Australian Government

Chief Scientist

8 May 2020

Mr Neville Power, Chair
Mr David Thodey AO, Deputy Chair
National COVID-19 Co-ordination Commission

CC:
The Hon Karen Andrews MP, Minister for Industry, Science and Technology
The Hon Greg Hunt MP, Minister for Health
The Hon Dan Tehan MP, Minister for Education

Dear Neville and David

Please find attached a response to your request for an analysis of the available evidence to respond to your question:

> *What impact is the pandemic having and likely to have on Australia's research workforce and its capability to support our recovery efforts?*

This rapid response has been prepared by the Rapid Research Information Forum that I Chair. The report synthesises the evidence base on this matter and has been informed by relevant experts and has been peer reviewed. Details of the authors and peer reviewers can be found in the Appendix.

I hope this document proves useful to you and your colleagues.

Yours sincerely,

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This rapid research brief responds to the question: What impact is the pandemic having and likely to have on Australia's research workforce and its capability to support our recovery efforts.

- Australia's research workforce will be severely impacted by the pandemic and the effects are likely to be felt for an extended period.
- Income to universities, medical research institutes, publicly funded research agencies, CRCs, and the industrial sector is suffering from the loss of foreign students and a sharp decline in business research spending and philanthropy.
- To try and make ends meet as budgets contract, universities are reducing the number of casual teachers and increasing the teaching loads of permanent staff, further limiting their research capacity.
- These impacts are greater than during the 2008 global financial crisis and are being observed internationally.
- University job losses of up to 21,000 full time equivalent (FTE) positions are projected over the next six months of which an estimated 7,000 could be research-related academic staff. There are concerns that women, early-career researchers and recent graduates will disproportionately experience negative impacts.
- Domestic and international post-graduate students comprise 57% of the university R&D workforce. Research interruptions and travel and visa restrictions suggest that more than 9000 international research students will not resume their research in 2020.
- Industry sectors may experience a reduced capacity to innovate given that universities perform approximately 43% of all applied research in Australia.
- A decline in innovation may limit economic growth by slowing the development of new technology, skills, and efficiency gains in service and production processes.

Research – industry, government and academic – will be negatively impacted by the economic aftershocks of the COVID-19 pandemic. Job losses will unfold over the next six months and longer as the true impacts of the reduction in international fee revenue, industry co-investment and the labour force, affects Australian companies, universities, and scientific agencies.

Australia's research workforce and its sources of funding

The research workforce comprises researchers in universities, government, not-for-profits and the industry sector, technicians and other staff, and postgraduate students. ABS figures show that the number of people

in the research workforce has increased from approximately 91,000 in 2009 to over 164,000 today in terms of full time equivalents (FTE).[1–3] Sectoral breakdowns are provided in Table 1.

Sector	Research Staff (FTE)
Universities	79,008 (24,075 academic staff, 9720 other staff and 45,212 postgraduate students, 2016 ABS data)[3]
Government	14,773 (including 7482 researchers, 4512 technicians and 2,777 other staff, 2016 ABS data)[1]
Industry	74,991 (34,576 researchers, 26,912 technicians and 13,504 other staff, 2017 ABS data)[2]

Table 1 – Employed researchers

The research workforce is funded by government, non-government grants, industry and discretionary income allocated by universities. In universities, revenue from international students is used to partially cover the costs of research, including salaries, co-funding of projects and investing in facilities.[4] In 2018, international student fees contributed an average 26% of universities' operating revenue (this figure ranges between 2 to 39% for individual universities).[5] Medical research institutes also rely on non-government funding, primarily from philanthropy, to cover research costs.

The ABS reports that post-graduate students comprise 57% of the university R&D workforce and make a critical contribution to the total research effort.[6] They are also employed in casual roles in teaching and research. Data from the Department of Education, Skills and Employment for 2018 show 37% of PhD students in Australia are international students, with 75% of those enrolled in science-related degrees.[7] Many international postgraduate students have limited options to extend their stay to make up for research interruptions and some have already returned to their country of origin.[8] These factors together with likely future travel restrictions mean that we can anticipate that more than 9000 international research students may not be able to resume their research programs in 2020.

