway through ACOLA’s implementation plan. The project situates the Australian doctorate within an international landscape. While the project has several units of analysis, the doctoral program itself is the main level of analysis. In taking a broad view, the project focuses on both the research and the professional doctorate. In many respects the two have become inseparable, and together they comprise AQF Level 10 (AQFC, 2013).

The project was funded in 2015 by the Australian Government Office for Learning and Teaching (OLT). It was led by the University of Melbourne in collaboration with nine other universities: Griffith University, James Cook University, La Trobe University, Macquarie University, Monash University, Queensland University of Technology, the University of Queensland, the University of Sydney, the University of Western Australia, and the University of New South Wales.

The project had multifaceted research and advisory arrangements. It was led by Hamish Coates. Project researchers included Emmeline Bexley, Jonathan Chew, Gwilym Croucher, Mollie Dollinger, Paula Kelly, Ilke Grosemans, Lijun Ma, and Kenneth Moore. Project experts

included Sue Berners-Price, Helene Marsh, Chris Pakes, Nick Mansfield, Zlatko Skrbis, Helen Klæbe, Dick Strugnell, Justin Zobel, Laura Poole-Warren, Alastair McEwan, Stephan Riek, Ross Coleman, and Kate Wright. At project commencement, the researchers and experts directly engaged in this project worked at universities which represented around half of Australia's doctoral students and graduates. An international advisory group was formed which included Thomas Jorgensen, Debra Stewart, Suzanne Ortega, Futao Huang, Alan Lawson, Robert Harris, Seeram Ramakrishna, Gill Clarke, Ingrid Lunt, and Chen Shiyi. Barbara Evans served as project evaluator.

National projects such as this include a variety of management activities. The project was divided into five phases, with discrete activities in each phase and some overlapping activities. The phases included project initiation, background research, environmental analyses, validating design options, and reporting and dissemination. Ongoing management included team meetings, national communication via email and newsletters, several rounds of consultation and formal interviews, a national survey, and reporting and liaison with the Australian Government OLT. The project flow was influenced by delays due to human research ethics approvals and changes in team composition and roles.

This project produced both knowledge and practice outcomes, and a series of high-quality, informative and sustainable deliverables. Specific project deliverables included a detailed project plan, progress reports, an environmental analysis report, contribution to national conferences, a report on doctoral design options, national engagement workshops, this project report, several scholarly papers submitted to peer-reviewed journals, and media articles.

## **Summary**

This report stems from a commissioned project shaped by a growing perception that the Australian doctorate, while effective, is not optimised to best serve the interests of students, academia or industry. This project was advanced as an education re-thinking of the doctorate. Working from current policy and practice, the project was delivered to help Australian universities fashion targeted and effective futures for research and professional doctorates. The report delivers both research-driven education options for building the quality of the doctorate in Australia, and resources to inform institutions and candidates. The project engaged leaders in the field, and it extended prior institutional, national, scholarly, and international investigations into the doctorate as well as academic and professional work. It involved research and environmental reviews, proposals for policy and strategy, surveys and interviews, and consultation with Australian and institutional stakeholders.

## Chapter 2: Understanding the terrain

### *Introduction*

The project sought to project future doctoral design. Consequently, it is necessary to inspect current practices and ideas, and to identify problems and alternatives. Hence, substantial work was conducted throughout the project to define problems and explore relevant contexts.

This chapter provides an overview of the background research conducted to synthesise existing insights on doctoral education. First, it summarises recent trends and contemporary contexts, taking account of international and national, then university and student, circumstances. Second, it summarises the conceptual perspectives that shaped this project. The chapter concludes with observations that frame the subsequent design work.

### *Key contexts*

#### **International contexts**

Comparable data on doctoral outcomes post-study are limited. Most of the available evidence tends to be survey-based, and comparability across surveys is generally poor. The rule that continues to hold, though, is that rising levels of tertiary education yields improved employment outcomes for employment rates, starting salaries, and lifelong earnings. Studies across different countries consistently report positive post-study employment outcomes for doctoral graduates. One of the most complete international comparisons is from the OECD Science, Technology and Industry Scoreboard (OECD, 2017). In all countries for which detailed data is available, doctoral graduates are shown to have higher employment rates than all other levels of tertiary study, ranging from 87 per cent (Russia) to 94 per cent (Turkey). The data shows that in some countries, namely Australia, Germany, Turkey and the United States, doctoral graduates can expect to have meaningfully higher rates of employment than masters graduates.

There is limited internationally consistent data on annual wage rates or lifetime earnings, but country-specific studies show that doctoral graduates also enjoy higher salaries on average. Figures derived from United States Census (Data USA, 2015) data, for example, show that doctoral graduates are much more likely to achieve annual earning at the top end of the earnings spectrum, particularly at US\$100,000 or more per annum.

Research publication is both a direct and indirect outcome of doctoral education. Comparing publication shares between 2005 and 2016 provides telling insights. First, the United States accounts for the largest share of top-cited publications by a significant margin, although this dominance has fallen from 38.2 per cent in 2005 to 25.5 per cent in 2016 (OECD, 2017). Its current share is in line with the United States' share of the global economy. Second, most developed countries have seen their share of top-cited publications reduce from 2005 to

2016, including the United States, United Kingdom, Germany, Japan, France and Canada. Third, several developing countries have increased their share of top-cited publications: China's growth from 3.9 per cent to 14.0 per cent far exceeded that of all other countries. Other countries that have increased their share at a more modest rate include Australia, Korea, India, Brazil, Poland and Russia (OECD, 2017).

Doctorates remain rare commodities in populations across the globe. National PhD attainment rates of around 1 per cent are common, including in Australia, United Kingdom, France and Israel. Most developed countries follow a similar population education attainment pattern, with a large proportion achieving either an upper secondary or bachelor's equivalent qualification. In developing countries such as India, a larger proportion of the population has not completed primary level education (ISCED 1). In the case of China, universal schooling has enabled a high proportion of the population to complete lower secondary education. Through economic and socioeconomic development, the level of educational attainment across the population gradually moves up the qualifications ladder, with countries like Germany and United States achieving high proportions of masters and doctoral attainment.

The most appropriate measure for doctoral activity is the number of enrolments in doctorates at a given point in time. Enrolments encompass new commencements each year, and the pipeline of candidates working towards graduation and attainment. Globally, there are more than 2.17 million students enrolled in doctoral level programs. This is a relatively small proportion of all tertiary education enrolments. In Australia, doctorates represent approximately 4.3 per cent of total higher education enrolments (DET, 2017). This ratio is 4.2 per cent for Canada (StatCan, 2017), 3.8 per cent for Germany (DESTATIS, 2017), 4.9 per cent for the United Kingdom (HESA, 2017), and 2.6 per cent for Japan (RIHE, 2017). These enrolments are highly concentrated in a relatively small number of countries. Just 12 countries account for 1.70 million enrolments, or almost 80 per cent of total enrolments worldwide.

Enrolments by field of study show a disposition towards STEM fields in most countries. OECD (2018) indicates that doctoral enrolments in STEM fields/disciplines tend to make up around 50 to 60 per cent of all such enrolments. Countries such as France, Poland and Turkey are the exception, with a higher proportion of doctoral enrolments in HASS fields/disciplines. In India, about 60.8 per cent of PhD enrolments are in STEM areas. OECD data does not include the STEM-HASS share for China, but data from China's Ministry of Education indicates that enrolments in STEM make up 75 per cent of total doctoral level enrolments (MOE, 2017). Japan has a similarly high proportion of students in STEM programs, with 68 per cent of PhD students enrolled in a STEM faculty (RIHE, 2017).

Growth trends for doctorates have grown relatively modestly in developed countries such as Australia, Canada, Germany and Japan (OECD, 2015). In contrast, in recent years compound annual growth has been much higher in China, Korea and India, at approximately 5.0 per cent, 4.4 per cent and 11.9 per cent respectively. In Australia, doctoral level annual enrolment growth (2.9 per cent) has lagged behind the growth rate for both undergraduate (3.2 per cent) and postgraduate programs (4.1 per cent). Recent years in Australia have witnessed strong growth in international enrolments at postgraduate level.

Enrolment growth in each country can be driven in part by growth in international student numbers. There is wide variability in the proportion of international student enrolments at the doctoral level. On average, one in five PhD students in OECD countries is an international student. Some countries have a higher reliance on international students at the doctoral level, like Australia (33%), United States (35%) and United Kingdom (42%) (OECD, 2018). The high rate of international students in European countries in part reflects student mobility within the European region. Generally speaking, reliance on international students is higher for STEM subjects. The proportion of international PhD students in STEM subjects can be more than twice that of students in HASS subjects, notably in United States and Australia.

International students undertaking doctorates are concentrated in a small number of countries. This is particularly so for United States and United Kingdom, but France, Australia, Germany, Canada, Switzerland, Sweden, Korea and Belgium also enrol large numbers of international students at the PhD level. These ten countries enrol almost 90 per cent of international doctoral level students in OECD countries (OECD, 2018). It is likely that non-OECD countries, such as China and India, also enrol international students into doctoral programs; however, data is not available to quantify this.

The focus on STEM fields/disciplines at the doctoral level is significantly driven in part by the focus of international students on STEM. In the United States in particular, over three-quarters of international enrolments are in STEM fields. The proportion of international students enrolled in STEM subjects is similarly high for all other countries listed, in particular Australia (72%), Canada (74%) and Sweden (88%) (OECD, 2018). Many developing nations are increasingly reliant on international students to undertake doctoral research in STEM fields. At a guess, this is because these developing nations do not have a strong pipeline of domestic students, or that their doctoral programs are financially dependent on international students, or that they have insufficient depth of research in their domestic cohorts. It may be a combination of such matters.

The doctorate is a highly international qualification in almost every respect. As a precursor to subsequent analyses, it is helpful to examine the international context and Australia's comparative place.

There are two key proxies for measuring investment in doctorate education. Given that doctorates are research intensive, the first proxy measure is gross domestic expenditures on R&D (GERD). The United States National Science Board, Science and Engineering Indicators (National Science Board, 2018) provide helpful information. The advanced economies of the United States, Canada, Australia, as well as Japan, South Korea and Taiwan, stand out as having a high proportion of Gross Domestic Product (GDP) allocated to GERD. Israel has the highest proportion of GERD as a share of GDP at 4.25 per cent, followed by South Korea, Switzerland, Japan and Sweden. The United States ranks eleventh in terms of GERD as a share of GDP, but by virtue of its sheer size, is ranked first in terms of absolute investment which stands at almost half a trillion dollars. China is ranked second with US\$408 billion invested in GERD. There is a large gap between the top two and the remaining countries.

Australia is ranked fourteenth, but with only US\$23 billion in GERD, representing 2.11 per cent of GDP (National Science Board, 2018).

Alongside GERD, the second, and arguably more direct proxy measure for investment in doctorates, is funding for Higher Education R&D (HERD). On this measure, Australia compares favourably with Canada with 0.63 per cent and 0.66 per cent of GDP respectively. Funding for HERD can come from several sources, although in most cases government is the majority funder (OECD, 2017).

In terms of the source of HERD funding, Australia is particularly reliant on government which provides 91 per cent. France, Germany and South Korea are similarly reliant on government funding. However, in Turkey, Japan, Canada and United States government contributes less than 60 per cent of HERD funding. Australia is among the OECD countries in which government R&D budgets have increased since 2008, growing some 9% from 2008 to 2016. This reflects strong growth in 2008 and 2009, and a slight decline since (OECD 2017).

Non-government sources of HERD funding comprise contributions from business, the higher education sector itself, private, not-for-profit and other organisations, and funding sourced from the rest of the world. For those countries with a lower reliance on government funding, non-government sources can vary significantly:

- a large proportion may come from the business sector, as is the case in China and Germany, which suggests stronger industry links;
- a large proportion may come from higher education institutions themselves, as is the case in Canada, Japan, Turkey and the United States, which may indicate universities have the ability to raise commercial and philanthropic revenue; and
- a large proportion may come from the rest of the world, as is the case in United Kingdom, Poland and Israel, possibly reflecting more globalised linkages.

It is apparent that Australia is not a leader in the international context. On input measures, Australia is ranked 16th amongst OECD countries for gross domestic expenditures on R&D as a percentage of GDP (National Science Board, 2018). Higher education expenditure on R&D as a percentage of GDP is comparatively high at 0.63 per cent, but this is significantly reliant on government funding. This composition underscores a lack of engagement and investment from the business sector, and also highlights a failure to attract funding from the rest of the world.

The Australian population has benefited from comparatively higher rates of HERD funding and a generous subsidy scheme for doctoral candidates, resulting in higher rates of doctoral study and attainment. With just on 12 per 1,000 people holding a doctoral qualification, Australia compares favourably with the OECD average and sits around the levels of Germany (a high 12 per 1,000), the United Kingdom (13 per 1,000) and the United States (18 per 1,000). The United States' high level of attainment comes as no surprise. Despite being a highly popular destination for international study (one in three doctoral students are from overseas), Australia ranks twelfth in the number of doctoral students in training. Like most countries, doctoral enrolments in Australia are not growing as strongly as undergraduate

and other postgraduate enrolments, and the majority of these doctoral candidates (61 per cent) tend to be in STEM disciplines (in part driven by international student enrolments).

Increased investment in higher education research and doctoral programs are the first and most apparent opportunities for growing Australia's research workforce and associated research output. Increasing the proportion of that funding from private enterprise and industry is another important dimension to the opportunity, as is the need to promote cross-border coordination, collaboration and investment. In 2015, Australia had the second highest share of tax support for business R&D in the OECD, at almost 87 per cent (OECD, 2017). Reforms to the R&D Tax Incentive in Australia may further improve the yield from private investment.

## **The Australian context**

In Australia, the funding of research training at masters and doctoral levels reflects a national commitment to the development of research, research capacity, research training and its attendant outcomes. These are perceived broadly as having positive effects on labour productivity, economic prosperity and social health of a nation through research and development. Additionally, the growth of doctoral education in Australia has an important economic benefit for governments as the higher education sector represents the third largest export nationally.

The Australian Qualifications Framework (AQF) provides broad specifications for the knowledge, skills and application of skills. It is a harmonising tool for qualification level outcomes rather than an evaluation measure. The highest qualification in the national framework, the doctoral degree, has two specified forms or types: the Doctoral Degree (Research), referred to as a Doctor of Philosophy (PhD) and indicating significant and original contribution to knowledge; and the Doctoral Degree (Professional), titled Doctor of [field of study] (DFoS), which requires a significant and original contribution to knowledge in the context of professional practice (Australian Qualifications Framework, 2015). While the AQF distinguishes these two types of doctoral education, the learning outcomes are not distinct and are broadly aligned to the qualification level descriptors for the doctoral degree.

Coupled with the AQF, the Higher Education Standards Framework provides threshold standards for research training specifically, and for educational outcomes at the qualification level more broadly. Only those institutions with self-accrediting authority (all Australian universities and some other higher education institutions) are authorised to confer doctoral qualifications without accreditation from the regulator, the Tertiary Education Quality and Standards Agency (TEQSA, 2018). The Higher Education Standards Framework makes reference to material developed by the sector, including for instance the Australian Graduate Research Good Practice Principles developed and endorsed by the ACGR (2015).

Postgraduate research degree enrolments have grown at a slower pace than total student enrolments between 2001 and 2016. In that time, postgraduate research student enrolments have dipped from 4.9 per cent to 4.3 per cent of the total Australian higher education student body (Department of Education and Training, 2018). Over that same

period, total higher education students have grown 72 per cent. Notwithstanding the decline in share, doctoral student numbers have grown in absolute terms from 43,700 in 2001 to 66,400 in 2016. This growth trend correlates to global data for doctoral graduates with increases from 2005 to 2013 in all but three (Austria, Finland and Slovenia) OECD countries (OECD, 2015). Significant growth in Australia is reported in the number of women and international students, relative expansion of non-science disciplines, and growth in universities other than the Group of Eight (Dobson, 2012).

