



2020-21 Pre-Budget Submission

24 August 2020

To the Treasury,

Thank you for the opportunity to provide a supplementary submission for the 2020-21 Budget.

Science & Technology Australia is the peak body for the science and technology sectors. We represent more than 80,000 scientists and technologists through their scientific associations, research institutes, and research strategy bodies.

In this submission, we outline a bold vision for a “STEM-smart recovery” for Australia.

In a JobCreator plan, we propose a series of clever strategic investments to drive major jobs growth, build on Australia’s STEM strengths, and build back stronger out of the COVID-19 pandemic.

This work draws inspiration from the strategy being pursued by the United Kingdom under Prime Minister Boris Johnson, who plans to double R&D outlays to reach £22 billion by 2024-25.

We urge the Australian Government to:

- Announce a non-medical research translation fund to support the translation of cutting-edge Australian research into new products, services and Australian jobs;
- Expand funding for industry-led research programs such as CRC-Ps to generate economic returns and strengthen sovereign manufacturing capability;
- Add a 20% collaboration premium to the Research and Development Tax Incentive for businesses that work with public research institutions. Enable firms to claim the first three years of an early-career researcher’s salary if they hire STEM PhDs;
- Invest in a one-off boost to the Research Training Program to support 6-month extensions as a bridge to stop postgraduate researchers from falling out of Australia’s research workforce;
- Develop a Science Alliance program that provides professional development to early-career researchers and strengthens their engagement with industry; and
- Expand the Office of the Chief Scientist to resource ongoing rapid real-time evidence to support Government decision-making.

These initiatives would be a powerful foundation for a budget that invests strongly in new job creation, strengthens Australia’s traditional industrial base, and safeguards jobs and by bringing science and technology more deeply into service across our economy.

There is a vast task of economic and social recovery ahead for our nation. We offer the skills, goodwill and commitment of the nation’s science, technology, engineering and maths sector – and its highly skilled workforce – to this major national effort.



Associate Professor Jeremy Brownlie
President
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INTRODUCTION

The COVID-19 pandemic and ensuing recession has damaged almost every sector of the Australian economy. Yet some face even greater threats than others. Right now, our science and research sector is poised on the edge of a funding cliff.

For the past decade, Australia has partly funded our world-class research and science system by building a strong export market in high-quality education for international students. This has enabled Australia to produce research of quality and volume well beyond our public investment in research and development.¹ And this, in turn, has led to the creation of Australian jobs, companies and industries we would not have otherwise been able to generate.

With the closure of international borders in 2020, all Australian export sectors have faced major collapses in revenue. This situation is particularly acute for our science and research sectors, with universities also unable to access JobKeeper payments to keep scientists and researchers in jobs.

A report from the Chief Scientist's Rapid Research Information Forum in May projected this revenue collapse for universities would result in the loss of around 21,000 full time jobs this year, including 7,000 research jobs.² This alarming figure is for job losses in ongoing roles. It is in addition to the thousands of contract staff who have been told in recent months that their contracts cannot be renewed and casual researchers and teaching staff who no longer have paid hours. In the medical research sector, the economic downturn has resulted in a fall in donations and investment returns. These factors are expected to result in a loss of \$500 million in the sector.³

With the exception of COVID-19 vaccine research, business investment in research is also expected to fall. This drop in investment is a result of shaky business and consumer confidence - as well as uncertainty around the proposed changes to the Research & Development Tax Incentive. If passed, these legislative changes would see R&D investment drop by \$1.8 billion, even though Australia's overall R&D investment has already fallen to just 1.79% of our GDP - well below the 2.4% average across the OECD economies.⁴ An alternative plan to encourage investment in the R&D sector through other investment vehicles has not yet been articulated.

With falling investment from public, private and international student sources, Australia's science and research sector has never been at greater risk. This is especially concerning when we are relying so heavily on the STEM and research sector to be our salvation from the pandemic - and also from the recession. The economic returns on collaborative research investment are well established. Collaborative R&D with universities returns \$4.47 to business for every dollar invested.⁵

Investment in STEM and research generate strong economic returns. They also create new jobs. Advancements in advanced manufacturing, quantum computing, artificial intelligence, and deep technology will create jobs and income for Australia. All of these industries - and many others - require an innovative and diverse STEM workforce supported by strong and steady investment.

STA and the STEM sector are deeply committed to help Australia navigate the major challenges ahead. We propose a bold vision for a "STEM-smart recovery" for Australia.

In a JobCreator strategy, we propose a series of clever strategic investments to drive major jobs growth, build on Australia's STEM strengths, and build back stronger out of the pandemic.