The Australian Government provides support for the research workforce through various mechanisms: grant funding and tax transfers to industry, paying the salaries of researchers in government agencies and departments, and providing both grant funding through research councils and block funding to universities. In 2019–20 this was budgeted to be a total of $9.6 billion – $2.1 billion to industry, $2.1 billion for Australian Government research activities (including CSIRO, AIMS, ANSTO and Defence), $3.6 billion to universities, and $1.8 billion to medical research institutes and other sectors like agriculture and energy.[9]

What impact is the pandemic having on Australia's research workforce now?

The 'research engine' has slowed down overall for several reasons.

Much of Australia's research workforce has placed its existing research on hold to answer the call for COVID-19 research, both in the laboratory and clinic. Physical distancing and travel restrictions are hindering some research, denying access to laboratories, major research facilities and archives. In addition to this, clinical trials and population health studies have been affected by the new demands on clinical resources and interrupted access to patients and population cohorts.[10] Anecdotal evidence indicates that some organisations already have insufficient international PhD students to conduct research, and some commercial partners are withdrawing their contributions to cut costs. However, it is too early to quantify the impacts of these factors.

Restrictions are also limiting access to conferences and collaborative teams, preventing international placements and reducing the ability to undertake fieldwork abroad and locally, including research required to respond to urgent national needs such as the effects of the bushfire crisis.[11–13]

The impact on funding and job security differs according to sector

For universities, significant job losses have not yet been realised.[14] This is because, so far, universities that rely on international student revenue have reduced costs elsewhere. However, continuing loss of international students will reduce income available to support research. Estimating a loss of $2.5 billion in 2020, Professor Chris Moran of Curtin University projects at least 38% of the research academic payroll is at risk. Universities Australia estimate an even higher decline in revenue of at least $3 billion and possibly up to $4.6 billion in 2020, a decline that will be more acute for research intensive universities.[15]

To try and make ends meet as budgets contract, universities are reducing the number of casual teachers and increasing the teaching loads of permanent staff, further limiting their research capacity.[16] As well as taking on extra caring responsibilities at home, teaching and research academics have had to invest time to deliver online teaching, with an unknown impact on future research productivity.

Universities are required to co-fund research from all sectors – industry, government and non-profit. The decline in revenue will severely impact their ability to provide co-funding, which will in turn compromise research collaborations with industry and other sectors.

The impact of COVID-19 on **medical research institutes** (MRIs) is mixed. While some institutes and teams within institutes have experienced increased workload and funding, the closure of most laboratories is disrupting almost all lab-based research not directly related to COVID-19. Projects will need to be extended, and some will be terminated. In some cases, research can be re-commenced relatively easily, but other projects will take months to recalibrate, resulting in lengthy research delays. MRIs report that revenue from philanthropy, investments and commercial income is falling. Based on data from previous economic

downturns, the Association of Australian Medical Research Institutes (AAMRI) has projected this fall in revenue to be between $200 million and $400 million over the next two years.[17]

The main impact on **publicly funded research agencies** (PRFAs), which include CSIRO, ANSTO and AIMS, has been the redeployment of staff to address the pandemic. However, other laboratories classified as conducting non-essential activities have been subject to closure.

For the **industrial sector**, the impact on the research workforce is less easily assessed. It is difficult to estimate the percentage of job losses across industry research, but manufacturing and professional scientific and technical services have experienced large employment layoffs or reductions as illustrated in Table 2.