This growth in the doctoral education system in Australia reflects the changing higher education landscape over the last decade, including higher education policy reforms such as uncapping of government subsidised undergraduate student places. The expanding market for higher education has prompted a rise in the number of registered non-university higher education providers. Other influences on growth in doctoral program enrolments include increased demand for higher education services in global markets (most significantly in China and India), sustained focus on international rankings, and 'credential creep'.

In response to growing demand, since 2000, a broad range of higher education policy agendas, instruments, agencies and funding arrangements have been introduced, reformed or disestablished at both the national and state levels in Australia. Most significant for doctoral education during this period was the introduction of the Research Training Scheme (RTS) in 2001, replaced by the Research Training Program (RTP) in 2017. The RTP funds institutions based on the numbers of higher degree by research (HDR), or postgraduate research, completions. The focus on completions highlights increased concerns about high participation rates realised through the uncapping of government supported places for undergraduate education, and increased numbers of international students at all qualification levels.

Policy agendas and new funding models are playing a key role in ongoing development of doctoral education. But there is room for improvement given several inconsistencies in policy, funding and regulatory frameworks that impede the enhancement of doctoral education in Australia. Enhancement is limited, for example, by the lack of transparency, and variant practices and outcomes, across the sector, coupled with a lack of reliable and comprehensive data that provides meaningful insights into the individual, institutional and national impact of doctoral education. In Australia, a number of studies have surveyed doctoral graduates from research-intensive universities (for example: Neumann, Kiley & Mullins, 2008; Platow, 2012; Western et al., 2007), and others have used national graduate survey data (for example, Neumann & Tan, 2011). However, there is insufficient information from which to derive a holistic picture of graduates, or of the aggregate impact of doctoral education on broader institutional, economic and social contexts (Manahitunga et al., 2011; Raddon & Sung, 2009).

Recently, vital but limited information on doctoral education is found in educational and demographic statistics, census data, and graduate employment survey data. Completion data can provide some useful information about graduate trends. However, less clear is the actual number of doctoral students mapped to their stage of study and progress. Largely absent is information about when particular students graduated, how long it took them to complete, the work experience and prior skills they brought to their study, and how their

doctoral qualification impacted their career. Also absent is information about the motivations of the small proportion of doctoral graduates (GCA, 2014) who go on to undertake further study at the same or lower qualification levels.

The sector's growth rate, in particular growth in doctoral education enrolments, since 2001 has significant implications for government, industry, universities, doctoral graduates, and not least those seeking to undertake doctoral study. Growth is coupled with issues including oversupply, increased competition for postdoctoral and research positions within universities, a crowded postgraduate employment market, and constraints on institutional resources and funding to support high quality research training.

There is greater scrutiny on doctoral education outcomes in Australia, and in response to the ACOLA report many universities are focusing on this. In terms of research publications and citations, the quality of Australia's overall research output is considered healthy. According to OECD data for 2013, Australia contributed 3.85 per cent of global publication output while representing only 0.3 per cent of the world's population. Yet out of 30 OECD countries, Australia ranks last on the proportion of innovation collaborations between large businesses collaborating with higher education and public research institutions, and second last for collaborations involving small to medium enterprises (SMEs) (Department of Education and Training, 2015). Current government initiatives target the translation of research into commercial outcomes as a precondition for innovation.

Industry linked and supported doctoral places are an expanding feature of the Australian system. Several programs, attracting both public and industry funding, support doctoral students: for example, the Australian Research Council (ARC) Linkage program, and the Cooperative Research Centre (CRC) program. At state government level, initiatives to stimulate connections between doctoral students and industry include industry investment in PhD funding, and appointment of industry supervisors for doctoral supervision of an industry nominated research topic.

With a heavy reliance on government finance, funding policy plays a huge role in shaping the doctorate. A longstanding goal of funding policy is to send a strong message to universities that supervising students to completion is the priority, supported by adequate research resources to achieve the desired outcome, rather than simply to expand the total number of enrolled students. From 1989 to 2016 there was a significant growth in HDR students: completions grew faster than enrolments, and significantly faster than overall higher education enrolments. The data reveal that research training policy and associated funding models have facilitated dramatic growth in doctoral student numbers, with stipend amounts kept constant in real terms (inflation adjusted) since 2000. However, research training grants to universities have fluctuated on a per capita basis.

There is a well-established link between productivity and a highly skilled labour force. Yet in Australia and internationally, there is frequently encountered concern about how effectively doctoral study prepares graduates for employment in a rapidly evolving and increasingly uncertain employment environment. Despite these concerns about the employability of doctoral graduates, data presents a relatively positive picture of high employment rates,

and median salaries higher than for those with a bachelor qualification although commensurate with salaries for other postgraduates (McGagh et al., 2016).

It must be acknowledged that for doctoral graduates, the traditional pathway into academia is now less certain given higher numbers of doctoral graduates over the last 15 years, and the changing nature of the academic role. Yet employment options outside academia are also challenging. Research shows industry leaders do not always value the doctoral process. They may hold views that doctoral students have too narrow a focus on research, lack the ability to work in groups or on commercial projects (Edwards & Smith, 2008), and that they have too few non-academic skills to thrive in commercial sectors (MacDonald & Barker, 2000; Jackson, 2007; Rubio & Hooley, 2010, cited in Grande et al., 2014). Other studies of doctoral employment patterns in Australia suggest there may be cultural resistance to employing PhD graduates (Manathunga, 2011).

With low employment rates of doctoral graduates in SMEs both in Australia and internationally, there may exist a reciprocal lack of awareness between both business and graduates concerning mutual benefits (UNESCO, 2014; Sear et al., 2012). In other employer surveys it was found that private sector employers are reluctant to hire doctoral graduates because they are seen as too expensive, or that high levels of management are required rather than high levels of technical expertise (UNESCO, 2014). Additionally, data demonstrates that few doctorate holders engage in entrepreneurial activities (Bentley & Hooley, 2010; Smith et al., 2014).

There is tension between postgraduate expectations about employment outcomes, realistic employment opportunities (Go8, 2013) and a lack of training in business, management and entrepreneurial skills (Smith et al., 2014). This tension has stimulated debate about possibilities for tailoring doctoral education to secure multiple and varied outcomes (ACOLA, 2012). The emergence of add-on coursework units, or embedded lower qualifications within doctoral degrees, is an acknowledgment that graduates require broader employability skills, including generic or 'soft skills' (Allen Consulting, 2010).

As the academic profession evolves, employability of doctoral graduates becomes a more pressing issue. The rise of professional (or in some cases 'industrial') doctorates in Australia, United Kingdom and North America, is demonstration of a buoyant market for developing expertise in established professional practice, especially in the fields of Education, Jurisprudence and Psychology (Boud & Tenant, 2016). In part this is a response to the diminishing impact of doctoral education on research and development of the kind required for a knowledge economy, or required to train knowledge workers (Usher, 2002). What is urgently needed is a mechanism for redressing the concerns about the quality of doctoral graduates which is voiced by employers outside academia (Kehm, 2004; Nerad, 2004).

The challenge for institutions and doctoral graduates is to demonstrate the value of the doctorate compared to other postgraduate awards. The challenge must be met by reorienting doctoral education, both in Australia and globally, in ways that assist employers to differentiate between the skills and attributes of a 21st century doctoral graduate and other postgraduates. The ACOLA review recognised this need and in recent years ACGR has been responding by articulating national guidelines on the development, assessment and recognition of transferable skills.

## University and graduate contexts

Individual institutions and faculties frame and implement specific policies and processes for providing doctoral education. Across the sector there are significant differences in many areas, including admission procedures, supervisory arrangements, formality of milestone requirements, research methodology training, and the relative proportions of coursework and research projects in doctoral programs. This section presents a broad picture of key institutional characteristics relevant to doctoral education in Australia.

A 2017 desktop audit of websites of higher education institutions in Australia offering doctoral education revealed different approaches to delivering doctoral education. Differentiating factors rested primarily on how integrated coursework was into the degree. Significantly, faculties within many institutions had different requirements for integrated coursework. Analysis of national provision suggests the Doctoral Degree (Research), or the PhD, with no formal coursework was by far the most common approach to doctoral education. Other more involved models constituted the remainder. The Doctoral Degree (Professional), or the 'professional doctorate,' appears to be offered primarily in a selection of fields such as business, education and science.

This review of doctoral program architecture in Australia suggests that current offerings resemble variations on a theme rather than designs forged by educational or professional rationales. This isomorphism stems mainly from exogenous factors like institutional policy requirements, national funding parameters, international conventions, and historical precedents. It seems curriculum for professional doctorates is more often better aligned with external contexts and needs than is the case for PhDs.

Application and selection data are not readily available in aggregate for Australian universities. Individual Australian universities are under no obligation to make public selection data such as the number of applications, offers or acceptances. Acceptance criteria, in the qualitative sense, can be gathered from admissions web pages and applications; however, precise benchmarks, cut-offs, key decision-making criteria, and scholarship/funding judgments have not been systematically investigated on a sector-wide basis. Consequently, their operational and functional impacts are not well understood, especially for postgraduate research degree programs.

Despite unavailability of data on detailed selection criteria across the sector, some norms are evident. The main entry pathways into a doctoral degree are the Australian Bachelor Honours Degree, the Masters Degree (Coursework) where there is some research component or preliminary research training in methods, and the Masters Degree (Research) (McGagh et al., 2016). The 2016 ACOLA Report details numerous issues and constraints imposed by each of these pathways, including the lack of international recognition for the Australian Bachelor Honours degree, funding and structural inconsistencies in the Masters Degree (Coursework), and declining enrolments for the Masters Degree (Research) (McGagh et al., 2016).

Current literature has not clearly mapped the major milestones of the doctoral process. Moreover, students in varying international contexts reach these milestones differently. For

example, United States' students are often expected to take coursework while developing their thesis scope and research questions, which from the time of their enrolment may take two years to develop. In Australia a student's full research proposal is expected to be completed one year into enrolment, with no coursework required. Australia also differs from other international contexts, as no oral defence of student's work is required. In the United States, PhDs are designed to be completed after four years fulltime, while Australian full time students can complete at three. However, most students in the United States, United Kingdom and Australia usually submit dissertations for their doctorate between three and eight years after enrolment.

Student retention is an important matter, though difficult to grasp. Some clues about retention rates can be inferred directly from year by year enrolment dynamics. Edith Cowan University (2009) explored enrolment and completion data from 2003 to 2008 and found the average retention rate of HDR students across Australian universities from the single cohort that commenced in 2003 was approximately 70 per cent by 2008. The average five-year completion rate for all cohorts during that same period was 44 per cent. However, these averages are not representative of all universities as there was considerable variation between institutions.

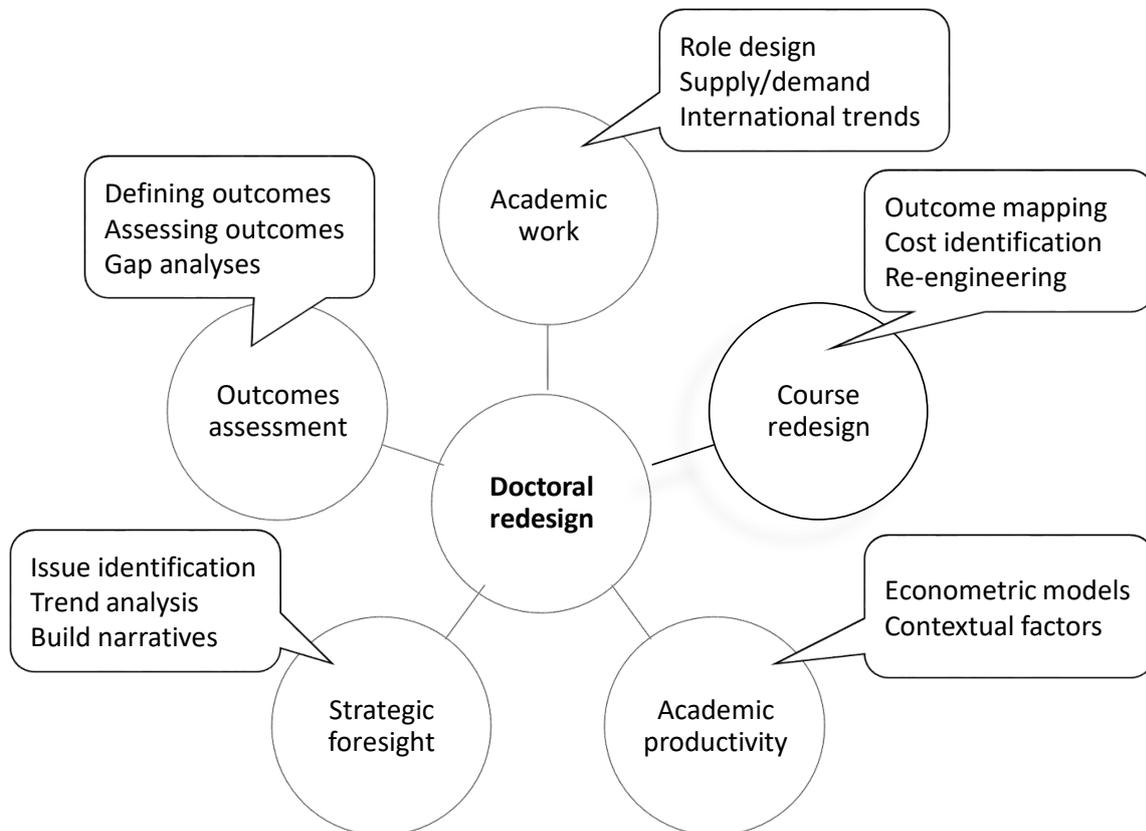
In Australia, as it is internationally, the student/supervisor relationship is highly nuanced, personal, and multifaceted. The evidence surrounding best practices in this dimension of the postgraduate research degree remains open, despite substantial research on this topic (Kandbinder & Peseta, 2001; Nulty et al., 2009; Pearce, 2006; Brew & Peseta, 2004). Much of the research in this area appears to centre on personal accounts of successful student/supervisor relationships, or on single institution or departmental improvements to, or restructuring of, these relationships. There are two notable trends in the literature; namely, increasing prevalence of student/supervisor relationship assessment, and formalisation and professionalisation of the supervision processes (Mainhard et al., 2009; Wubbels et al., 2006; Brew & Peseta, 2004; Park, 2007; Nulty et al., 2009). These trends highlight better recognition and higher prioritisation of supervision models and processes as key leverage points in postgraduate research degree program improvement. It is evident that there is no single or universal guide for managing this relationship as individual personalities may shape the nature of the collaboration as much as any other factor.

In Australia, most doctoral graduates report high levels of satisfaction and have favourable employment outcomes (McGagh et al., 2016). Students seemed most satisfied with their skills development, goal attainments and expectations. Areas of lower satisfaction included thesis examination, supervisor, infrastructure and intellectual climate. However, these areas were still positive overall and showed improvement across time (McGagh et al., 2016). Moreover, 86.8 per cent of all respondents reported overall satisfaction with the doctoral experience (McGagh et al., 2016). Doctoral graduates have favourable initial employment outcomes in terms of jobs and salaries, though the nature of employment varies depending on field and demography. Yet it should be noted that medium- and longer-term employment outcomes remain relatively unknown, as no longitudinal data exists and data is conflicting. One constant is the tension between the primary research focus of a doctorate and the need for broader technical and leadership development (Western et al., 2007). There is little data on the broader pan-disciplinary capabilities developed through doctorate

education, though ACGR is currently developing national guidelines to help address this important gap. One of the major challenges facing doctoral graduates lies in transferring their skills to non-academic positions.