A RESEARCH TRANSLATION FUND

COVID-19 has presented major challenges beyond the medical threats it poses. It has also highlighted an urgent need to bolster Australia's sovereign capability. A decline in traditional manufacturing over several decades and missed opportunities to innovate have left us at the mercy of other countries.⁶ This pandemic has forced deep reflection across Australian industry about supply chain reliance on overseas suppliers, and focused minds on building stronger sovereign capability in Australia. To keep up with global competitors, we need a strengthened Australian advanced manufacturing capability underpinned by high quality Australian research and development.

The Medical Research Future Fund (MRFF) has come into its own in 2020. The fund not only provides long-term funding stability, but can be used to rapidly address national emergencies like the COVID-19 pandemic and the effects of the pandemic and bushfires on mental and physical health.

To improve Australia's sovereign capability and our economic recovery, investment in medical research translation won't be enough. The model of the MRFF, however, points Australia to a solution to our economic and sovereign capability challenges.⁷ A new Research Translation Fund would be a vehicle to enable "almost there" research insights to be developed and made here in Australia. Applying this research would create new local jobs, and generate new markets to boost Australia's economic recovery. They would drive our national strategy to bolster our sovereign capability.

There are two clear options to fund the creation of a new Research Translation Fund. STA's current recommendation is that any savings from changes to the Research & Development Tax Incentive could be used to create a new Research Translation Fund.⁸ While most comparable countries rely on a combination of direct support (grants and interest free loans) and indirect measures (tax incentives) to encourage business investment in research, Australia relies heavily on indirect measures (the R&D tax incentive). A research translation fund from any savings from the RDTI would create extra policy levers to encourage investment and bring Australia closer into line with our economic competitors.

The second option for funding the Research Translation Fund would be to endow a Research Translation Future Fund. The benefits of this measure would be to create a long-term more stable research funding resource - just as the MRFF does in medical research. However, a future fund model would mean resources would not immediately be available to aid in Australia's urgent need for economic recovery and sovereign manufacturing capability.

STA also sees a strong and expanded role in this economic recovery plan for Government support for industry-led research programs such as Cooperative Research Centres Projects (CRC-Ps) grants program. A boost to funding for this program would help to kick-start the recovery and strengthen Australia's sovereign manufacturing capability. To the surprise of industry, the most recent CRC round - round 10 - was only open to smart recycling projects, and the money is only half the level of the previous round.⁹ This CRC program should be boosted and open to the breadth of industry sectors.

RECOMMENDATION: Announce a non-medical research translation fund to support the translation of Australia's research into innovative new products, services and Australian jobs.

RECOMMENDATION: Expand funding for industry-led research programs such as CRC-Ps to generate economic returns and strengthen sovereign manufacturing capability.

A RESEARCH & DEVELOPMENT TAX INCENTIVE COLLABORATION PREMIUM

In STA's previous submission, we advocated for the introduction of a 20 percent collaboration premium for the Research & Development Tax Incentive. This collaboration premium would encourage businesses to collaborate with the university sector's innovative researchers. Such a premium could particularly help small and medium enterprises that do not have an in-house R&D capability to access help from some of our nation's best researchers.

Along with a collaboration premium, the Research & Development Tax Incentive Review in 2016 recommended enabling businesses to claim the premium for the cost of employing PhD STEM graduates for their first three years with the firm.¹⁰ STA specifically draws the Treasury's attention to this measure - and commends it.

The Australian university sector faces a dramatic fall in available funds for research.¹ This is expected to result in significant cuts to researcher numbers and a fall in Australia's overall research capacity.² Australia's economic recovery relies on this research and development. Rather than lose these workers, there is an opportunity for industry to invest in research. By implementing a collaboration premium, the Government would incentivise the hiring of PhD STEM graduates and early-career researchers. Australian business would be supported to invest in research talent at a time when the science and research sector needs it most.

RECOMMENDATION: Add a 20% collaboration premium to the Research and Development Tax Incentive for businesses that work with public research institutions. Enable firms to claim the first three years of an early-career researcher's salary if they hire STEM PhDs.

A JOBS LIFELINE FOR OUR BRILLIANT YOUNG SCIENTISTS & RESEARCHERS

The importance of the work done by postgraduate research students is often underestimated. They make up almost 60% of the researchers employed by universities.¹¹ These students, who are trained at relatively low cost, are the workhorses of Australia's research sector. The investment in their modest stipends not only delivers Australia a highly-skilled and cost-effective research workforce - but also trains our star senior researchers of the future.

In May, the Australian Government recognised COVID-19 was going to have an impact on the ability for PhD students to complete their research.¹² To provide support to these students, a temporary measure was put in place to allow for the extension of PhD projects by six months. While this announcement was very welcome, it did not include any extra resources to implement this measure. For universities to be able to provide these extensions, they would have to take resources from future postgraduate students.

