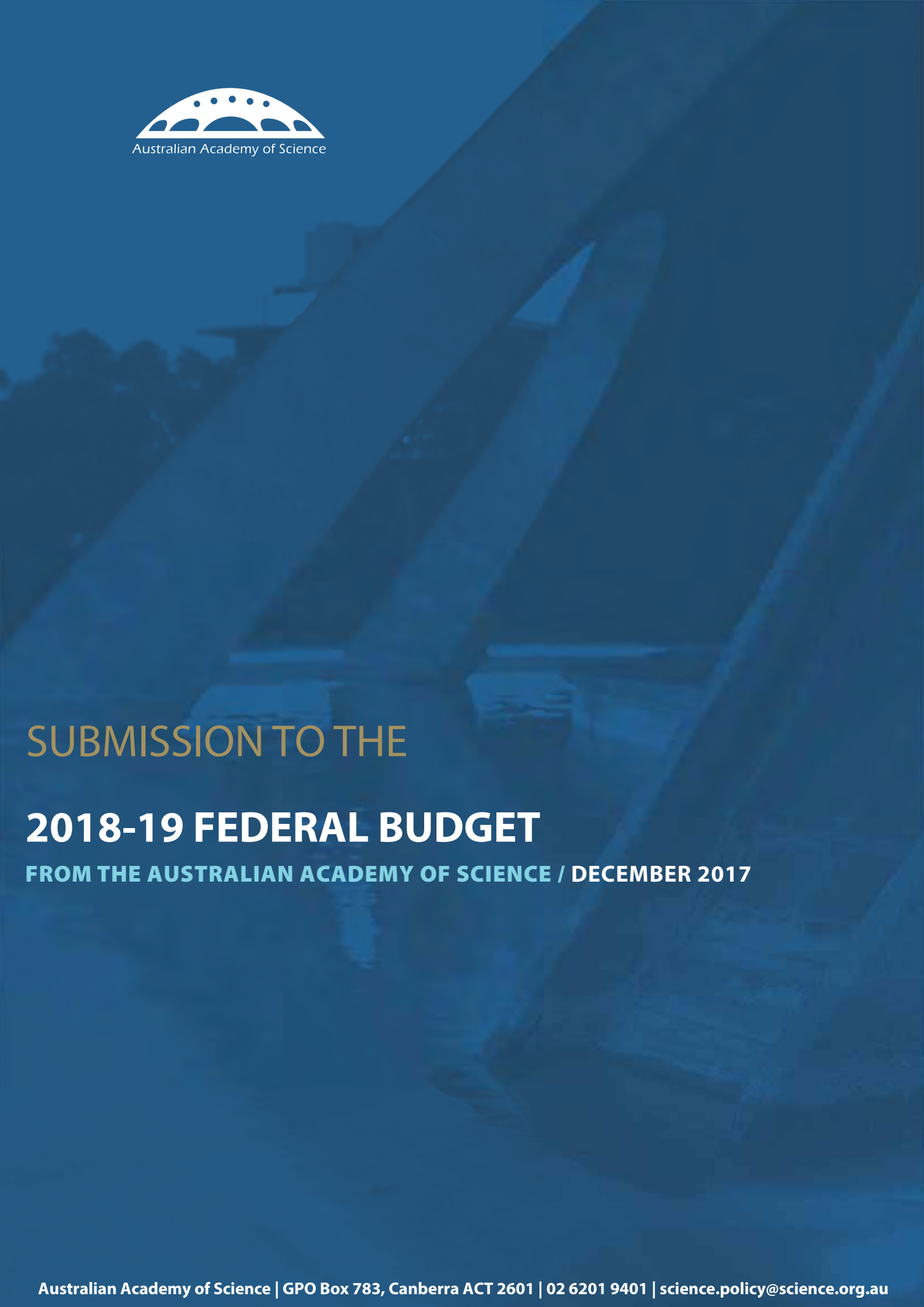

Australian Academy of Science

SUBMISSION TO THE

2018-19 FEDERAL BUDGET

FROM THE AUSTRALIAN ACADEMY OF SCIENCE / DECEMBER 2017

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Australian Academy of Science

Pre-Budget Submission to the 2018-19 Federal Budget

Executive Summary

The Australian Academy of Science comprises more than 550 of the nation's most distinguished scientific practitioners. It has active groups of Fellows throughout Australia. It is extensively networked and is well balanced within and between the disciplines of science.