### ***Conceptual perspectives***

It is helpful to delineate key perspectives and approaches behind this project’s design work. As with all design work, the emphasis is on a varied exploitation of theories rather than assignment of, or confinement to, particular methods. The pan-methodological approach is suited to a focus on doctoral design rather than generalisable insights. Figure 3 presents an overview of approaches and focuses for doctoral design, showing insights and methods relating to academic work, course redesign, academic productivity, strategic foresight, and outcomes assessment. These ideas are unpacked in the paragraphs that follow.



**Figure 3: Conceptual perspectives used for this design**

It is insufficient to examine doctorate practice and design without reference to theories and methods relating to academic work. Two strands of academic work analysis are relevant to this project. First, as the context review showed, taking account of empirical research is necessary to gauge the characteristics of academic work and workforce. This work has grown in volume in recent years in step with the enlargement of the value of academic work to society as a whole. It provides insight into matters such as demographics, professional opportunities, and what academics do, and information on supply and demand of work, talent and, of course, international trends. Second, a related but distinct vein of research relates to the design of academic work. This vein has been followed by education

researchers and, in more pointed ways, by consulting firms, universities and governments or sector-related agencies. Collectively, their investigations illuminate a quickening struggle to understand how to reconfigure academic work for contemporary and future contexts. A sample of relevant studies includes Bentley et al. (2012), Appelt et al. (2015), Macfarlane (2011), McCormack, Propper and Smith (2014), Coates and Goedegebuure (2010), PWC and AHEIA (2016), EY (2018). Recognising both the contexts and nature of academic work is essential to this project.

Course redesign is a powerful technique developed to help diagnose and improve academic programs. Launched by Carol Twigg at the United States National Center for Academic Transformation (NCAT), academic course redesign refers to the process of analysing and improving education outcomes while reducing cost, making as much use of IT as possible (NCAT, 2018). Course redesign was developed to assist academic coordinators at traditional universities to reduce course-level costs and improve outcomes; however, the ideas are readily applicable to doctoral education. In essence, course redesign involves selecting a redesign model, defining student outcomes and appropriate assessment methods, and specifying detailed cost reduction strategies. Over several years NCAT has developed specific resources and approaches for application. This project uses experience design, including profile and mapping, as part of this agenda. Of most use to the current project is the idea that applying commercial logic to existing/legacy education practices can improve productivity.

Doctoral education remains best conceptualised as a non-profit and non-priced activity. However, this does not mean productivity is unimportant. Indeed, doctoral education and doctoral students lie at the heart of much academic productivity, contributing to both research and teaching 'production functions,' and fuelling the future advanced professional workforce. Contemporary work on academic productivity has been pioneered in the United States by Massy who, through scholarly and large-scale professional work, has defined econometric models, identified pertinent contexts, and built functions and tools for university managers and leaders. This work has been expanded to incorporate doctoral and international perspectives (Coates et al., 2017; Moore, Coates & Croucher, 2018). Such augmentation has delivered generalisable models, spotlighted data and indicators of most relevance, revealed interactions between academic and financial matters, and defined constraints and assumptions relevant to academic design. These ideas are directly relevant to this project which seeks to produce more efficient, not just higher standard, doctoral designs. This project does not involve forecasting in any formal sense, but it does involve projecting doctoral designs, and this must be done in ways that are likely to be feasible and useful. The point is not to predict futures, but rather to explore alternative narratives in transparent ways that help make sense of options and developments.

People and universities invest in doctoral education for individual experiences and institutional work, but mainly to achieve an outcome. So, it is helpful to draw from the international field of learning outcomes that has flourished since the turn of the century, yet has hardly been connected with doctoral education. Essentially, this work involves defining outcomes, specifying assessment tasks, and improving the host of assessment support procedures that help improve learning, teaching and curriculum (Coates, 2014). The value of applying this work to doctoral education is that it provides a suite of rationales, tools and

insights that foster understanding of doctoral education, and hence reshapes its various outcomes. The purpose in doing so is to put in place structures that clarify outcomes in ways that help universities and graduates. It does not serve as a mechanism for standardising or formalising learning outcomes for any bureaucratic or regulatory purpose.

## ***Summary***

Research training contributes much to Australia and its universities. As the context review detailed, research training outcomes are many, embracing research funding, research labour and publications, and in some cases acquisition of intellectual property which stimulate and drive opportunities for commercial ventures. It is clear that over the last 15 years doctoral education has experienced significant growth both internationally and within Australia. Localised higher education policy and funding arrangements have influenced this growth, as have other complex factors, including a globalised and mobile workforce, shifts in economic and industrial patterns, overall growth in the higher education sector, and technological advances.

The detailed analysis illustrated, however, that this growth appears largely to have proceeded without due reference to graduate employment outcomes. Until recently, and in particular in response to the ACOLA review, national policy reform in higher education was concentrated on a few major funding reforms. However, most policy change has tinkered at the margins, including policy related to doctoral education—an area inherently subject to policy capture as higher education providers are inclined to advocate and act on their institutional interests. Relative to its importance, not much is known about the doctorate. Key evidence of this point is that right now the doctorate remains impossible to cost accurately.

An approach to doctoral education that is research- and evidence-based will ensure that future growth is strategically aligned to desired stakeholder outcomes. Much important reform is occurring, not least in response to the ACOLA review, yet there is still a need in many areas for a more considered approach to the way doctorates are designed and implemented, the manner in which graduate numbers are managed and allocated and, more importantly, the extent to which learning and teaching within doctorates are fit for purpose. The conceptual perspectives detail helpful infrastructure for constructing a broad doctoral design that carries potential to improve quality and productivity for students, universities and broader communities.

## Chapter 3: Defining structures and insights

### *Introduction*

With background insights to hand, the project's next stage involved defining the things that are important and creating points of view based on needs and insights. This definitional stage involved parameterising the problem of doctoral design and then collecting insights from people involved.

This chapter discusses development of the project's empirical insights. It first reviews the conceptual and technical work done to produce the broad design frame and associated fieldwork instruments. Then it presents empirical insights into doctoral outcomes, experiences and inputs.

### *Defining structures*

#### **Designing the framework**

The contextual and conceptual reviews were used to design a framework to parameterise the doctorate. This began by documenting the vocational outcomes from doctoral programs. For instance, while it has become customary to drive such analysis with the assumption that graduates face a binary choice of academic or non-academic work, the context as surveyed in chapter 2 reveals far more complex situation (DIISRTE, 2010; Edwards, Bexley & Richardson, 2011; DoI & DoE, 2014). Even in the first few years after graduation, doctoral graduates may participate in a diverse range of academic and non-academic work. Over the course of a career people move through a range of roles, organisations and industries. Of course, academic work itself has become highly differentiated (Bexley et al., 2011; Coates & Goedegebuure, 2012), and non-academic professional work is far more diverse again. Hence, an architecture is needed which brings into the analysis a suite of more nuanced conceptualisations about professional work. The resulting theoretical lens is intended to chart the work graduates undertake in the first five years post completion.

With an expansive, nuanced understanding of graduate outcomes to hand, the project worked backwards to define a suite of required field-specific capabilities (at a relevant level of aggregation) and general capabilities implied by these vocational outcomes. This involved mapping the learning outcomes of doctoral education in Australia (in terms of knowledge, skills and attitudinal change, as well as the induction into an academic disciplinary culture). Learning outcomes techniques were used for this work (for example: Tuning, 2014; Coates & Richardson, 2012; AMAC, 2014; Edwards et al., 2012). The process involved a series of preliminary thematic reviews, leading into a series of iterative consultations, which together delivered a validated suite of suitably specified learning outcomes. This analysis avoided a purely deductive linking of outcomes and capabilities as this would be overly conservative and simplistic, not least given the currently muted link between doctoral graduation and

work in non-academic industries (DoI & DoE, 2014). Rather, the analysis referenced emerging thinking about the capabilities and roles future work is likely to require, drawing on contemporary relevant Australian analysis (such as Shreeve, Wellings & Wood, 2014). The United Kingdom's Vitae Researcher Development Framework (2018) was particularly helpful in supporting outcome mapping for facets of the doctoral research project. Consideration was also given to various non-academic professional and personal contexts which play important roles in generating capabilities and vocational outcomes, and attention was also paid to experiences in other countries. Multisector and multidisciplinary consultations in Australia and abroad played an important role in the analysis.

With a cogent mapping of capabilities, the team enumerated discrete educational experiences required to generate these outcomes. There are various means for structuring analysis of educational experience, and the approach for this project drew on relevant distillations of available research, policy and practice, including work commissioned by the Australian Government (Deloitte Access Economics, 2011; Access Economics, 2010; Allen Consulting Group, 2010; Cutler, 2008), undertaken by the Australian Parliament and Australian Government (DoE, 2014; DIISRTE, 2011a, 2011b; DIISRTE, 2010; House of Representatives Standing Committee on Industry, Science and Innovation, 2008), and undertaken by stakeholder groups (CAPA, 2012; Marsh & Lamprecht, 2012; Go8, 2010). Of course, a central part of this analysis addressed the desirable and actual capabilities and capacities of academics and teams who supervise and advise research candidates. A broad range of experiences was considered, including admissions experiences and those which ready graduates for work, such as industry internships, supplementary training, and broader engagement skills.

Table 1 shows the initial doctoral design framework produced through this foundation work. It groups parameters into those relevant to university/student outcomes, processes and inputs. Underneath this broad representation a number of more specific attributes were defined to give expression to each parameter. For instance, 'leadership outcomes' were characterised as involving general leadership skills, interpersonal capabilities, management skills, entrepreneurship capability and general social outcomes. 'Support arrangements' included support from other doctoral students, academics in the same department, academics at the university, academics at other universities, researchers working outside universities, non-research professionals outside universities, academics at international universities, university professional/administrative staff, academic support staff, and postdoctoral students. This three-phase design mirrored the project logic, serviced a framework for the empirical work, and underpinned subsequent interpretations.

**Table 1: Doctoral outcomes, experiences and inputs**

Phase	Design parameter	Brief description
Outcomes	Vocational outcomes	Paid and unpaid work characteristics
	Academic outcomes	Research, education, engagement and service knowledge and skills
	Leadership outcomes	Leadership and management capabilities
	Personal outcomes	Personal capabilities
	Doctoral outputs	Research, education, engagement and service outputs
Processes	Assessment practices	Nature of formative and summative research and broader assessments
	Advisory arrangements	Broader advisory/governance arrangements in place
	Supervisory arrangements	Nature of supervisors and supervisory arrangements
	Support arrangements	Key student supports and resources
	Supplementary activities	Nature of any additional activities
	Research activities	Details of research work
	Study locations	Organisational locations in which the doctorate is located
	Academic work patterns	Characteristics of students' academic work
	Professional development	Participation in supplementary professional development
	Work activities	Nature of student participation in paid and unpaid work
	Key technologies	Core technologies involved in doctoral implementation
	Program management	Characteristics of doctoral program management
Inputs	Research specification	Approach taken to research specification
	Student role design	Way in which student work is designed
	Student expectations	Reasons shaping student participation in doctoral study
	Student admissions	Information and approaches used for student admissions
	Marketing and recruitment	Nature of promotion and engagement opportunities
	Contexts and demographics	Educational and individual information

## Empirical approaches

With this framework the project sought to gather insights into doctoral education outcomes, processes and inputs. Insights were gathered from consultations, interviews and a large national-scale survey.

Both informal and formal consultations were conducted. Informal consultations came through ongoing liaison with stakeholders and experts in Australia and globally. The dialogues revealed thinking and practice that is at the leading edge of doctoral education and is unlikely to be documented for one or more years to come. The core ideas in this project were tested through such conversations which played a formative role in shaping outcomes. The project also involved formal consultations. These took the form of expert interviews with stakeholders. Interview subjects were drawn from populations stratified by institutional type and role. An interview schedule was derived from the doctoral framework (Table 1) to guide the semi-structured discussions. The interview schedule consisted of five open-ended questions from the expert questionnaire. Eighteen interviews were conducted with nine institution experts, seven graduates, and two employers. Interview results were synthesised into broader observations to query and confirm both project rationales and, more particularly, project outcomes.

An important part of the project involved a survey of doctoral graduates five years out (people who completed their study in 2011 even if their degree was not actually conferred in this calendar year), and also doctoral experts at participating universities. The survey sought to capture data that availed insights into doctoral education and also validated the doctoral design. The survey was not primarily designed to furnish university or national generalisations. A brief overview of instrumentation and fieldwork is given here as a background to subsequent presentation of insights.

Questionnaire design was informed by substantive, technical and practical considerations. Substantively, the questionnaires were shaped by the research reviews and design perspectives above, and by an extensive review of existing relevant instruments (for example: Coates & Edwards, 2011; Auriol, Schaaper & Felix, 2012; EUA, 2005; NORC, 2014), insights garnered from interviews with a range of stakeholders, and design prototyping within the project team. Technically, although the instrument was designed for one-shot use in this project, it was designed to high standards as are other national instruments built by members of the project team (for example: Radloff et al., 2012; Coates & Edwards, 2011; Griffin, et al., 2003; Coates, 2009; Coates et al., 2006). Practical considerations considered included constraints around population lists and project timeframes, the need to balance data richness with the quality of response, and the needs and interests of participating universities.

A national approach was taken to the fieldwork which used standard survey methods. All 40 universities providing doctoral education in Australia were invited to participate in the survey fieldwork. Thirty universities signed-up to fieldwork, with decline or no reply from 10 universities, and two universities subsequently discontinuing, giving 28 participating in fieldwork with excellent cross-section of sector. Graduate population files were sourced from the Australian Government (DOET, 2015) and then further validated with universities. Expert population size estimates were provided by universities, and they varied greatly in number. There was a validated graduate population of around 4,649 (from 8 at one university to 525 at another) and staff population of just under 1,000 (from 3 at one university to 119 at another). A census of graduates was conducted. For the expert survey, Vice Chancellors were asked to nominate a lead university expert responsible for distributing the online inventory to discipline experts who completed the questionnaire with respect to their organisational unit. Fieldwork ran from 6 February to 20 April 2017. A total of 673 graduates responded (14% response), as did 338 experts (35% response). Monthly updates were provided to around 300 stakeholders. As the graduate sample aligns with the population, no non-response or stratification weighting was used. Raw data was read into SPSS files, cleaned, coded, aggregated, merged, labelled and validated for analysis.

It is important to clarify assumptions and limitations. The dual-population design was intended to produce insights of intrinsic interest regarding doctoral education (that is, from those involved in managing doctoral education programs) and also to complement views provided by graduates. The design was not intended to produce generalisations for direct comparison. There is an unavoidable misalignment between graduates and experts—graduates are reflecting on 2011 and earlier experiences, whereas experts are reflecting on

2017 experiences. However, the contrast is useful and intentional as it spurs conversations rather than produces definitive figures.

## ***Empirical insights***

This section summarises insights from the graduate and expert surveys. These are structured in terms of information on doctoral outcomes, processes and inputs.