Sector	FTE researchers by sector (as at 2017)[2]	Employee jobs change by sector from 13 Mar to 4 Apr 2020[17]
Information and communication	1,089	-6.8%
Financial and insurance activities	6,733	-3.2%
Manufacturing	7,362	-4.3%
Professional, scientific and technical activities	12,902	-7.9%

Table 2: Sectors with largest numbers of FTE researchers and jobs change by sector

While some larger industry employers may be protecting their R&D capacity so they can pivot after the pandemic, others rely on universities and research institutions for R&D capacity.[18] In 2016, universities performed approximately 43% of all applied research in Australia compared to 39% by industry. Industry is most active in the experimental development area of research, comprising 86% nationally.[1–3]

Mirroring the Australian experience, researchers in the US and Europe are reporting that research into COVID-19 is taking precedence. Research projects and laboratories not related to the pandemic have been delayed or shut down. In the UK, the government has established a multi-agency and funding councils taskforce to consider what measures are necessary to support universities, the research community and research institutions.[19]

What impact is the pandemic likely to have on Australia's research workforce in the next two years?

Job losses and other labour market effects

While the scale of job losses in the research sector are hard to predict, analysis by Universities Australia estimates up to 21,000 full-time equivalent (FTE) jobs in the next six months alone are at risk in the **university sector**.[20] Drawing on Commonwealth Department of Education staff data and assuming the loss of

research-related staff mirrors the overall university workforce losses, it is estimated that at least 7,000 research jobs are at risk.[21] Australia's ability to pursue research activities will be further hampered by international university-based research students who are not expected to be able to resume their research programs if international travel restrictions continue.[8]

Science and Technology Australia forecasts that revenue loss in 2020 (calculated from 2016 HERD data[3]) will reduce non-specified or discretionary university funding from $5.8 billion to $1.8 billion, potentially reducing research funding from $11.3 billion down to $7.3 billion. These forecasts are in line with modelling by the Mitchell Institute, which forecasts revenue losses of between $10 billion and $19 billion over the next four years.[5]

Science and Technology Australia estimates that this will translate to the loss of approximately 14,000 FTE research workforce jobs in 2020 alone, though these assumptions are very broad and based on projected income losses (not counting loss from industry investment) and FTE rather than actual staffing, and on averaged losses, cuts and salaries.

AAMRI forecasts that a 20% reduction in **MRI** revenue could translate into approximately 3,000 positions lost over the next 12 to 24 months. Access to the JobKeeper program will offer some temporary support to eligible MRIs, with around 70% of positions to date expected to be covered. However, universities will not be eligible, and this will have a negative impact on some MRIs.[22] While the Medical Research Future Fund (MRFF) is ramping up in future years, projects under this scheme will require co-investment from other at-risk discretionary income.

Because of the highly casualised and fixed term nature of the university research workforce, expectations are that negative employment impacts will be disproportionately felt by **junior researchers including recent graduates, early-career and mid-career researchers, and women,** who more commonly than men have additional commitments of childcare and other home responsibilities.[23–25] Journals are already observing that since the COVID-19 crisis began, submissions from women are underrepresented and articles authored solely by women are particularly affected.[26]

As a result of the reduction in international fee revenue, research staff are likely to become less available to **cooperative research centres** (CRCs), impairing the ability of CRCs to attract and retain industry and university partners to a program that has had a long-running positive impact on commercialising research.[27]

Overall, gaps in Australia's intellectual and technological capability will worsen in the mid to long term as research labour supply declines and the pipeline of researchers breaks down, risking a winding back of gains in cultural diversity and gender balance.[28]

Job losses in the research sector will reduce Australia's ability to maintain research collaborations with international partners. These are important for ensuring global participation and standards of research as well as access to discoveries and technologies.

Falling business investment in R&D and its impacts on publicly funded research institutes

Business expenditure on R&D (BERD) in 2017–18 was $17.4 billion, or 0.9% of GDP. Around 60% of BERD is spent on experimental development and 32% on applied research, predominantly in information and computing sciences and engineering.[2] The proportion of R&D expenditure by large businesses has declined in recent years.[2] During the global financial crisis business investment in research fell by 3.1% in Europe.[29] Statistics emerging from the US, Europe and Australia indicate the current economic crisis will be an order of magnitude worse, and a severe drop in BERD is expected.[30]

Publicly funded research institutes (PFRAs), including CSIRO, ANSTO and AIMS, source differing proportions of their annual revenue from external sources including industry and overseas entities.[31] This revenue is critical for current operations of these agencies and unless made up from other sources, reductions in revenue will have employment effects.