In more normal circumstances, it might have been possible for universities to fund such extensions from general university funds. The financial challenges outlined above, however, make it clear that university budgets have seen massive revenue falls during the pandemic. To maintain the pipeline of scientists and researchers, and support the completion of PhD training, STA recommends the Government fund these extensions. Such extensions would not affect the overall structural integrity of the budget - but would instead be a one-off investment.

If such extensions were granted, STA estimates it would require a maximum of \$500 million to be invested in the existing Research Training Program. This maximum amount assumes every student receiving support from the Research Training Program requires an extension. We know, however, that COVID-19 related delays to research can depend on the field of research, the stage of the students training, and even location. These variations mean that the real cost of this investment is expected to be less than the maximum \$500 million. The real cost would depend on the number of extensions granted by each university on a case-by-case basis.

RECOMMENDATION: Invest in a one-off boost to the Research Training Program to support six-month extensions as a bridge to stop postgraduate scientists and researchers from falling out of Australia's research workforce.

A SCIENCE ALLIANCE TO BRIDGE THE GAP BETWEEN INDUSTRY & RESEARCHERS

Strengthening incentives for business to employ researchers is an important step to boost the capabilities of our economy. But it is not the only step. Creating stronger relationships between researchers, universities and business is another. Australia has gone a long way in recent years to bridge the gap between universities and industry. Unfortunately, many researchers still find it challenging to move between industry and research. Early-career researchers and PhD graduates have already indicated a preparedness to enter industry - with 51% indicating they hope to leave academia.¹³ Research from the Australian Mathematical Sciences Institute suggests industry and the public sector combined now employ 48% of graduating PhD students.¹³

The US Science Alliance, run by The New York Academy of Science, presents Australia with a solution to the challenge of creating stronger partnerships between researchers, universities and industry. This program now includes 250+ partner organisations and provides professional development, career resources and networking opportunities for 10,000+ graduate students and early-career researchers.¹⁴ According to their 2019 annual report, the program was able to provide over 275,000 hours of STEM program to 6,000 early-career researchers.¹⁴

Programs like this help to give researchers the connections and the skills that are needed to move fluidly between the private sector and the research sector. This fluid movement of human resources brings with it increased collaborative research and greater economic innovation.⁵ An Australian version of this program will not need to be as large to be as effective. Providing support in this area would not only protect and provide support for the 7,000 researchers at risk from the university funding crisis - but also prepare future PhD graduates for a career in industry.²

RECOMMENDATION: Develop a Science Alliance program that provides professional development to early-career researchers and strengthens their engagement with industry.

A RAPID REAL-TIME EVIDENCE BASE TO SUPPORT POLICY DECISION-MAKING

The COVID-19 pandemic has made the value of a real-time expert evidence base clearer than ever. Notwithstanding the continuing challenges in some parts of the country, the overall success of Australia's pandemic responses has been due to guidance by strong expert evidence. The Rapid Research Information Forum has highlighted how effective the research sector can be at providing advice to assist the Australian Government on urgent national priorities.¹⁵ During the pandemic, it published 11 high-quality research papers synthesising complex evolving research and evidence to help decision-makers across the Australian Government and the National COVID-19 Commission.

The Office of the Chief Scientist initiated this forum which oversaw this rapid real-time evidence gathering process. It is not only on COVID-19 that strong links between Government decision-makers and the nation's brilliant researchers can be beneficial. The bushfire disaster at the start of the year highlighted exactly how important it is to be able to gather scientific expertise quickly.

This capacity to gather experts and scientific evidence should not be limited to times of national challenges and disasters. The science and research community can provide evidence-based solutions on many more of the nation's challenges. The Office of the Chief Scientist already does an admirable

job at providing such evidence-based support. An expansion of this office would however allow evidence-based advice to be provided on a much wider array of topics.

The importance of evidence to guide decision making is also recognised by Chief Scientist roles in some Government departments. But there are thousands more researchers nationwide whose expertise can be harnessed to help the nation to navigate major national challenges. This where the Government Office for Science in the UK excels.

The Government Chief Scientific Adviser and the Government Office for Science act as an independent advisory body to the Government on a wide array of issues. In recognition of the importance of scientific advice in the current situation, the UK Government has boosted support to this office by almost 50% (\$3.36 million).¹⁶

STA recommends that in this budget, the Government announces funding to expand the Office of the Chief Scientist. This expansion of the already exceptional work done by this office might reflect the UK model. An expansion may also allow for funding specific short term projects like those supported by the Rapid Research Information Forum.

A key aspect of this measure would be to include the capacity to liaise with key Government departments. STA acknowledges that many Government Departments have a Chief Scientist/science liaisons within them. By expanding the capacity of the Office of the Chief Scientist to support these Departments, the model of Rapid Research Information Forum can be extended across all areas of Government.