### **Doctoral outcomes**

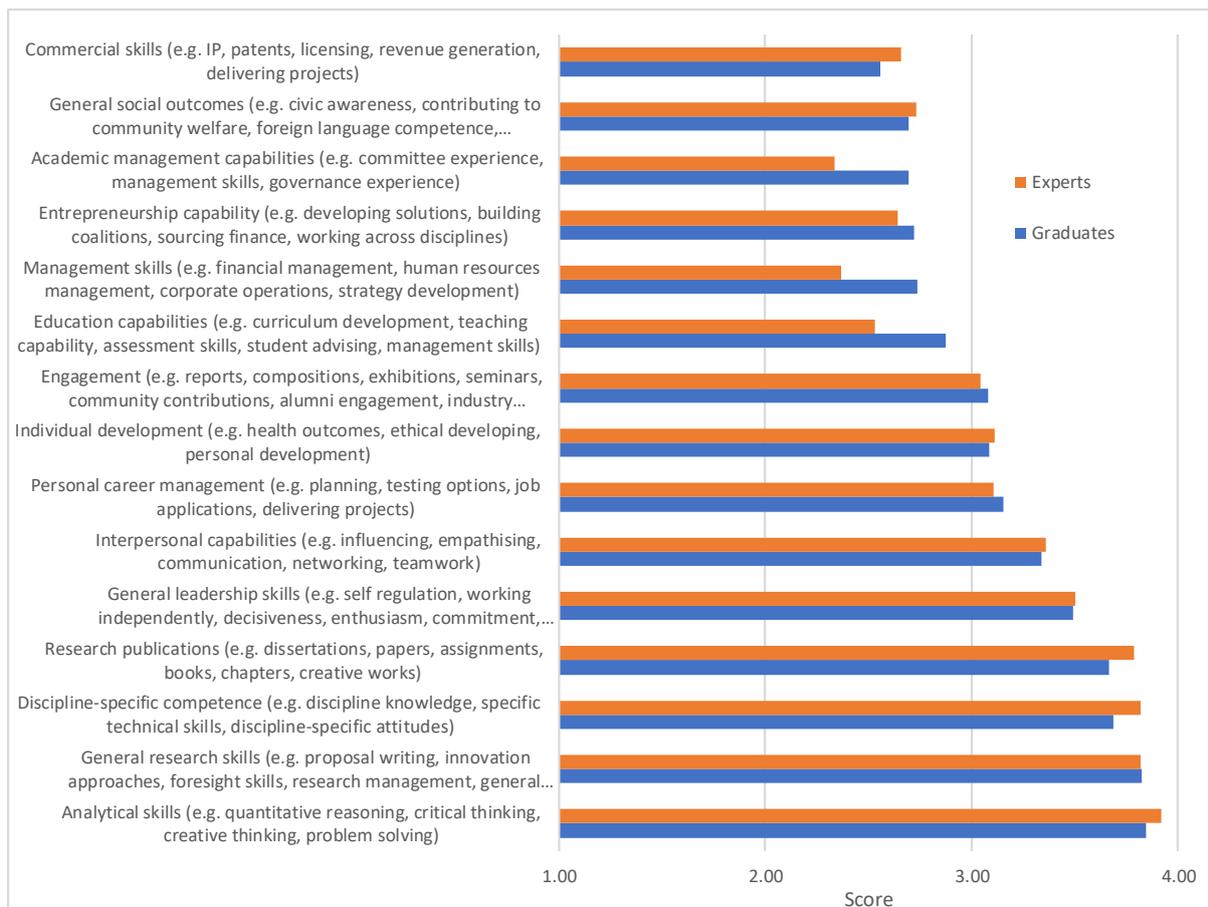
With regard to satisfaction there was general consistency across different types of demographic and contextual groups. International graduates tended to be more satisfied, as did older graduates and graduates in particular fields of education (though it was hard to discern any pattern).

To build a broad picture of doctoral education outcomes, the empirical work probed a range of practical, intellectual, sociocultural and non-cognitive doctoral outcomes. Table 2 reports ratings of different groups of graduates for personal, academic and professional outcomes. A score of '4' indicates maximum satisfaction and '1' minimum satisfaction. There is consistency across most groups with the exception of field of education.

**Table 2: Survey summary of doctoral outcomes**

Attribute	Group	Personal	Academic	Professional
University type	ATN	3.05	3.47	2.74
	GO8	3.09	3.53	2.81
	IRU	3.07	3.54	2.78
	Other	3.05	3.49	2.79
Sex	Male	3.00	3.46	2.79
	Female	3.14	3.53	2.89
Citizen	No	3.18	3.57	3.02
	Yes	3.03	3.47	2.78
Age	30 to 34	3.06	3.51	2.92
	35 to 39	3.13	3.51	2.77
	40 to 44	3.10	3.53	2.89
	45 to 49	3.08	3.46	2.90
	50 or more	3.06	3.48	2.78
Home language	English	3.02	3.47	2.78
	Other	3.26	3.60	3.03
Field	Natural and Physical Sciences	3.04	3.51	2.90
	Information Technology	2.74	3.42	2.69
	Engineering and Related Technologies	3.00	3.44	2.89
	Architecture and Building	3.22	3.56	3.00
	Agriculture and Environmental Studies	3.04	3.61	2.97
	Health	3.19	3.54	2.99
	Education	3.08	3.54	2.75
	Management and Commerce	3.07	3.44	2.87
	Society and Culture	3.06	3.46	2.66
	Creative Arts	3.21	3.58	2.81

The survey instrument design enabled comparison between graduate and expert opinions regarding very specific doctoral outcomes. As Figure 4 shows, most prominence was given to outcomes which in many respects might be considered necessary or inherent facets of doctoral study (for example, analytical skills, research skills and publications). There was then a range of important but less specific outcomes (such as career development and engagement). More commercial and broader civic outcomes were rated with less importance as were education/teaching capabilities. There was substantial consistency between the two groups, though graduates value education and management outcomes more highly than experts.



**Figure 4: Importance of doctoral outcomes for graduates and experts (score)**

The specific questions about doctoral outcomes were also scaled together to form measures which were personal, academic or professional in nature. There was consistency across most demographic and contextual groups. This does not mean there is not variation within the sample; rather variation is driven by individual- rather than group-level factors.

When asked about areas in which to improve doctoral outcomes, graduates put greater emphasis on various real-world forms of learning (such as real-world and problem-based assessment, internships and practicums, careers advice, real-life case studies) than did experts. Graduates also emphasised the need to improve supervision. Doctoral experts put more emphasis on improving interpersonal matters such as student engagement and generic skills, and deepening relationships among students and with supervisors. These two areas are not inconsistent: there is no reason why both facets of doctoral education cannot be improved.

The graduate questionnaire sought information about work. Nearly all graduates reported working, mostly full time. Analysis of the work-related data signalled a reasonably high level of employment mobility, though nearly all graduates expected to continue in the same line of work. All graduates reported working in professional industries, and by far most in university teaching, research or management roles. Most graduates reported that their doctoral study had prepared them well for work. Even after repeated exploratory modelling it was hard to ascertain patterns between work and other doctoral outcomes, or between

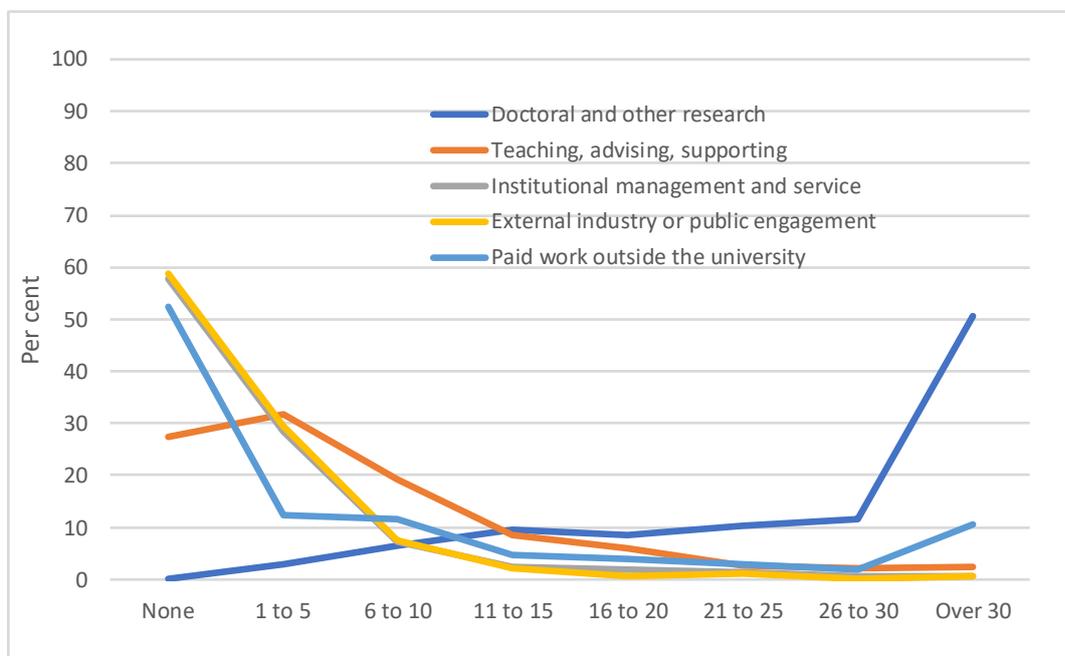
experiences. Graduates identified the integration of work-ready skills into doctoral programs as important in better preparing them for work.

## Doctoral processes

The empirical work generated insights into doctoral processes. A key aim was to generate insight that went beyond core research work and instead focussed on surrounding circumstances, supports and activities.

In terms of the location of study, for instance, it is unsurprising that nearly all studied on a university campus. However, it is surprising that hardly any studied elsewhere. If students do not have experiences during doctoral study that enable them learn how to work with people across community, commercial and government sectors, it is unclear where training in such cross-sectoral liaison will occur.

Graduates and experts were asked about the hours spent on various activities in a typical seven-day week. Most time is spent on research. Other activities mostly involve one to five hours per week of teaching, institution-related administration, and broader community engagement. However, and echoing the above figures, it is striking that around 60 per cent of responding graduates report spending no time engaged in these other activities, or in paid work outside university. Surprisingly, given it is the main work of academics which is the target vocation of most doctoral students, almost 30 per cent spent no time teaching. There were similar patterns in results for the doctoral experts regarding their views on doctoral students. Figure 5 provides a snapshot.



**Figure 5: Hours per week graduates report doing various activities (per cent)**

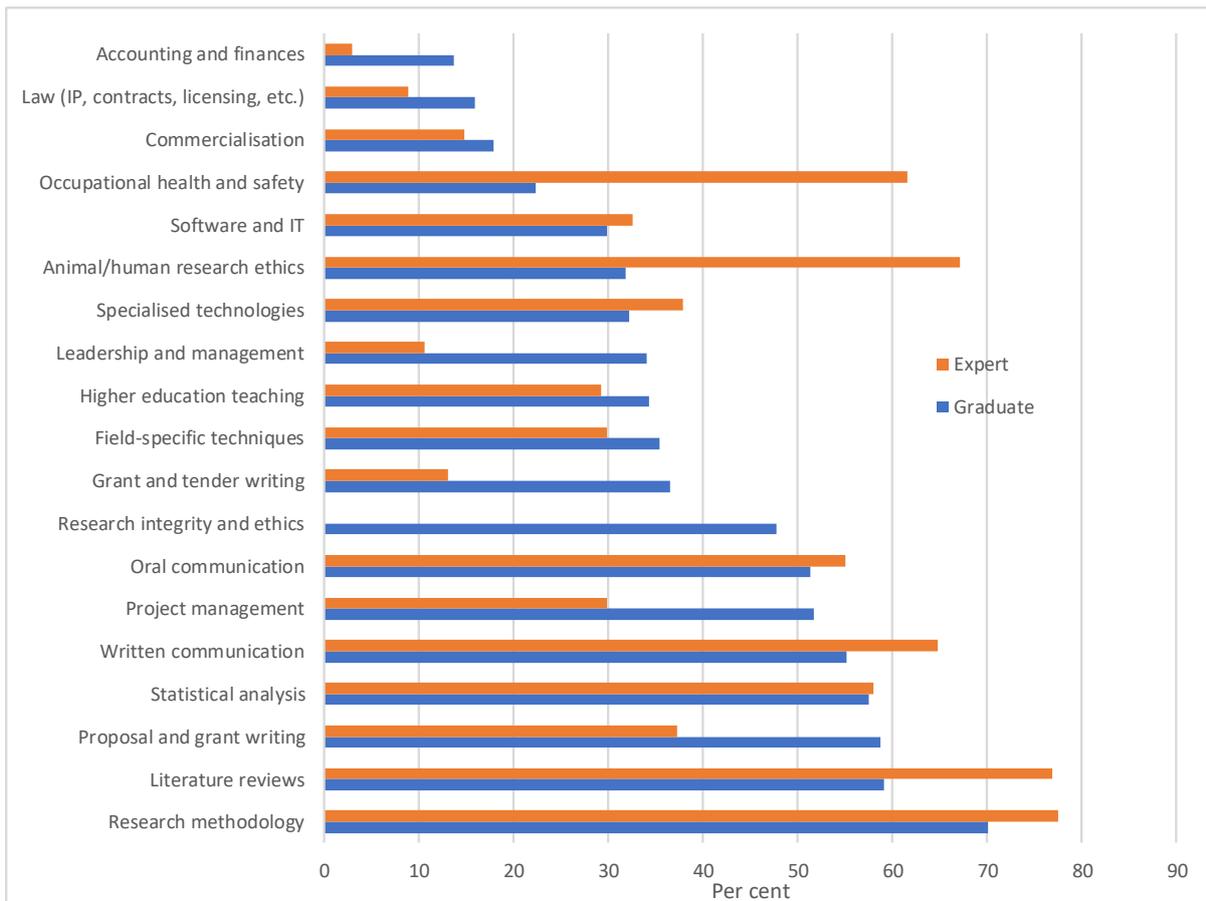
The survey probed expert and graduate views on typical engagement in academic activities. Over half of responding graduates reported participating in very standard activities (for example, literature/background reviews, data collection and analysis, presenting at

conferences, and scholarly publishing). A smaller number reported participating in broader forms of academic engagement, including working with other doctoral students, meeting visiting scholars, laboratory work and research assistance. Activities which might be considered less conventional were far less common, such as coursework completion, training in supplementary areas, contributing to media, and industry placements. The engagement levels reported by graduates conform to very conventional views on doctoral education; namely, that there are core activities, then supplementary activities, then optional activities. The lack of participation in broader forms of non-academic experience exposes room for more such experiences. The results also revealed clear divergence between graduate and expert views about engagement. Experts almost always perceived higher engagement than graduates reported. The largest differences pertained to value-adding professional and social experiences encompassing conferences, research assistance, seminars and meeting visiting scholars.

Sources of support for doctoral students were queried. Academics and other doctoral students are the most important supports, reaffirming the need for communities of practice for doctoral scholars. Graduates reported finding less support from people farther afield, such as researchers and academics outside their university. The results for experts followed those for graduates, with the notable exception of those in post-doctorate roles whom graduates saw as more supportive than did the experts.

Both graduates and experts were asked what could be done to improve assessment practices in doctoral education. The most common suggestion from graduates was to increase opportunities to review work several times prior to thesis submission. The importance of reviewing work and timely feedback resonated in many responses from graduates, and they viewed it as an integral part of the assessment process. They also suggested clarifying and standardising both assessment requirements and the role of examiners.

Professional development opportunities were investigated. Figure 6 shows that more than half the graduates report training opportunities in formal technical facets of research. Less report training opportunities in broader forms of management and analysis. It remains perplexing that less than a third of graduates accessed teaching training, though this is a core job for many doctoral students. Very few graduates report training in broader facets of academic and professional management. Again, this is perplexing given their future work and careers. Overall, experts report fewer training opportunities than graduates, with the exception of attention to informal training about safety and academic writing. Industry reports suggest an increase in training activities in response to the ACOLA review, though it was too soon to register any such development in this study.