CSIRO also employs early career research staff from both domestic and international origin.[26] CSIRO's post-doctoral research cohort turns over at approximately 35% each year, and about half are originally from overseas. All PFRAs use PhD candidates, especially international PhD candidates, as key components of their research teams.

Ninety percent of ANSTO-led peer reviewed publications from 2016 to 2018 had external national or international co-authors. ANSTO believes that this pattern of collaboration and partnership will re-establish itself after the pandemic. In this sense, ANSTO's workforce (at the level of publications and collaboration) is resilient and can also maintain key functions.

Will we have the research workforce capability to support our recovery efforts?

Modern economic theories argue that sustained economic growth comes mainly from productivity increases.[32–34] There are several ways to improve productivity but knowledge capital, through new technology, skills, R&D and efficient services and production processes, is the most significant factor. R&D also has positive spillovers, meaning that knowledge can result in increasing returns to scale up production cheaply, and can generate significant benefits for those other than the primary investors as discoveries are made and spread.[35,36] Given the decline in immigration in the short term, and the uncertain outlook for international mobility, Australia will be even more reliant on productivity as a driver of growth, and therefore R&D. This is the rationale for public and university sector R&D, noted by, among others, the

Productivity Commission, Innovation and Science Australia, and the 2016 review of the R&D tax incentive.[18,37,38]

During the global financial crisis and subsequent slump in international student enrolments, the impact on Australia's university research was offset by the introduction of demand-driven funding with the research sector benefiting from the stimulus.[39] The scale of the revenue losses for universities from the COVID-19 pandemic is likely to be worse than 2008. While international education mobility will remain a significant industry globally, hopes should not be pinned on a quick recovery. Experts such as Simon Marginson from Oxford University expect recovery to take at least five years.[40] Australia will need to find new sources of growth and improve productivity to maintain our standard of living.[18]

It is too early to say with confidence what form the research workforce will take following the pandemic. However, contractions in sources of discretionary spending for universities, and industry and overseas income for public and university bodies, strongly indicate that the research workforce will contract and will have less capacity than prior to the pandemic to contribute to economic recovery.

An important note on available COVID-19 research

Given the speed of the economic impact of COVID-19, little research is available either through pre-print servers or through traditional peer reviewed journals. As such, conclusions drawn need to be interpreted with caution.

The impact of COVID-19 is a rapidly developing area of research with almost daily updates. This brief is accurate at the time of writing and may become out of date later. Consultation with the Australian Academy of Science and the Australian Academy of Technology and Engineering is possible if the reader has questions.

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APPENDIX

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RAPID RESEARCH INFORMATION FORUM

Impact of the pandemic on Australia's research workforce

The Rapid Research Information Forum (RRIF) is a forum for rapid information sharing and collaboration within the Australian research and innovation sector. It is convened by Australia's Chief Scientist, Dr Alan Finkel AO FTSE FAA FAHMS, and its operations are led by the Australian Academy of Science.

RRIF provides a mechanism to rapidly bring together relevant multidisciplinary research expertise to address pressing questions about Australia's response to COVID-19, as they emerge.

RRIF enables timely responses to be provided to governments based on the best available evidence. RRIF also informs the Chief Scientist's interactions and collaboration with other national chief scientific advisers. It demonstrates the critical value of research and innovation in driving societal as well as economic progress now and into the future.

Forum member organisations

- Australia's Chief Scientist (Chair)
- Australian Academy of Science (AAS)
- Australian Academy of Health and Medical Sciences (AAHMS)
- Australian Academy of Technology and Engineering (ATSE)
- Academy of the Social Sciences in Australia (ASSA)
- Australian Academy of the Humanities (AAH)
- Royal Society Te Apārangi (New Zealand)
- Australian Council of Learned Academies (ACOLA)
- State and Territory Chief Scientists and representatives
- Chief Science Advisor to the Government of New Zealand
- Scientific expert members of the National Science and Technology Council (NSTC)
- CSIRO
- Universities Australia (UA)
- Science & Technology Australia (STA)