The success of Australia's handling of the COVID-19 pandemic has been largely due to the expertise brought together through vehicles like the Rapid Research Information Forum. The opportunity now exists to capture this success and translate it to other urgent national challenges. The STEM community stands ready, willing and able to assist.

RECOMMENDATION: Expand the Office of the Chief Scientist to resource ongoing rapid real-time evidence to support Government decision-making.

Please note: This supplementary submission should be read in conjunction with STA's earlier Pre-Budget submission lodged earlier this year. It contains proposals for a wider range of important initiatives, including proposed funding for an Australian Indigenous Science Network.

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Appendix 1

Introduction

The critical role of science and technology in the growth and prosperity of the Australian economy is unarguable. Dramatic changes are on the horizon with the introduction of automation, AI and the digital economy. If Australia is to remain competitive globally, and meet the environmental, medical, social and economic challenges of the future, a strong science and technology sector is the answer.

The evidence is quite clear on the benefits to the economy of strong and stable public investment in scientific research and technological development. The calculated returns on investment for science and research are excellent, with a \$2.21 return shown in the US¹ on every \$1 of public investment in science, and a £1.50 return in the UK on every £1 of public investment in science, in perpetuity². Medical research alone was shown to provide a \$3.90 return on the dollar, here in Australia³.

Despite the proven return, public investment in science and technology is at a four-decade low⁴. As stakeholders across the research sector have regularly stated, steady, long-term investment and planning is crucial if we are to undertake the best research and encourage innovation.

Since the National Innovation and Science Agenda⁵ and the National Science Statement⁶ released in 2015 and 2017 respectively, strategic leadership and new investment in the STEM sector has been restricted to medical research translation and research infrastructure. With a budget surplus on the horizon and favourable economic outlook, now is the perfect time to show strong leadership across the STEM sector.

There has been significant progress towards a national, long-term plan in medical research, with strong leadership shown through the establishment of the Medical Research Future Fund (MRFF)⁷. The sector was also grateful for long-term vision for research infrastructure and secure investment through the Research Infrastructure Investment Plan⁸. STA strongly advocates for the continuation of both the MRFF and Infrastructure Investment Plan.

STA calls for a similar emphasis on the remaining areas of scientific research funding that are yet to experience the benefits of this visionary, strategic direction; and a whole-of-government plan that provides a united strategic vision for all work done in science, technology, engineering and mathematics research in Australia.

¹ ["Science economics: What science is really worth"](#) Colin Macilwain, Nature 2010

² ["Rates of return to investment in science and innovation"](#) Frontier Economics, 2014

³ ["Australian medical research delivers outstanding returns on investment"](#) Association of Australian Medical Research Institutes, 2018

⁴ ["Funding cuts risk life-changing research: AS R&D spend plunges"](#) Universities Australia, 2018

⁵ ["National Innovation and Science Agenda Report"](#) Department of Industry, Innovation and Science, 2015

⁶ ["Australia's National Science Statement"](#) Department of Industry, Innovation and Science, 2017

⁷ ["Medical Research Future Fund"](#) Department of Health, Accessed January 2019

⁸ ["Research infrastructure investment plan"](#) Department of Education and Training, 2018

STA calls for a funding commitment to establish a 10-year Strategic Plan for research and development, underpinned by a clear 5-year funding plan. These should build on the successes of the National Innovation and Science Agenda and the National Science Statement.

STA Recommends: The development and commitment of a 10-year strategic plan for Research & Development including a concrete 5-year funding commitment.

Within this budget submission STA has outline a series of initiatives that will help create the strong Australian science & technology sector that is needed now, and into the future. This includes a focus on:

- Research investment;
- Business investment in research;
- Investment in STEM education; and
- Investment in a strong workforce through improving equity, diversity and inclusion in STEM.

Research Investment

Increasing research investment as a proportion of overall GDP

According to the OECD, countries including the US, UK, China, New Zealand, and Singapore⁹ are reinvesting in science and technology following the Global Financial Crisis - Australia is lagging behind. With recent cuts to the research block grant, Australia is at its lowest level of direct public investment in research in decades (just 0.5% of GDP)¹⁰. Australia cannot compete globally if we do not provide long-term stable investment in research that stacks up against the rest of the world.

STA Recommends: That the federal government commits to increasing overall research and development investment to a minimum of 3% of the national GDP

Long-term investment in research translation through a Research Translation Future Fund

One of the key challenges facing the Australian Research & Development sector has been encouraging industry to invest more in R&D. The primary mechanism to do so is through the Research & Development Tax Incentive. While this incentive is responsible for the largest proportion of spending on research, the results have failed to meet its intent, as business investment in research continues to fall (business expenditure on R&D dropping by 12% between 2013-14 and 2015-16¹¹). The proposed changes to the Research & Development Tax Incentive reflect ongoing issues created by this policy mechanism.