**Figure 6: Professional development opportunities (per cent)**

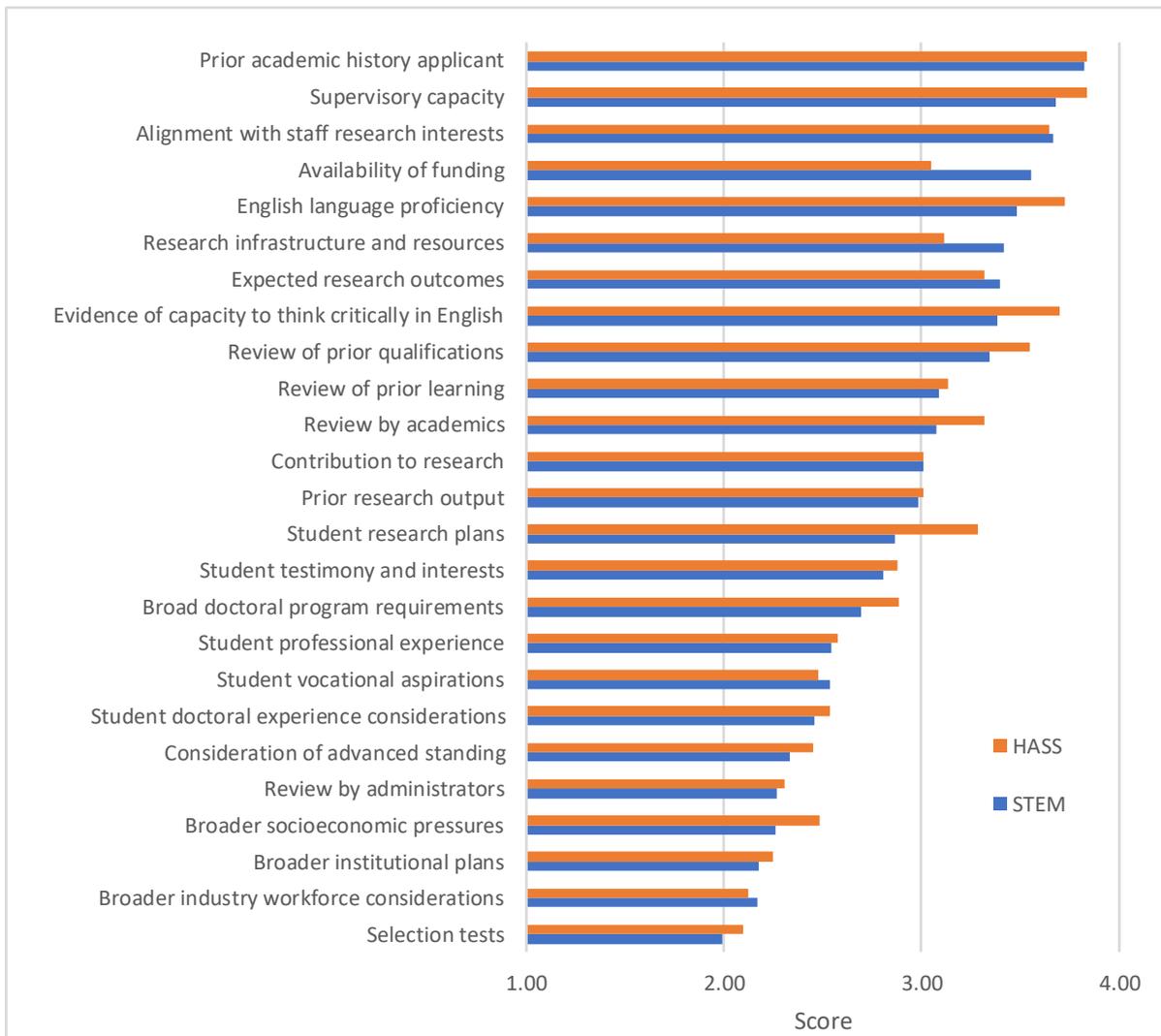
When asked broadly about specific ways to improve the doctoral experience, graduates and experts most commonly listed supervision, training and collaboration between students. Both graduates and experts emphasised the need for more training related to personal development, improving professional skills, project management, research skills and time management. The considerable rise in institutional interest and planning for greater skill development provision since the ACOLA review is noted, along with national guidelines currently being developed by ACGR.

## Doctoral inputs

The range of inputs to doctoral education is broad, covering financial support, infrastructure and human resources. The fieldwork tried to touch on each of these areas to build insight into the human and other resources required for effective doctoral education. When questioned about human support, graduates reported seeing doctoral education as largely supported by themselves and by academics. This is unsurprising, though there was a notable gap between experts and graduates regarding support offered by other doctoral students. Also unsurprising was the lower level of support received from non-research professionals outside universities. At least on the human side, these results affirm the sustaining expectation that doctoral education is supported by students and their university-based academic supervisors.

University admissions appear as one of the opaquest areas of social practice, particularly for doctoral admissions. Experts were asked about likelihood of being admitted to a doctoral program. The rates of admission were quite high. Around a quarter of responding experts indicated only around 20 per cent of students are admitted. Most respondents indicated more than 20 per cent of students are admitted. Around half the experts indicated more than 40 per cent of applicants are admitted, and a third signalled that more than 60 per cent of applicants are admitted. Such high admission rates raise questions about entry standards, and about program and student alignment and expectations.

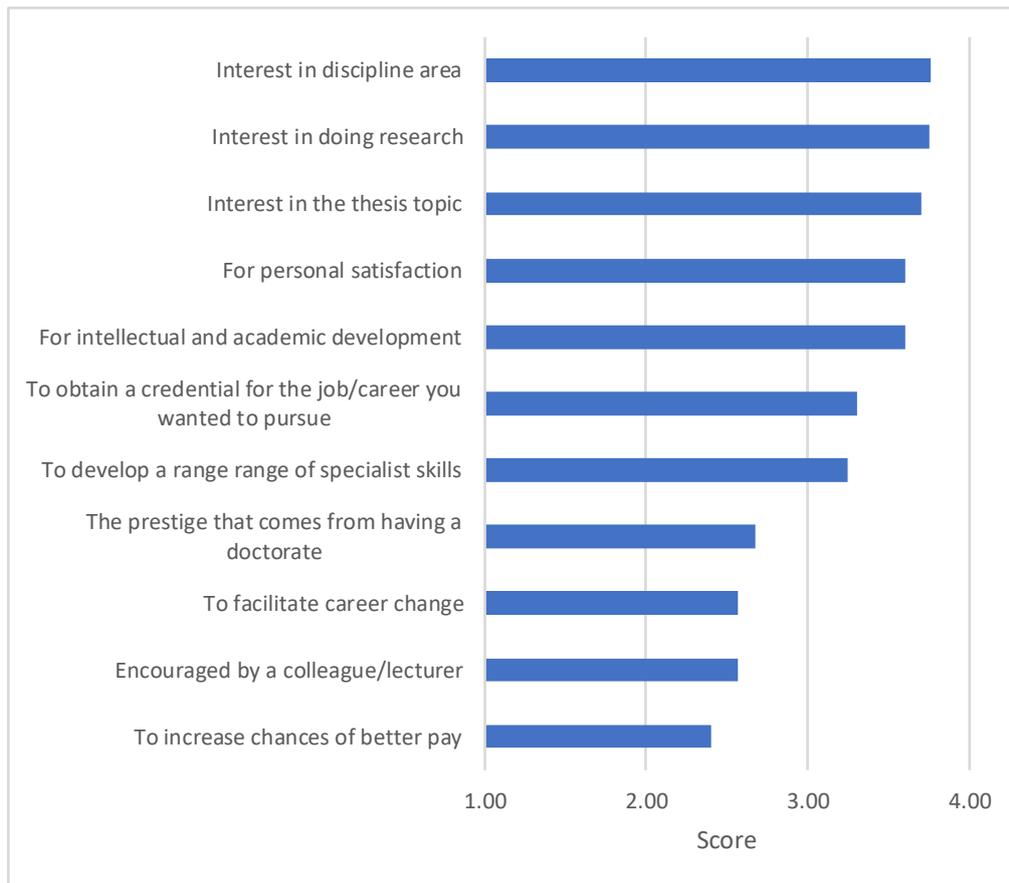
To unpack this matter further, doctoral experts were asked to rate the importance of facets in student selection. Evidently, institutions emphasise what might be considered necessary conditions for doctoral success, such as academic ability, supervisory capacity and language competence. It is notable that compared with other factors, lower emphasis is placed on outcome-related factors. Professional and industry considerations also attract less emphasis. In general, doctoral experts report weighing people's capacity to obtain a doctorate as more central to selection than their capacity to contribute beyond research communities, during or after their program. The low emphasis on selection tests is unsurprising given the lack of a common standard in Australian higher education. Figure 7 provides the details.



**Figure 7: Facets of student selection (score)**

When asked how to improve doctoral setup practices experts indicated the most important aspects were interaction (collaborating and networking) and building relationships between academics and students. They also flagged three other key aspects: supervision, support and clear requirements.

Graduates were asked about their reasons for commencing doctoral study. Figure 8 shows that graduates appear motivated by personal development interests. There are then more tangible but still internal motivators, and finally, more instrumental or extrinsic factors. There was little variation in these rationales across demographic and contextual subgroups.



**Figure 8: Reasons for commencing doctoral study (score)**

Graduate and expert views were sought regarding how to improve recruitment practices, with graduates viewing applicant characteristics as most important, drawing attention to high research capability, previous experience, and genuine interest of candidates. They identified means of assessing applicant characteristics as important, including introducing a merit-based selection process, and interviewing candidates prior to admission.

Graduates perceive supervision as the second most important aspect in improving recruitment practices. Views about supervision include matching student and supervisor research interests, building a healthy relationship, and having better communication between both parties from the beginning. Similar to graduates' views, experts were also of the opinion that it is important to select appropriate candidates who have characteristics that enable them to engage in higher degree research activities. Another common view shared by experts regarding improved recruitment practice is the need to increase both the number of, and funding for, scholarships as a means of attracting more qualified doctoral candidates. Qualities of candidates, funding, supervision, and access to information were the main areas in which graduates and experts shared similar views.

Experts were also asked how doctoral education could be made more cost effective. They drew attention to program duration/timely completion and funding. They stressed the importance of timely completion, and indicated that in certain instances adequate funding is linked to timely completion as students can then focus better, and invest more time in their research. Other cost-effective ideas raised included industry sponsorship and collaboration, international funding, and more funding for supervisors. It is also important to note that

several experts shared the view that cost effectiveness is unnecessary or should not be a consideration.

## ***Summary***

This chapter discussed the frameworks and instruments defined to give life to a generic perspective for understanding the doctorate. It then showcased the utility of these materials by summarising insights collected from experts and graduates. Together, this work makes three broad contributions to aid better understanding of, and to enhance, the doctorate.

First, presentation of the data for the measured attributes reveals illuminating aspects and nuances about doctoral education. Though this empirical work was not conducted to yield such information as an end in itself, it is important that the parameters and attributes that inform redesign of the doctorate touch on non-trivial facets of doctoral education.

Second, the results reveal the inherent complexity of doctoral education, affirmed by the difficulty in finding deeper statistical patterns among the parameters and attributes. This is a simple but important observation for it belies any attempt to try and package doctoral education into boxes—one tempting response to try to control the diversification of current practice. There is unlikely to be any strategic or operational benefit in ‘boxing-up’ the doctorate in ways that are specific to fields, industries, institutions or occupations. This kind of splintering may seem like a means for engineering productivity, but at best is likely to represent a veneer of order that fails to respond to an inherently complex activity.

The third contribution of this project integrates elements of the two contributions just described. The results affirm the value of a generalised design framework, and in particular the value of the three-phase and parameterised design framework advanced in this project. This is a framework with many dimensions. It provides a structured means for thinking through, in sociological and educational ways, important aspects of doctoral education. A more compelling value of this framework is that it lays the foundations of a policy or managerial instrument that universities and doctoral students could use to provide greater clarity about, and hence efficiency and quality in, doctoral education.

## Chapter 4: Creating a doctoral design architecture

### ***Introduction***

The title of this report, *Design Options for the Future Doctorate*, conveys the purpose of this project. Following the design logic stepped out in Figure 2, the third and final stage involves drawing together the contextual and conceptual reviews, and the empirical insights, to urge new frontiers in design. The purpose of this architecture is to inform thinking on future reform as well as initiatives being developed by universities at present. This chapter continues to build momentum, distilling the doctoral design architecture and looking at the work required to bring this architecture to life.

### ***The doctoral design architecture***

The doctoral design architecture took shape over two years. It took account of the contextual and conceptual reviews, stakeholder consultations, graduate and expert interviews and surveys, and further regional discussions. The goal was to produce a simple yet powerful architecture that can help ensure the future doctorate is internally coherent, externally transparent, and nuanced to individual and institutional contexts. Advancing this architecture is the boundary of this project.

Table 3 presents the doctoral architecture. The word ‘architecture’ conveys that the contribution has both structure and function. These are briefly described to bring the architecture to life.

The left two columns of Table 3 present the structural side of the architecture. The structure includes three phases, each with three focus areas:

- ‘successes’ are at the top, and pertain to outcomes which are academic, professional and more personal in nature;
- ‘experiences’ embrace foundation training in the discipline, research experiences, and broader forms of development; and
- ‘preparations’ encompass the sequence of steps, from initial awareness about doctoral opportunities, to the application process and onboarding.

As noted, many specific attributes underpinning this stage have been tested in the instrumentation and empirical work. By way of example, consider the three focus areas for ‘successes’:

- ‘academic’ outcomes would focus on producing research publications, development of discipline specific competence, general research skills, education (teaching and learning) skills, academic management capabilities, stakeholder engagement skills, and broader analytical skills, as well as specific programmatic outputs such as dissertations, oral defences, coursework, seminars and creative work;

- ‘professional’ outcomes would focus on different kinds of work arrangements, as well as broader professional skills pertaining to leadership and management; and
- ‘personal’ outcomes sought by people and universities might cover general social outcomes, individual development, and capacity for career management.

In the ‘experiences’ phase, again as depicted in Table 3, specific attributes would pertain to varied advisory arrangements, academic activities contexts, university-related social supports, training and development in professional skills, practical arrangements, and broader forms of institutional and individual support. Specific background attributes would pertain to academic history, interest and aptitude, prior research outcomes and professional experiences, and individual interests and aspirations. Though not couched exactly in this form, the survey instruments produced for this project spell out these detailed ideas.

The two right columns of Table 3 present the functional side of the architecture. This pertains to activities undertaken by students and universities both for themselves and on behalf of other stakeholders. A series of reasonably standard business rules can be envisaged to knit these functions together. Broadly, universities would first provide information on doctoral successes, experiences and preparations. Next, prospective students specify their aspirations in terms of the kinds of successes, experiences and preparations that they seek and bring. A series of more granular business rules could then furnish the architecture with a matching framework that helps dynamically align these two perspectives. This alignment could well continue throughout the duration of doctoral study.

**Table 3: Doctoral design architecture**

Structure		Function	
Phase	Focus	Student	University
Successes	Academic	Produce outputs and outcomes	Provide assessment and guidance
	Professional	Engage in job and build career	Guide, support and engage through alumni activities
	Personal	Personal and social experiences	Engage and enrich through alumni activities
Experiences	Development	Build generic research, education and leadership capabilities	Provide development courses and guidance
	Research	Engage in research training and experiences	Provide support, advisors and opportunities
	Foundation	Study discipline foundations	Provide education and guidance
Preparations	Onboarding	Identify readiness and needs	Design services and infrastructure
	Application	Provide education and demographic profile	Articulate programs and infrastructure
	Awareness	Explore futures and opportunities	Market programs, experiences and outcomes

The architecture is designed to give life to dynamic design options for future doctorates. It represents an advance because it codifies doctoral structures and functions, providing a touchstone for future change. It has potential to help clarify and align successes with experiences and preparations. Such clarifications can avoid dashed expectations, dropout and burnout, and support prudent estimation of costs and returns.

Importantly, the design architecture does not define one or more specific reductive models for the doctorate in any declarative way. It looks beyond tinkering with supplier-centric formats. For instance, the design architecture does not specify different structures based on 'year lengths' or 'examination options'. It does not envisage one option that is an 'education track,' another for 'administrators' or another for 'researchers.' It does not suggest reversion to the 'US model' or other national/regional variants. Any such narrow re-envisaging or regulation of practice is only near-term, and therefore in the future is likely to lack alignment with international practice.

Importantly, the architecture is not intended as a permissive excuse for extrapolating existing diversified practice. Rather, it is a general frame for gathering, analysing and reporting information in ways that inform ongoing improvements in practice, and while including those improvements underway, is aimed at a longer horizon. It advances an efficient and robust means for matching students with doctoral programs. The simplicity of the logic is both its value and its risk. In paving a way to enhance the success of doctoral programs, it risks disrupting established arrangements. Given the distribution of research resource capabilities, it is likely that clarification rather than disruption is a more likely outcome.

### ***Articulating doctoral options***

The doctoral design architecture is intentionally parsimonious and powerful. To bring out these attributes, it is helpful to clarify applications at national, institutional and individual levels. The applications show how the doctoral design architecture can be used to develop future options.

#### **National application**

National application reflects a broad, policy level implementation of the architecture in ongoing reform. This could involve the architecture informing further development of university and graduate survey instruments, and then recurrent annual or bi-annual collection of data on doctoral education in Australia. This would go well beyond current data, collected mainly for funding and regulatory purposes. It would fill a major knowledge gap and yield insights of immense value to universities and other stakeholders. It would unleash all kinds of data-driven quality improvement not routinely possible in Australia, or seemingly any other countries.

By way of example, Table 4 applies a framework for summarising national insights and improvement suggestions (denoted by '→') collected during this project. This summary shows the value of the coherent design architecture and the derived insights, and of progressing this national infrastructure for evaluating and enhancing doctoral education.

**Table 4: Application of the architecture to summarise national insights**

Structure		Function	
Phase	Focus	Student	University
Successes	Academic	Doctoral output requirements vary and can lack relevance. →There is a need for more clarity, consistency and alignment.	Examination procedures vary and are not always well supported. →There is a need for clearer standards and greater consistency.
	Professional	The role of doctorate is changing in a dynamic labour market. →Students must ensure they have grounded expectations and participate in training that will gain desired employment.	Doctorates are no longer terminal qualifications or end of training. →Universities should keep contact with doctoral alumni to engage their expert contribution and for ongoing professional development.
	Personal	There is a lack of information about the broad personal and social outcomes of doctoral education. →Students should keep lifetime contact with their university.	Universities have limited information about their doctoral alumni and their lifestyle trajectories. →Universities should sustain contact with doctoral alumni.
Experiences	Development	Students can fail to develop broader professional skills expected of advanced knowledge professionals. →Students should engage in broader leadership training during doctoral study and have experience outside the university.	Graduates work in diverse roles that demand broad capabilities. → Universities should provide development courses and guidance in research management, education practice, and leadership, and they should provide industry training experiences in line with the new guidelines developed by ACGR in response to the ACOLA review.
	Research	Research training is highly varied and opportunistic, and even with careful milestone articulation the single generalist academic program can be confusing or insufficient. →Students should map out expectations and plan opportunities to ensure necessary experiences.	The nature of advisory and support arrangements varies across programs and universities, as does peer support. →Universities should adopt standards to ensure at least baseline provision of advice, support and research opportunity.
	Foundation	Students vary in their foundation knowledge and skills. →Students should participate in courses that ensure they have necessary disciplinary foundations and networks/cohorts.	Students enrol in doctorates from a wide range of backgrounds. →Foundation programs must be provided to ensure students have necessary foundation knowledge and skills, and that students build a sense of peer group during their study.
Preparations	Onboarding	Student cohorts are diversifying and expanding. →Students need to build awareness of doctoral study lifestyle and responsibilities and ensure they seek required support and training.	The number of doctoral students is expanding—they are also diversifying and becoming more central to research mission. →Universities must design student pathways and supports that help students succeed.
	Application	High admission rates and lack of common admission processes raises questions about efficiency and standards. →There is a need for more scientific and transparent doctoral admission practices.	Traditional admissions pathways can be unclear and limiting and fail to clarify competence and potential. →There is a need for reformed admissions methods that take account of capacity to succeed.
	Awareness	Diverse motivations inspire people to engage in doctoral study. →There is a need for careful understanding and management of expectations.	The marketing of generalist doctoral programs takes many forms. →There is a need for more consistency and transparency around options, experiences and outcomes.

## University application

Within universities the architecture can be deployed quickly as an audit or interpretative tool to identify areas of strength and areas in need of improvement. It might be applied at the university level, or more helpfully within certain education or industry fields. For instance, what information is available to help prospective students improve their awareness of doctoral options and outcomes? During the ‘application’ and ‘onboarding’ stages, is enough information gathered about student prior knowledge and skills to design the supports and education needed for success? Is foundation study available to ensure students have the competence to engage successfully in research? Are universities providing programs to help students develop broader research, education and leadership capabilities? Such review might be conducted for internal improvement, for benchmarking, or for external reporting.

Table 5 depicts the application of the framework as a traffic light report which summarises insights for a sample university involved in this project. It highlights areas shaded green which are performing well, such as application preparations and onboarding, and academic successes. Several areas, shaded amber, are either of unknown or unsatisfactory quality, or are in the process of being reformed. The areas shaded red are flagged by students or universities as problematic.

**Table 5: Sample application of architecture to one university doctoral program**

Structure		Function	
Phase	Focus	Student	University
Successes	Academic	Clear about protocols for producing outputs and outcomes	Reformed and benchmarked assessment policies
	Professional	Misalignment between outcomes, preparations and experiences	Need to build career support and professional engagement activities
	Personal	No information about lifelong outcomes and experiences	Alumni activities planned but not implemented
Experiences	Development	Ad hoc participation in research and leadership development activities	Sporadic provision of development courses and guidance
	Research	Participation in generalist research experiences without clear planning	Traditional advisory and support arrangements
	Foundation	Students have diverse and uncertain disciplinary foundations	Varied provision of foundation education and guidance
Preparations	Onboarding	Students have mixed experiences identifying readiness and needs	University has established systems for academic and broader supports
	Application	Students provide extensive education and demographic profile	University works with students to match programs and infrastructure
	Awareness	Students have access to vast information on futures and opportunities	University provides information about programs, but without clear link to experiences or outcomes

## Individual application

Though analysing existing broad practice is necessary, the main purpose of the architecture is to design better doctoral experiences and outcomes for individual students and their universities. The phased structure helps ensure that a student and a university have addressed all facets of the doctorate in ways which are coherent and aligned with external circumstances. For instance, foundation disciplinary training and supplementary capability development can be embedded into the program design, rather than neglected or ‘bolted on.’ Universities and students can ensure that doctoral experiences have a reasonable chance of moving students from where they are on entry to a place where they are likely to achieve expected outcomes.

Marketing science, and the subfield of ‘experience design,’ reveals a dynamic and promising approach for ensuring quality experiences and outcomes. Van Bommel, Edelman and Ungerman (2014) and Lemon and Verhoef (2016) provide helpful insights into such prospects. By way of summary, the design architecture is seen as a means of furnishing a generic blueprint for the doctorate. The structured parameters and attributes can be used to understand the characteristics and experiences of doctorates, both in general terms and as they pertain to each student’s distinct decisions and journeys. As the architecture is used by students and universities it generates information which can be rendered as countless ‘journeys’ that people and universities co-trace. A journey is a multiple branching pathway through a doctorate, from beginning to end. These journeys can be aggregated into ‘profiles.’ Simply put, a profile can be envisaged as a complex dynamic of diverse attributes which portray a student in relation to a successful doctoral experience. The idea of profiling ‘movements through journeys’ steps well beyond the idea of allowing people into doctoral study based on only small snippets of the architecture. On first glance, this approach may seem to unleash infinite complexity for conceptualising and managing each student’s success, but experience in other industries implies otherwise. After initial reworking in terms of new processes, effective digitisation can yield substantial increases in productivity and quality of people’s purposeful interactions with organisations.

Figure 9 depicts this individual-level application in an indicative doctoral journey map for one student/university doctoral arrangement. The phases have been re-arranged to align with the sequence of the doctoral journey. For illustrative purposes, an array of buttons is shaded grey (not applicable), green (clarified with student and university), amber (uncertain arrangement), or red (problematic arrangement in need of clarification). This coloured shading indicates settings for this particular doctorate. The different attributes which pertain to different phases are signposted as numbers. With recourse to the business rules which give life to the functional architecture, this doctoral journey map can identify areas in need of resolution, and alert users to disallowable combinations of preparation, experience and outcome. This illustration shows how different student and university settings give life to different doctorates. It is possible to specify a seemingly infinite array of arrangements, each within the same generalisable architecture. A more formal journey map would sketch touchpoints, artefacts, and the different actors engaged. Such infrastructure aligns with the doctoral architecture’s structures and functions.

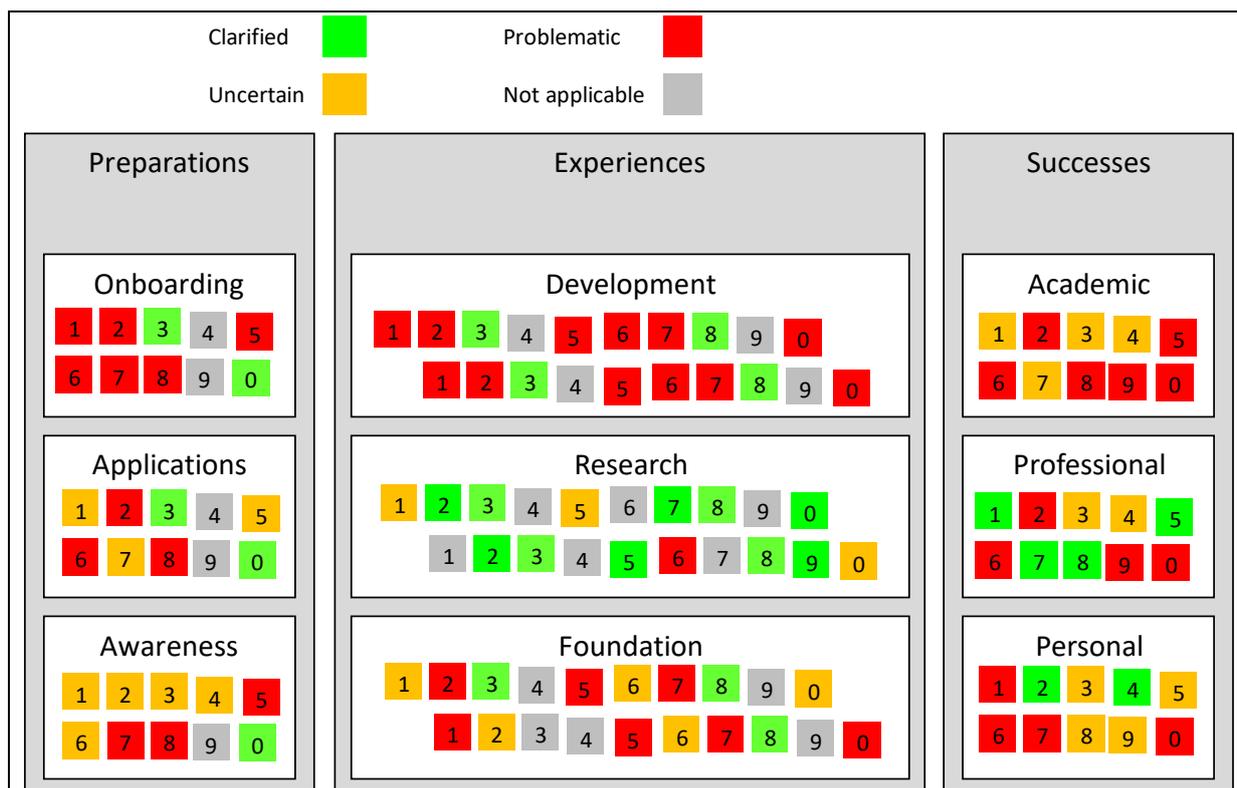


Figure 9: Indicative single student/university doctoral journey map

## A doctoral design platform

These kinds of design can be given life in software platforms with transformative value for higher education. From a student perspective it would help to identify options for study, to tease out experiences of interest or of no interest, and to consider feasible outcomes from completing a doctorate. Of course, the architecture is relevant beyond initial graduation and would be used in a longitudinal and dynamic sense as a portfolio guidance tool to track and navigate progress. From a university perspective the architecture would help to organise information about doctoral programs, to ensure alignment between students, research and broader experiences, to plan and account for appropriate resources, and to review and improve programs. If rendered in relevant ways, there would be spill over for other stakeholders, such as businesses, industries and governments, all of which could find more information about the nature of doctoral education and how it addresses their interests.

A prototype platform could well be built to give life to these ideas in ways that increase value for students, professions and universities. Initial software could be primed with data on university supply and information from students, which would serve as a springboard for more widespread use. Even without complex matching algorithms used in other software designed to match people with people and with organisations, the process of tracing options and futures in contextually bounded ways would inform expectations, understandings and, presumably, outcomes.

Given such value it is reasonable to ask why such a platform does not already exist or is not widely adopted. In short, to date the nature of most doctoral programs (that is, well funded,

elite, supplier-centric) means they have not been required. Students have been able to use traditional forms of collegial interaction to facilitate appropriate matching. In most instances, universities (and in particular elite universities) which conduct most research and research training have been able to recruit doctoral students for their needs without recourse to broader market-clearing mechanisms. The proposed architecture signals a new means of facilitating potential transactions between students and universities. Almost by definition this architecture would not signal a radical break with current practice, but rather advance a coherent, research-driven and nationally validated logic against which current and prospective policy and practice can be framed and which it can use to evolve productively. As such, it forms a compelling basis from which to review current offerings, and to plan and develop future practice. Strategies for implanting the design options will flow from considering quality and productivity levers available to government, industry, institutions, academics, disciplines and candidates.

## ***Summary***

The doctorate in its current form is little more than 150 years old. The first Australian PhD was awarded in the 1950s. Current arrangements have evolved through complex interplays between universities, governments and broader communities, and although they are changing in response to the ACOLA review, they will need to continue to evolve. Given unanticipated and innovative change to other facets of university education and research in recent decades, and to nature and role of universities more broadly, it is difficult to argue there are any inherent grounds on which the doctorate must not continue to evolve.

Almost by definition, Australia's university sector is ready for this contribution as the project was launched with the sector's current circumstances in view, which served as the platform for designing the architecture. These ideas are not designed in response to contemporary contingencies, or for near-term implementation. However, they do flow from internal and intra-university communication on the nature of the doctorate, and from deep engagement in government policy dialogues and implementations. Indeed, there is broad recognition across government, universities and industry that Australia needs a more coherent approach to doctoral training. Across key stakeholders there is a widespread desire for greater strategic clarity that best harnesses available resources and innovations.

In line with the pressures identified by ACOLA and the work already underway in universities and by ACGR, international and industry pressures are spurring change in doctorate programs. International competition in higher education is growing, not least via strong and growing competition for recruitment of doctoral candidates. Industry is looking to universities to produce work-ready doctoral graduates for an increasingly diverse job market, both within academia and in industry. This requires institutions to demonstrate how their doctoral offerings are calibrated to give their candidates the right employability attributes, and requires that graduates themselves have access to attractive, differentiated education and training from their doctoral program provider.

As the Australian higher education sector diversifies, institutions and institutional segments should adopt and implement differentiated doctoral models that suit their individual

outlooks and strengths. This diverse activity must be supported by appropriately resourced national coordination and resources so that the Australian doctorate remains a globally competitive, distinctive and valued.