While STA accepts that the Research and Development Tax Incentive may encourage large businesses to engage more in R&D, the strategy would benefit from a multi-pronged approach to encouraging small-to-medium businesses to also invest more in research¹². It is also worth considering more direct approaches such as that used in

⁹ "[Gross domestic spending on R&D](#)" OECD Date, Accessed 2019

¹⁰ "[Budget ram raid on university research](#)" Universities Australia, 2018

¹¹ "[Australia's spending on research plummets far below OECD average](#)" The Guardian, 2018

¹² "[Inquiry into the Treasury laws amendment \(making sure multinationals pay their fair share of tax in Australia and other measures\) Bill 2018](#)" Science & Technology Australia, 2018

Germany where public investment in research translation is in the form of direct funding of peer reviewed collaborative projects. It is time to reconsider the role of Australian public funding in supporting translational research¹³. Australia has already proven that public investment in research translation can be used to leverage business investment, with the immediate success of the Medical Research Future Fund. Although this Fund is yet to reach its full target expenditure, funds have already been used to complement basic research funded by National Health and Medical Research Council (NHMRC). This translational research is already showing returns on investment of 4.1%¹⁴.

A similar non-medical fund aimed at complementing the curiosity-driven scientific research supported by the Australian Research Council (ARC) is likely to show the same level of success and should be explored. This fund could be built using the savings garnered from efficiencies and improvements to the Research & Development Tax Incentive scheme. It would provide direct funding to translational research in a similar way to that done successfully in Germany, the US, and the UK, and also have the benefit of encouraging business investment through leveraging co-investment of initiatives, making the fund ultimately self-sustaining.

Like the MRFF, which assigns funding based on a set of national priorities, these principles rely on, and encourage co-investment from both industry and philanthropic investment. A research translation fund could potentially be used to ensure that Australian translational research is incorporating both Australian business investment and research resources in the most efficient and effective fashion.

STA Recommends: A non-medical Research translation fund be created using the savings from the changes to the Research & Development Tax Incentive

Investment: \$2.4 billion over the forward estimates

Investing in Australia's research agencies and funding bodies

Important national agencies including the Bureau of Meteorology, CSIRO, Geoscience Australia, the Australian Bureau of Statistics, and many other scientific and research organisations have faced efficiency dividends, which limits their ability to undertake independent research that benefits the nation. For example, the Australian Bureau of Statistics is being forced to reduce staff and key statistical surveys as a result of a 10% cut to appropriations over three years¹⁵.

In 2018, legislation was passed to guarantee increases in investment for the ARC to match the consumer price index¹⁶. This indexation should be the standard for every Federal Budget, and STA believes all research funds and institutes should have similar increases enshrined in legislation. Without this protection, public research agencies and research funding agencies are required to reduce costs rather than focusing on expanding and enhancing Australia's ability to create and translate knowledge.

¹³ ["Business doesn't spend enough on R&D"](#) Australian Financial Review, 2018

¹⁴ ["Is the Medical Research Future Fund fulfilling its mission as promised"](#) Dr Lesley Russell, Croaky, 2019

¹⁵ ["Australian Bureau of Statistics to cut staff by 17% and axe some key surveys that explain the economy"](#) Business Insider Australia, 2017

¹⁶ ["Australian Research Council Amendment Bill 2018"](#) Parliament of Australia, 2018

Long-term investment in these research institutions and funding agencies is a key component to ensure a balanced approach to research. Investing in translational research may be considered more cost effective in the short-term, when quick outputs are desired, but research translation requires a foundation of blue-sky research to be successful. The “eureka moment” that comes from translation research is achieved thanks to decades of blue-sky research. Because national research institutions and funding agencies are funded through public investment, they are able to undertake blue-sky research free from conflict and ulterior motives; this can then be used to develop great Australian innovations. For example, the research regularly undertaken by the Bureau of Meteorology is vital to almost all agriculture related translational research being undertaken in Australia.

It is essential that investment in these research agencies along with investment in the national funding bodies is restored and costs from rising inflation are met.

STA Recommends: an increase in the base funding of national research agencies and government research institutes of 4% each year for the next 4-years.

Building cross-sectoral support for science and technology

Research collaborations premiums

After the review into the Research and Development Tax Incentive was undertaken, the Federal government accepted a number of the recommendations outlined in the final report¹⁷. One that was not accepted was the call for tax incentive premiums to be placed on research collaboration between research institutions or universities and business, to encourage them to work together to undertake research and development¹⁸. The result of such collaborations has already been shown to be extremely profitable, with a report indicating that the current benefit to the economy of \$19.4 billion per year could be lifted to \$30 billion per year through increased research collaborations between business and universities¹⁹.