## References

- Access Economics. (2010). *Australia's Future Research Workforce: Supply, demand and influence factors*. Canberra: Access Economics.
- Allen Consulting Group. (2010). *Employer Demand for Researchers in Australia: Report to the Department of Innovation, Industry, Science and Research*. Canberra: DIISR.
- Appelt, S., van Beuzekom, B., Galindo-Rueda, F. and de Pinho R. (2015). Which factors influence the international mobility of research scientists? In A. Geuna (ed.) *Global Mobility of Research Scientists: The Economics of Who Goes Where and Why*. Amsterdam: Elsevier
- Auriol, L., Schaaper, M. & Felix, B. (2012). *Mapping Careers and Mobility of Doctorate Holders: Draft guidelines, model questionnaire and indicators*. Paris: OECD Publishing.
- Australian Council of Graduate Research (ACGR) (2015). *Graduate Research Good Practice Principles*. Accessed from: [www.ddogs.edu.au/good-practice-principles](http://www.ddogs.edu.au/good-practice-principles)
- Australian Council of Learned Academies (ACOLA). (2012). *Career Support for Researchers: Understanding Needs and Developing a Best Practice Approach*. Canberra: Australian Council of Learned Academies.
- Australian Medical Assessment Collaboration (AMAC) (2014). *Determining the Quality of Assessment Items in Collaborations: Aspects to discuss to reach agreement*. Sydney: Office for Learning and Teaching.
- Australian Qualifications Framework Council (AQFC). (2015). *Australian Qualifications Framework Second Edition*. Adelaide: AQF Council.
- Australian Qualifications Framework Council (AQFC). (2018). *Australian Qualifications Framework Second Edition*. Adelaide: AQF Council.
- Bentley, P., Coates, H., Dobson, I., Goedegebuure, L. & Meek, V.L. (Eds.) (2012). *Job Satisfaction Around the Academic World*. Dordrecht: Springer.
- Bexley, E., James, R. & Aroudis, S. (2011). *The Australian Academic Profession in Transition: Addressing the challenge of reconceptualising academic work and regenerating the academic workforce*. Canberra: DEEWR.
- Boud, D. & Tennant, M. (2006). Putting doctoral education to work: challenges to academic practice. *Higher Education Research & Development*, 25(3), 293-306.
- Brew, A., & Peseta, T. (2004). Changing postgraduate supervision practice: a program to encourage learning through reflection and feedback. *Innovations in Education & Teaching International*, 41(1), 5-22.

Coates, H. & Edwards, D. (2011). The Graduate Pathways Survey: New insights on education and employment outcomes five years after completion of a bachelor degree at an Australian university. *Higher Education Quarterly*, 65(3), 74-93.

Coates, H. & Goedegebuure, L. (2010). *The Real Academic Revolution: Why we need to reconceptualise Australia's future academic workforce, and eight possible strategies for how to go about this*. Melbourne: LH Martin Institute for Tertiary Education Leadership and Management.

Coates, H. & Goedegebuure, L. (2012). Recasting the Academic Workforce: Why the attractiveness of the academic profession needs to be increased and eight possible strategies for how to go about this from an Australian perspective. *Higher Education*, 64, 875-889.

Coates, H. & Richardson, S. (2012). An international assessment of bachelor's degree graduates' learning outcomes. *Higher Education Management and Policy*, 23(3), 51-69.

Coates, H. (2009). Development of the Australasian Survey of Student Engagement (AUSSE). *Higher Education*, 60(10), 1-17.

Coates, H. (2014). (Ed.) *Higher Education Learning Outcomes Assessment*. Frankfurt: Peter Lang.

Coates, H. (2017). *The Market for Learning: Leading transparent higher education*. Dordrecht: Springer.

Coates, H. (Ed.) (2017). *Productivity in Higher Education: Research insights for universities and governments in Asia*. Tokyo: Asian Productivity Organisation.

Coates, H. Tilbrook, C. Guthrie, B. & Bryant, G. (2006). *Enhancing the GCA National Surveys: An examination of critical factors leading to enhancements in the instrument, methodology and process*. Canberra: Department of Education, Science and Training.

Council of Australian Postgraduate Associations (CAPA). (2012). *The Research Education Experience: Investigating Higher Degree by Research Candidates' Experiences in Australian Universities*. Canberra: DEEWR.

Cutler, T. (2008). *Venturous Australia: Building Strength in Innovation*. Canberra: DIISRTE.

Data USA (2015). *Data USA*. Accessed from: <https://datausa.io/>

De Grande, H., De Boyser, K., Vandavelde, K. & Van Rossem, R. (2014) From Academia to Industry: Are Doctorate Holders Ready? *Journal of the Knowledge Economy* (2014) volume 5 issue 3: 538–561.

Deloitte Access Economics. (2011). *Examining the Full Cost of Research Training*. Canberra: DEEWR.

Department of Education (DoE) (2014). *2013 Award Course Completions*. Canberra: DEEWR.

Department of Education and Training (DET). (2015). *Higher Education Statistics Data Cube (uCube)*. Accessed from: <https://www.education.gov.au/higher-education-statistics>

Department of Education and Training (DET). (2017). *Higher Education Statistics Data Cube (uCube)*. Accessed from: <https://www.education.gov.au/higher-education-statistics>

Department of Education and Training (DET). (2018). *Higher Education Statistics Data Cube (uCube)*. Accessed from: <https://www.education.gov.au/higher-education-statistics>

Department of Industry and Department of Education (Dol & DoE) (2014). *Boosting the Commercial Returns from Research*. Canberra: Australian Government.

Department of Innovation, Industry, Science and Research (DIISRTE). (2010). *Mapping Research Career Pathways in Australia*. Canberra: DIISRTE.

Department of Innovation, Industry, Science and Research (DIISRTE). (2011a). *Research Skills for an Innovative Future: A Research Workforce Strategy to Cover the Decade to 2020 and Beyond*. Canberra: DIISRTE.

Department of Innovation, Industry, Science and Research (DIISRTE). (2011b). *Defining Quality for Research Training in Australia: A Consultation Paper*. Canberra: DIISRTE.

Design Management Institute (DMI) (2018). *What is Design Thinking?* Accessed from: [www.dmi.org/?WhatisDesignThink](http://www.dmi.org/?WhatisDesignThink)

Dobson, I. R. (2012). PhDs in Australia, from the beginning. *Australian Universities' Review*, 54(1), 94.

Edwards, D., & Smith, T. F. (2008). *Supply, demand and approaches to employment by people with postgraduate research qualifications in science and mathematics*. Consultation Report: Australian Council for Educational Research, available at: [http://research.acer.edu.au/higher\\_education6](http://research.acer.edu.au/higher_education6).

Edwards, D., Bexley, E. and Richardson, S. (2011) *Regenerating the academic workforce: The careers, intentions and motivations of higher degree research students in Australia: Findings of the National Research Student Survey (NRSS)*, Australian Council for Educational Research.

Edwards, D., Wilkinson, D., Coates, H. & Canny, B. (2012). *The Australian Medical Assessment Collaboration: Developing the foundations for a national assessment of medical student learning outcomes*. Sydney: Office for Learning and Teaching.

European University Association (EUA) (2005). *Doctoral Programmes for the European Knowledge Society: Report on the EUA doctoral programmes project*. Brussels: EUA.

EY (2018). *University of the Future*. Accessed from: <https://www.ey.com/au/en/industries/government---public-sector/ey-university-of-the-future-2030>

Graduate Careers Australia (GCA) (2014). *Graduate Salaries 2014: A report on the earnings of new Australian graduates in their first full-time employment*. Melbourne: Graduate Careers Australia.

Griffin, P., Coates, H., McInnis, C. & James, R. (2003). The development of an extended Course Experience Questionnaire. *Quality in Higher Education*, 9(3), 259-266.

Group of Eight (Go8) (2013). *The Changing PhD: Discussion paper*. Accessed from: [www.go8.edu.au/university-staff/go8-policy-and-analysis/2013/the-changing-phd](http://www.go8.edu.au/university-staff/go8-policy-and-analysis/2013/the-changing-phd)

Group of Eight (Go8). (2010). *Group of Eight Response to DIISR Consultation Paper: Meeting Australia's research workforce needs*. Canberra: Go8.

Higher Education Statistics Agency (HESA) (2017). *Students and Graduates*. Cheltenham: HESA.

House of Representatives Standing Committee on Industry, Science and Innovation. (2008). *Building Australia's Research Capacity*. Canberra: Parliament of Australia.

Jackson, C. (2007). *Recruiting PhDs: what works?* Cambridge: CRAC, 2007.

Kandbinder, P., & Peseta, T. (2001). *In supervisors' words: An insider's view of postgraduate supervision*. Sydney: Institute for Teaching and Learning, The University of Sydney.

Kehm, B. M. (2004). XIV. Developing Doctoral Degrees and Qualifications in Europe: Good Practice and Issues of Concern—A Comparative Analysis. *Studies in Higher Education*, 2000(6), 279.

Lean, J. (2012). Preparing for an uncertain future: the enterprising PhD student. *Journal of Small Business and Enterprise Development*, 19(3), 532-548.

Lemon, K. N., & Verhoef, P. C. (2016). Understanding customer experience throughout the customer journey. *Journal of Marketing*, 80(6), 69-96.

MacDonald, C., & Barker, D. (2000). *Post PhD-What next? A follow-up study of PhD postgraduates of the school of biological sciences*. Manchester: University of Manchester.

Macfarlane, B. (2011). The Morphing of Academic Practice: Unbundling and the rise of the para-academic. *Higher Education Quarterly*, 65(1), 5-73.

Mainhard, T., van der Rijst, R., van Tartwijk, J., & Wubbels, T. (2009). A Model for the Supervisor-Doctoral Student Relationship. *Higher Education*, (3). 359-73.

Manathunga, C., Kiley, M., Boud, D., & Cantwell, R. (2011). Honouring the incomparable: honours in Australian universities. *Higher Education*, 62(5), 619–633.

Marsh, H. & Lamprecht, M. (2012). *Outcomes from a Workshop to Explore Approaches to Quality Doctoral Research Training in Our Region*. Canberra: DoE.

McCormack, J., Propper, C., & Smith, S. (2014). Herding cats? Management and university performance. *The Economic Journal*, 124(August).

McGagh, J, Marsh, H, Western, M, Thomas, P, Hastings, A, Mihailova, M, Wenham, M (2016). *Review of Australia's Research Training System*. Canberra: Report for the Australian Council of Learned Academies.

Moore, K., Coates, H., & Croucher, G. (2018). Investigating applications of university productivity measurement models using Australian data. *Studies in Higher Education*, 1-15.

National Center for Academic Transformation (NCAT) (2018). Center for Academic Transformation. Accessed from: [www.thencat.org](http://www.thencat.org)

National Science Board (NSB). (2018). *Science and Engineering Indicators 2018*. NSB-2018-1. Alexandria, VA: National Science Foundation. Accessed from: <https://www.nsf.gov/statistics/indicators>.

Nerad, M., Rudd, E., Morrison, E., & Picciano, J. (2007). *Social Science PhDs- Five+ years out, a national survey of PhDs in six fields highlights report*. Seattle. Center for Innovation and Research in Graduate Education, University of Washington.

Neumann, R., & Tan, K. K. (2011). From PhD to initial employment: the doctorate in a knowledge economy. *Studies in Higher Education*, 36(5), 601-614.

Neumann, R., M. Kiley, and G. Mullins.(2008). Australian doctoral graduates: Where are they going? In *Quality in postgraduate research in the new global environment*. ed. M. Kiley and G. Mullins 84–89. Conference Proceedings of the 2008 Quality in Postgraduate Research Conference. Adelaide, South Australia.

NORC (2014). *Survey of Earned Doctorates*. Chicago: University of Chicago.

Nulty, D., Kiley, M., & Meyers, N. (2009). Promoting and Recognising Excellence in the Supervision of Research Students: An Evidence-Based Framework. *Assessment & Evaluation in Higher Education*, 34(6), 693-707.

Organisation for Economic Co-operation and Development (OECD). (2017). *OECD Science, Technology and Industry Scoreboard 2017: The digital transformation*, OECD Publishing, Paris.

Organisation for Economic Co-operation and Development (OECD). (2015). *OECD Science, Technology and Industry Scoreboard 2015*. Accessed from: [https://www.oecd-ilibrary.org/content/publication/sti\\_scoreboard-2015-en](https://www.oecd-ilibrary.org/content/publication/sti_scoreboard-2015-en)

Organisation for Economic Co-operation and Development (OECD). (2018). *The future of education and skills: Education 2030*. Accessed from: [www.oecd.org/education/2030/E2030%20Position%20Paper%20\(05.04.2018\).pdf](http://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf)

Park, C. (2007). *Redefining the Doctorate*. York: Higher Education Academy.

Pearce, E. (2006). Effective personal development planning for doctoral candidates. Presentation at UKCGE European Summer Conference *New Dimensions for Doctoral Programs in Europe: Training, Employability and the European Knowledge Agenda*. Florence, Italy.

Platow, M. J. (2012). PhD experience and subsequent outcomes: A look at self-perceptions of acquired graduate attributes and supervisor support. *Studies in Higher Education*, 37(1), 103-118.

PWC & AHEIA (2016). *Australian Higher Education Workforce of the Future*. Melbourne: Australian Higher Education Industrial Association.

Raddon, A., and J. Sung. 2009. *The career choices and impact of PhD graduates in the UK: A synthesis review*. Report prepared for the Economic and Social Research Council 'Science and Society' Team and the Research Councils UK Research Careers and Diversity Unit. University of Leicester.

Radloff, A. Coates, H. James, R. & Krause, K. (2012). *Development of the University Experience Survey (UES)*. Canberra: Department of Education, Employment and Workplace Relations.

Research Institute for Higher Education (RIHE). (2018). *Statistics of Japanese Higher Education*. Accessed from: <http://rihe.hiroshima-u.ac.jp/en/statistics/synthesis/>

Richardson, S., & Coates, H. (2014). Essential foundations for establishing equivalence in cross-national higher education assessment. *Higher Education*, 68(6), 825-836.

Shreeve, R., Wellings, P. & Wood, J. (2014). *Graduate Capability*. Accessed from: [www.cshe.unimelb.edu.au/research/res\\_seminars/pub\\_policy/2014/](http://www.cshe.unimelb.edu.au/research/res_seminars/pub_policy/2014/)

Smith, K., Williams, D., Yasin, N., Pitchford, I. (2014). Enterprise skills and training needs of postgraduate research students. *Education + Training*, 56(8/9): 745-763.

Statistics Canada (StatsCan) (2017). *Statistics Canada*. Accessed from: <https://www.canada.ca/en/statistics-canada.html>

Statistisches Bundesamt (DESTATIS) (2013). Federal Statistical Office, Germany. Accessed from: <https://www.canada.ca/en/statistics-canada.html>

Tertiary Education Quality and Standards Agency (TEQSA). (2018). *Higher Education Standards Framework*. Melbourne: TEQSA.

Usher, R. (2002). A Diversity of Doctorates: Fitness for the knowledge economy? *Higher Education Research & Development*, 21(2), 143–153.

van Bommel, E., Edelman, D., & Ungerman, K. (2014). Digitizing the consumer decision journey. *McKinsey Quarterly: Insights & Publications*. Accessed from: [www.mckinsey.com/insights/marketing\\_sales/digitizing\\_the\\_consumer\\_decision\\_journey](http://www.mckinsey.com/insights/marketing_sales/digitizing_the_consumer_decision_journey)

Vitae (2018). Vitae Researcher Development Framework. Accessed from: <https://www.vitae.ac.uk>

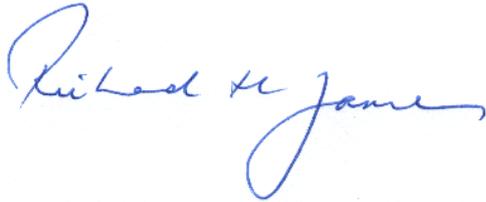
Western, M., Boreham, P., Kubler, M., Laffan, W., Western, J., Lawson, A., & Clague, D. (2007). *PhD graduates 5 to 7 Years out: Employment outcomes, job attributes and the of quality research training: Final report (revised), prepared for the Department of Education, Science and Training*. Brisbane: The University of Queensland Social Research Centre.

Wubbels, T., Brekelmans, M., den Brok, P., & van Tartwijk, J. (2006). An interpersonal perspective on classroom management in secondary classrooms in the Netherlands. In C. Evertson & C. Weinstein (Eds.), *Handbook of classroom management: Research, practice, and contemporary issues* (pp. 1161–1191). Mahwah, NJ: Lawrence Erlbaum Associates.

## Appendix A: Certification

Certification by Deputy Vice Chancellor (or equivalent)

I certify that all parts of the final report for this OLT grant provide an accurate representation of the implementation, impact and findings of the project, and that the report is of publishable quality.

A handwritten signature in blue ink that reads "Richard James". The signature is written in a cursive style with a large, looping initial 'R'.

20 September 2018

Professor Richard James  
DVC (Academic and Undergraduate)

# Appendix B: External Evaluation Report

## OLT Project – Design Options for the Future Doctorate

### *External Evaluator – Dr. Barbara Evans*

*Dean Emeritus, Faculty of Graduate Studies, The University of British Columbia*

*Professor Emeritus, School of Biosciences, The University of Melbourne*

## A. Formative Evaluation Report – May 22<sup>th</sup>, 2017

### 1. Outline – Framework of Project

The stated aim of this project is to produce a suite of program designs and change opportunities that engage Australian universities in advancing doctoral experiences and outcomes, and support the modernisation and realignment of doctoral education in Australia.

The project is to focus on the professional and learning outcomes of doctoral education and on using insights into inputs, processes and outcomes to design new options for provision. This critical review of the inputs, processes and outcomes of current doctorates is to be used as the basis for developing conceptual models to frame subsequent planning, fieldwork and recommendations.

The processes involve completion of research reviews and environmental scans, development and analysis of surveys and interviews, and ongoing consultation with experts and stakeholders.

The project also seeks to define the outcomes and capabilities that are developed through candidate experiences and program designs.

The research questions are (with my *emphases*):

- What are the desirable and actual learning and professional *outcomes* of doctoral education?
- What generic and specific *capabilities* equip doctoral graduates for professional success?
- What essential and optimal *training experiences* are required to develop capabilities?
- What suite of *design options* best equips the sector for steering the future of doctoral education in Australia

Listed project deliverables include:

- A detailed research-informed review of recent trends and developments to be published
- Research-driven doctoral design options to enhance the productivity and quality of doctoral education
- A suite of resources to inform institutions and candidates
- New data on graduate outcomes
- Case studies illustrating good practice training and outcomes

- Sector engagement in building the new doctorate through National Symposium and National Engagement Workshops
- Invigorated national discussions about the doctorate in Australia

## 2. *Progress to date*

### a) *Project management*

The experienced project management team is working effectively and efficiently, despite some recent changes in personnel, and the project processes appear sound. Project development and administration and analysis of data are proceeding smoothly.

### b) *The Critical Review*

I have seen and commented on an early draft of the 'detailed research-informed review' of recent trends and developments'. This research has already contributed to the evolution of the project. Finalising the review for publication remains a considerable challenge as it requires the interrogation and integration of the huge number of relevant Australian and international publications that have been produced over the last two decades.

### c) *Project plan and instruments*

The Project Plan is progressing in a timely fashion. The survey instruments, refined through research and feedback, have been implemented successfully and data gathering closed for graduates and doctoral coordinators on April 20<sup>th</sup>, 2017.

### d) *Fieldwork*

Effective cross-institutional engagement has resulted in twenty-eight Australian universities agreeing to participate in the fieldwork providing a good cross-section of sector. Surveys have been completed by a validated population of 4525 doctoral graduates completing in 2011 (from 8 at one university to 525 at another) and a staff population around 1,000 (from 3 at one university to 119 at another). A total of 642 (~14%) graduate and 327 (~33%) staff responses have been received. Survey fieldwork ran from 6 February to 20 April, with key *graduate/expert interviews ongoing* throughout balance of project. Preliminary analyses of these data are underway and the database is looking good.

### e) *Communication and engagement*

There has been regular communication of progress reports to the reference group by email to about 300 stakeholders and several teleconferences with the reference group. Communications included project responses to feedback leading to changes and general progress. Two important deliverables, relating to both engagement and evaluation were the National Symposium, which was to be held in the first year, and the National Engagement Workshops, have not yet been held. It will be important to engage more effectively with the Advisory Group, Reference Group, and other relevant groups such as ACGR, as project moves into its concluding stages (see further below).

#### *f) Evolution of the project*

Progressive evolution has occurred as the project has developed. Earlier concerns raised about the survey instruments, such as the impossibility of 'costing' and unclear and ambiguous questions, have been resolved. Other changes included needing to use graduates five years out rather than three. An attempt was made to include 'non-completers' in the surveys but this was not possible.

The project aims, products and outcomes and potential impact have also evolved as a result of work completed, responding constructively to specific feedback from various sources and an increasing understanding of national and global research in the doctoral field.

### **3. Remainder of Project to be completed**

The stated project deliverables (page 1) are at various stages of completion.

I understand the background research is largely finished and will be prepared for publication. While surveys of doctoral candidates and coordinators are done, data analysis is ongoing, as are the interviews with university staff, graduates and a broader range of experts and stakeholders.

Consultation, reporting and engagement will need to be ramped up as various prototypes for the design options are developed and validated, and final products produced.

#### *a) Analysis and broader engagement*

A plan has been proposed for analysis and further engagement, which are critical to the success of this project.

1. Build and validate data files (completed?)
2. Consultative prototyping analytic approach by circulating 'mini-briefings' for review and feedback based on:
  - i. Analysing graduate survey responses
  - ii. Analysing staff survey responses
  - iii. Comparing key differences between graduates and staff
  - iv. Validating design architecture
3. Fully specify doctoral design prototype
4. Target further interviews based on survey findings
5. Compile reports and doctoral design platform prototype

#### *b) 'Dynamic' design options*

The team's latest iteration of possible 'dynamic design options' (1 – 4 below) is looking very interesting.

1. Analysis of current doctoral provision prompted work to create architecture to *dynamically clarify* rather than *compartmentalise* doctoral options, experiences and outcomes
2. Team is designing specifications for prototype platform that will *articulate\_and align* what people bring to doctoral education, the experiences they seek, and the success that they want
3. The platform would improve doctoral choices, progress and outcomes for universities, students and professions/communities
4. Insights can be used by universities to improve the engagement, contribution and success of doctoral students/graduates

This approach could provide positive outcomes and effectively address the difficulties of managing the high variabilities in university governance models, university and doctoral cohort sizes, multimodal student populations, discipline-based differences, recent changes in institutional doctoral arrangements, diversity of the doctoral incoming cohorts, etc.

*c) Design validation activities*

Validation of these emerging designs should be drawn from insights from expert interviews and broad scholarly consultation with university executives and stakeholders globally. In this regard effective and deep engagement with the university sector will be critical.

*d) 'Case Studies' and 'Suite of Resources'*

These are yet to be scoped and developed.

#### **4. Further Comments and Recommendations**

- i) As a result of the required change to the graduate cohort, the graduate data are quite 'old' – comprising graduates who commenced their degrees well over ten years ago (and even longer if they were part-time). Many changes in institutional doctoral arrangements are more recent and thus could not be reflected by surveyed graduates. Therefore it will be essential to bring current perspectives to inform and support conclusions. For example industry links in doctoral programs are currently highly valued but were much less prominent over ten years ago.

Data from the ongoing interviews with experts and doctoral coordinators will provide more recent perspectives.

The highly relevant ACOLA Report (2016) is a substantial resource of up-to-date perspectives on doctoral education in Australia and it would be valuable to engage with this team in two-way discussions to inform the project's outputs.

- ii) Many respondents added comments to their surveys and there will be an increasing amount of valuable information arising from the ongoing interviews with experts. **Qualitative** analyses of these potentially novel comments would seem imperative to maximize insight and effective project outcomes.
- iii) 'Benchmarking' is mentioned in the project description. I am unsure of the nature of this and how it is intended to be done. There is some history of national and international doctoral benchmarking in Australia. The ACGR should be able to provide some details of this.
- iv) As design options are refined it will be critical to achieve greater involvement of the Advisory Group, Project Reference Group, and of the sector more broadly. This is necessary to get 'buy in' by the sector and thus greater eventual implementation and impact. Thus see (v) and (vi).

- v) Two deliverables relating to both engagement and evaluation were the National Symposium, which was to be held in the first year, and a series of National Engagement Workshops.

The purpose of these meetings was 'to bring together all insights from the project, to discuss the findings, and to agree on priorities for further action and work'. Both would be extremely useful in achieving effective outcomes and impact. I am not sure when/if they are planned.

- vi) I propose that, as soon as practicable, dedicated workshops for concrete discussion of developing draft design proposals be held with as many members of the team, ACGR Deans and Advisory and Project Group members present. Fewer workshops with larger numbers of participants would be most productive.

## B. Summative Evaluation Report – September 25<sup>th</sup>, 2018

The early stages of the Project including framework, goals, management, project plan, progress, etc. are outlined above in the Formative Report.

### **Management**

Significant later changes in the project researcher group and the relocation of the Project Leader to China led to slowed progress and an extension of the time frame.

It is somewhat difficult for me to evaluate the input of 'project experts' and the 'international advisory group'. While these were excellent groups, I was not aware of any summary or circulation of their input for integrated consideration and 'consensus'.

### **Main outcome of this project – Doctoral design architecture**

Constructive feedback from stakeholders and insight from interviews and research led to an evolution in the main goal of the project from a 'suite of designs' to 'doctoral design architecture'. This is a promising dynamic framework to develop more effective instruments for selection, program design and management, and maximizing positive outcomes for all stakeholders in doctoral education.

While some universities have similar processes in practice, the 'reverse order' of this architecture could provoke new insights and perspectives.

### **Main project findings and improvements**

These were outlined in the executive summary. On balance the four findings essentially concluded that doctoral education in Australia shows sustained demand, with good experiences and productive outcomes but with several opportunities for improvement. The 12 ideas for improvement are relevant and could prove useful in the ongoing development of doctoral programs. Some of the ideas mentioned have already been taken up in different ways by different institutions over recent decades.

Of particular interest are:

- Developing a software platform that ‘provides information, enhances transparency for all stakeholders, and progresses program, education and research design’ would certainly be a valuable tool for the sector.
- Improving the alignment of outcomes with assessment is a challenging idea worthy of further attention.
- Engaging effectively with alumni is always valuable and is most effective when it is focused on directly on enhancing the students’ experiences and employment preparation.
- The idea of a ‘journey map’ is positive. Some universities already promote developing an inclusive ‘portfolio’, others have ‘contracts’ that outline an agreement between students and providers about what is to be done and achieved during the student’s candidature. Whatever model is used an important aspect is that it must be reviewed and updated regularly throughout the candidature.

### ***The three stages of the project***

#### **The First stage**

‘Empathising with current circumstances to identify problems and different concerns.’  
This is presented in Chapter 2 – Understanding the terrain. (pp 15 – 27)

This stage involved a considerable amount of background research and analysis but I feel it was somewhat misaligned with the aim of this project. The international context analysis is about \$\$, publications, enrolments, investment ‘outcomes’, etc. of doctoral education. An evaluation of international current practices and research on doctoral strategies, structures, program design and management, of which much is available, would have been much more valuable.

The Australian analysis was a more relevant and useful account. It recognizes the importance of the recent ACOLA Review and current responses to it, but does not detail the decades of earlier work by the sector on improving the quality of doctoral education.

#### **The Second stage**

‘Determining and defining key concepts—creating a point of view based on needs and insights.’

This is presented in Chapter 3 – Defining structures and insights (pp 28 – 41)

The survey instruments designed to gather data from experts and graduates during this stage were detailed and well founded. There was excellent take-up by universities and graduates and the resulting data illuminate a variety of important aspects of the doctoral experience. There was adequate recognition of the different timelines of students (enrolled prior to 2011) and academic staff (responding on conditions up to 2017). These data will certainly be valuable into the future as work continues in the sector on providing better doctoral experiences and outcomes.

Somewhat less can be drawn from the limited number of interviews, which included nine institution experts, seven graduates and only two employers.

The overall the content and analysis of the data provided in this chapter clearly lay the foundation for the main outcome of the project – the doctoral design architecture.

### **The Third stage**

‘Ideation involved brainstorming possible futures, generating as many ideas as possible, which were distilled into an architecture for framing innovation over the next decade or more.’

This is presented in Chapter 4 – Creating a doctoral design architecture (pp 42 – 49)

As indicated earlier this is the main outcome of the project, which evolved during the course of the project. Its purpose ‘to inform thinking on future reforms as well as initiatives being developed by universities at present’ is worthwhile. And if it can be successfully implemented it would make a valuable contribution hopefully over much more than a decade.

The Doctoral design architecture is provided in the table, and the text investigates its various component parts in a detailed and reflective manner. The ‘reverse perspective’ of this model – successes, experiences and preparations – may lead to new thinking about the various issues.

After outlining the ‘architecture’ model, various ways that it could be developed and implemented are exemplified and discussed, as is its application at different levels – national, university and individual.

As recognised in the Report, this project was intended to provide a framework and schematic that institutions and the sector might use in their efforts to develop prototypes and test program designs. Tables 4 and 5 provide examples that could be a starting point for such developments by providers. Table 6 is somewhat less clear but still worthy of consideration.

### **Deliverables**

Some project deliverables were achieved and some were not. The listed project deliverables included:

#### *A detailed research-informed review of recent trends and developments to be published*

The research review has been completed but, while valuable and interesting, some aspects were of limited direct relevance to the main focus of this project. I understand from the report that several papers have been submitted for publication.

#### *Research-driven doctoral design options to enhance the productivity and quality of doctoral education*

This deliverable evolved considerably as a result of effective consultation and insight from interviews and research to become ‘doctoral design architecture’. I believe this could become a very useful instrument for the sector particularly if it is resolved and refined in consultation with those required to take it up and use it. This could be done effectively through the ACGR network.

#### *New data on graduate outcomes*

The considerable research data arising from the survey instruments (Chapter 3) make an excellent contribution to our understanding of doctoral education in Australia. They provided a strong basis for answering the research questions of the project and will be a valuable resource for future developments in doctoral education.

*A suite of resources to inform institutions and candidates*

As far as I understand these have not been developed.

*Case studies illustrating good practice training and outcomes*

I am also unaware what has happened regarding this deliverable.

*Sector engagement in building the new doctorate through National Symposium and National Engagement Workshops*

Unfortunately the National Symposium was not held. There were a small number of workshops over the last few months to bring together feedback on the draft Final Report.

*Invigorated national discussions about the doctorate in Australia*

This is yet to occur but is likely to occur when the 'doctoral design architecture' instrument(s) are communicated to the Deans of Graduate Studies through the ACGR.

#### **In conclusion**

While all deliverables were not completed, the project has provided a considerable resource of new doctoral data that can be used in future improvements in doctoral education programs and outcomes.

The main outcome of the project – the 'doctoral design architecture' could become a constructive contribution to the ongoing work of work of improving doctoral education in Australia.



September 25<sup>th</sup> 2018