The introduction of a research collaboration premium may also allow more small and medium enterprises to partake in research and development. Traditionally unable to provide sufficient outlay to support the setup of internal research teams, small and medium enterprises are not empowered through the incentive as it stands. As they are able to engage in arrangements with external research institutes and universities, a research collaboration premium would be an effective way to engage them in high quality research and development.

Encouraging collaboration between business and universities is also beneficial to the production of research itself. With access to a larger pool of talent than ‘in-house’ research programs would allow, business is able to reach innovative ideas faster²⁰. The linking of business to universities also increases the likelihood of an innovative

¹⁷ [“Review of the R&D tax incentive”](#) Department of Industry, Innovation and Science, 2016

¹⁸ [“Australia 2030: Prosperity through Innovation”](#) Innovation and Science Australia, 2017

¹⁹ [“Clever Collaborations”](#) Universities Australia, 2018

²⁰ [“Australian Industry Report 2015”](#) Office of the Chief Economist, 2015

breakthrough in research²¹. Such benefits, along with the economic advantages, reveal just how important it is to foster collaboration.

STA Recommends: a 20% research premium for collaborations between industry and registered public research agencies be placed on the Research & Development Tax Incentive

Investment: \$305 million over the forward estimates

Bridging the cultural divide between science and decision makers

Since 2010 successive Federal Governments have recognised the importance of science engagement with business, decision makers, and the public. Events such as National Science Week, Science meets Parliament and the Prime Ministers' Prizes for science are examples of this engagement. The result of increased engagement has been improved application of science and technology in both Australian society²² and in decision-making for our national leaders²³.

Improved engagement with the science and technology sector has can also help to improve research & development in the business sector. A barrier to business investment in research is the cultural divide that exists between the business and research sectors. This issue is known to both sectors and there are a number of initiatives underway to increase collaborative opportunities between the two.

The barriers to effective industry and research collaboration can be addressed by looking at four key factors²⁴. They are:

- Misaligned incentives;
- Differing priorities between university and industry;
- IP ownership and commercialisation issues; and
- Issues of scale and size.

Of these four factors, the first three can be addressed through better understanding and communication between business and research. We must provide more opportunities for leaders in each sector to come together to discuss shared goal and opportunities to work together, STA strongly advocates for a continuation of Federal support for programs like the Industry Growth Centres, the Cooperative Research Centres, Rural Research and Development Corporations, events like Science meets Business, and other initiatives to deepen mutual understanding and encourage collaboration across sectoral barriers, such as APR Interns.

In addition, STA recommends support for initiatives that create skills and opportunities for deeper engagement for people in the science and technology sector with leading business, decision-makers and the public. This will allow for the growth of new relationships and support well-established relationships to continue to aid the Australian economy for many years to come.

²¹ ["R&D Tax incentives: Evidence on design, incidence and impact"](#) OECD, 2016

²² "Household Use of Information Technology, Australia 2016-17" Australian Bureau of Statistics, 2018

²³ ["Australia's Tech Future"](#) Department of Industry, Innovation and Science, 2018

²⁴ ["Innovate and Prosper: Ensuring Australia's Future Competitiveness through university-Industry Collaboration"](#) Australian Technology Network of Universities, 2015

STA Recommends: A continuation of federal support for formal cross-sector science collaboration mechanisms, and events which deepen understanding and connection between science and business leaders.

Investment: \$1.25 million over the forward estimates to maintain the Decision Makers Engagement Grant, and a further \$1.75 million to expand on its success.

STEM Education Investment

Restoring funding to the Commonwealth Support Grants and the Research Block Grant

Over the past five years, there have been regular freezes or cuts to two important mechanisms that support students at Australian universities. The Commonwealth Support Grants provide funding for undergraduate students, and the Research Support Program provides funding for both research and the training of research students. Cuts to these areas have flow on effects for the Australian economy more generally - it is estimated that freezing the demand driven system will cost \$6.9 billion to Australia's GDP²⁵; and cuts to the Research Support Program are limiting universities' ability to train and prepare research students to be global researchers and STEM-qualified workforce leaders of tomorrow.

In spite of these cuts, the higher education sector remains the third largest sector in Australia, a major export industry and the single largest services sector. Based on the most recent analysis of Australia's Group of Eight universities, the economy gains \$66.4 billion each year from their work, and an extra \$19 billion through their contributions as major employers nation-wide²⁶. This is not to mention the social and cultural benefits that come from the education and research provided by higher education institutions. If Australia is to maintain these economic, social and research-born benefits, the university sector needs long-term and stable investment.

The higher education sector plays a critical part in preparing the science and technology-qualified workforce of the future. It is estimated that Australia is creating STEM jobs at 1.5 times the rate of non-STEM jobs, while the growth of STEM qualified workers is only increasing by 15%/year (the number of non-STEM qualified workers are growing at 26%/year)²⁷. If this remains unchanged, universities will be unable to fuel the jobs of the future, and as the demand driven system is frozen, universities are likely to focus on enrolling students in "cheaper" courses outside the STEM disciplines to make savings²⁸.

Australia is at risk of not meeting the growing demand for STEM qualified workers, and this could have serious ramifications on the nation's prosperity into the future.

STA Recommends: That the cuts to the Research Block Grant be reversed.

²⁵ ["Graduate Contributions and the impacts of the funding freeze"](#) Cadence Economics, 2018

²⁶ ["The economic impact of Group of Eight universities"](#) London Economics, 2018

²⁷ ["Perspectives on Education and Training: Australians with qualification in science, technology, engineering and Maths"](#) Bureau of Statistics, 2015

²⁸ ["Budget update: universities fear Morrison's freeze will cut student numbers"](#) The Australian, 2017

Investment (Research Block Grants): \$328.5 million over the forward estimates

STA Recommends: A return to the Demand Driven System for Commonwealth Support Grants

Investment (Demand Driven System): \$2 billion over the forward estimates

Fee-offsets for STEM undergraduates to undertake teaching courses during their study

One of the major issues facing STEM education in Australia is the level of out-of-field-teaching that occurs in the areas of maths and science. According to the Australian Mathematical Sciences Institute, there is a 76% chance that a student in years 7-10 will be taught by an out-of-field teacher²⁹. This has direct impacts on student outcomes, as teachers who are out-of-field tend to be anxious and have negative effects students' willingness to participate in such subjects³⁰.

A number of solutions to the issue of out-of-field teaching have been examined internationally. One of the most successful approaches is to encourage STEM enrolled students at university level to consider taking up education courses during their study. While there are already incentives available to graduates with STEM degrees to undertake education courses these are being shown to be insufficient to encourage graduates that have already graduated and are looking to a STEM career. What is needed is to encourage STEM undergraduates to view education as a viable and enjoyable career option, to achieve this an opportunity to study education before graduating should be encouraged through fee reductions or waivers for those who take up education electives as part of their STEM degree³¹.

If we are to encourage STEM graduates to then pursue a Diploma of Education to further expand their skills and move into a career as a science or maths teacher, further fee waivers and incentives must be explored.

Without investments and significant improvements to teacher education, it will take upwards of 10 years to train enough maths and science teachers to end out-of-field teaching. This shows Australia is facing a teaching crisis in maths and science.

STA Recommends: Fee waivers for undergraduate STEM students who enrol in education courses

A commitment to better resourcing schools to teach maths and science with a particular focus on regional education

Resourcing of Australia's schools continues to be a problem, particularly for regional Australia. While some inner city and private schools have access to science laboratories and top of the range digital resources, this is not the case for all schools. To equip our future workforce, it is essential that students are provided with the resources needed to foster and develop an enthusiasm for science and maths and comprehensive STEM skills.

²⁹ "[Crunching the numbers on out-of-field teaching in maths](#)" Australian Mathematical Sciences Institute, 2018

³⁰ "[Maths Anxiety: Students, Pre- and In-services teachers, No. 4 – 2018](#)" Australian Mathematical Sciences Institute, 2018

³¹ "[Status of the Teaching Profession](#)" Science & Technology Australia, 2018

There is some progress being made in providing resources to schools in the way of science laboratories and equipment. In Western Australia for example, 200 schools will be provided with science laboratories, resources and equipment by 2021 in a bid to improve science education in WA³². This is an initiative that STA believes should be embraced and encouraged at a national level, to ensure that no matter what school you attend, a sound foundation in science and maths is a priority.

Even more challenging is ensuring that students in regional and remote Australia are provided with a sound STEM education. The Federal government has put some effort into encouraging rural students to pursue higher education through regional study hubs and regional scholarships³³, but this does not address the issues informing these students' choices of what to study. If regional and rural students are engaged in effective STEM education, we may see higher rates of STEM enrolments among this demographic.

To provide all students with the same opportunities, it will be important to also guarantee an adequate maths and science education for regional students.

STA Recommends: A funding commitment to ensure every school has a science lab and the resources needed to provide a science education to all students.

Investment: \$365 million over a 4-year infrastructure plan

Diversity and Inclusions in STEM

Ongoing Funding for the Science in Australia Gender Equity Program (SAGE)

The Science in Australia Gender Equity Program has been a corner stone for improving gender equity within science, technology, engineering and mathematics. It is Australia's key gender equity program for institutions, working to support universities and research institutes to achieve internationally renowned Athena SWAN accreditation, and focused on inspiring systemic change within the STEM sector and the organisations that move within it³⁴.

While 15 institutions have already received Athena SWAN Bronze accreditation³⁵, this is the first step and there is still much more to be done to improve gender equity. The continuation of this vital program of reform is dependent on ongoing long-term funding at a Federal level.

STA Recommends: Funding to continue the work of the Science in Australia Gender Equity Program

Investment: \$18 million over 10-years to continue the national roll-out

³² ["More primary schools to receive dedicated science labs"](#) Government of Western Australia, Department of Jobs, Tourism, Science and Innovation, 2018

³³ ["Access and Participation"](#) Department of Education and Training, Accessed January 2019

³⁴ ["What Sage Does"](#) Science in Australia Gender Equity, Accessed January 2019

³⁵ ["Fifteen Australian Institutions have been recognised for efforts to improve gender equity and diversity, receiving the inaugural Athena SWAN Bronze Awards"](#) Science in Australia Gender Equity, 2018

Funding the Women in Science Decadal Plan

For the first time, there will be a national, long-term Women in STEM Decadal Plan to ensure gender equity within science and technology. This Plan is currently in development by the Australian Academy of Science and has received bipartisan support during its development. However, while the development of this plan has received support from the current Minister for Industry, Science and Technology³⁶, there has yet to be any commitment to acting on the recommendations that will arise.

STA Recommends: Funding and policy support be allocated to applying the recommendations of the Women in STEM Decadal plan in preparation for its release

Increasing women scientist presence in the media

The perceptions of a 'typical' scientist is developed at a young age and continues to be reinforced throughout a person's life. This perception is shaped by education, media, personal interactions and experiences, and the common view has been shown to be overwhelmingly that scientists are men³⁷. Different strategies may be implemented to improve female participation in STEM, however the overall perception of scientists must change in the broader community to make the biggest impact.

Many programs already exist to achieve better representation of women in STEM in the media, such as the Superstars of STEM program. However there remains a chronic under-representation in popular culture. Australian television programming has been shown to be extremely influential in altering the views of the broader public³⁸ and can be used to address these stereotypes.

STA, therefore, considers it important to include women scientists not just in news broadcasting, but through the portrayal of characters on television and in film. Through the provision of grants that specifically include women characters with STEM roles, the stereotypical view of a scientist can be altered to be more inclusive and equitable.

STA proposes that these grants be awarded through Screen Australia and go towards the salary of the female actors, playing the roles of scientists in the first year. The proposed grants will be awarded at a maximum of \$80,000 per awardee with a total of 5 grants awarded per year.

STA Recommends: Establishing a meaningful grant to provide incentives for Australian created television and movies to include characters that are women STEM professionals

Investment: \$1.6 million over the forward estimates

Investment in Indigenous networks for the STEM community

A significant challenge for the science, research and education sectors is engagement of the Aboriginal and Torres Strait Islander peoples. While some strategies are being implemented through Universities Australia³⁹ to increase the number of Indigenous students participating in universities, there is still room for more work to be done.

³⁶ "A 10-year plan for women in STEM" Minister for Industry, Science and Technology, 2018

³⁷ "[Children drawing more women in science](#)" Mary Halton, BBC News, 2018

³⁸ "[Measuring the cultural value of Australia's Screen sector](#)" Screen Australia, 2016

³⁹ "[Indigenous Strategy 2017-2020](#)" Universities Australia, 2017

A major barrier to the participation of Aboriginal and Torres Strait Islanders is the racial and cultural divide that exists in universities⁴⁰. To overcome feelings of division and isolation, there needs to be investment in developing networks of Indigenous STEM professionals. Through development of professional networks Aboriginal and Torres Strait Islanders can create more appropriate mentor relationships, have a better sense of place, and receive support for the unique challenges that they face.

The development of a professional Indigenous STEM network is already being considered however given the challenges face by setting up such a national network there will need to be investment from government so that such work can be realised.

Along with the development of a unique Aboriginal and Torres Strait Islander STEM network, the ability for STEM professional societies to undertake diversity and inclusion projects should also be explored. These professional societies are central to the STEM sector and assist in developing policy, professional guidelines and help shape the careers of STEM professionals. As readily established, grass-roots organisations, driving change through them would provide a significant opportunity to improve diversity and inclusion within the STEM sector. In order for these societies to do so however, there needs to be support and incentives provided at a Federal level.

STA Recommends: Investment in an Australian Indigenous Science Network

Investment: \$4 million over the forward estimates

STA Recommends: Support to be provided to STEM professional societies that are undertaking diversity and inclusion projects within their field

Investment: \$260, 000 per year over the forward estimates

⁴⁰ "[Why many high achieving indigenous students are shunning university](#)" Professor Jenny Gore, The Conversation, 2017
Science & Technology Australia