When the Academy looks forward, it is clear that the world in which Australians will strive to reach their ideals will be different from anything experienced by past generations.

It is obvious that science and the capacity to make judgements and policies informed by scientific evidence is paramount. This is a view shared by many. Indeed, other comparable countries have already developed long-term strategic plans that build on national capacity in science, technology, engineering and mathematics (STEM) to deliver high-value industries and jobs for the future.

Their plans are accompanied by resources to ensure that the personnel, the infrastructure, and the partnerships are in place to drive innovation and build prosperity. They include concerted approaches to extend capacity and basic understanding of science across the population, and to overcome barriers to participation in STEM resulting from outdated practices and cultures.

To compete internationally and ensure continued prosperity, health and wellbeing, Australia must plan for and invest in STEM on par with the best in the world.

Without stable support for research infrastructure and for basic and applied science, Australia risks losing knowledge and expertise and damaging the training pipeline of high-skilled STEM professionals. Lack of stable support for science also risks creating an 'innovation gap', where the pipeline of people and ideas falls short of the skills, the capability, and the collaboration needed to feed the development of new products and services for domestic and international markets.

A well-planned and well-resourced STEM education and research capability is necessary to drive innovation and growth into the future.

The Economic Importance of Science

The economic contribution of science to the Australian economy and population is much greater than many people, including many policy-makers, realise. Two studies, commissioned jointly by the Academy and the Office of the Chief Scientist (OCS), highlight the nature and the magnitude of this economic and social contribution.

The first of the studies looked at the importance of advanced[1] physical and mathematical sciences to the Australian economy[2]; and, the second looked at the importance of advanced biological sciences to the Australian economy[3].

These reports found that in the 2012-13 financial year:

- 11 per cent of Australian **economic activity** relies directly on advanced physical and mathematical sciences, with another 3.6 per cent relying directly on advanced biological sciences. The contribution of:
    - Physical sciences rises to 22 per cent of economic activity when both direct and flow-on effects are taken into account – or more than $290 Billion annually
    - Biological sciences rises to 5 per cent of economic activity when both direct and flow-on effects are taken into account – or some $65 billion annually[4]
- 7 per cent of total Australian **employment** (or some 760,000 jobs) is directly related to advanced physical and mathematical sciences – many of these in the minerals, manufacturing and financial sectors – with another 4 per cent (or some 464,000 jobs) directly related to advanced biological sciences – many in health and related sectors[5]
- 23 per cent of Australia's **exports** of goods and services (worth around $74 billion annually) are associated with advanced physical and mathematical sciences, with another 4 per cent (or some $10 billion) associated with advanced biological sciences[6].
- Taken as a whole, advanced physical, mathematical and biological sciences make a **total contribution** of $357 billion annually to the Australian economy[7].

Advanced physical and mathematical sciences also make substantial contributions to the performance of key industries within the Australian economy. For example, they account for 40 per cent of the Gross Value-Added (GVA) of the Wired Telecommunications Network Operation, the General Insurance and the Gold Ore Mining industries, 50 per cent of the GVA for the Oil and Gas Extraction industry, and 60 per cent of the Other Telecommunications Networks Operation industry.

Advanced biological sciences make a substantial contribution to Australia's (medical) health and its (economic) welfare. Without recent advances in biological sciences (such as medical vaccines, diagnostics etc), the burden of disease in Australia could be as much as 34 per cent greater than it is now because of such progress, and our national economy would be 5 per cent smaller.

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[1] Defined as science undertaken and applied in the last 20 years

[2] Australian Academy of Science (2015) *"The Importance of Advanced Physical and Mathematical Sciences to the Australian Economy",* Australian Academy of Science, Canberra

[3] Australian Academy of Science (2016) *"The Importance of Advanced Biological Sciences to the Australian Economy"*, Australian Academy of Science, Canberra

[4] Assuming no changes in the percentage shares, the money values increase for the APMS to $313 Billion, and for the ABS to $70 billion, in the 2015-16 financial year (the last year for which estimates of GVA are currently available);

[5] Assuming no changes in the percentage shares, the total employment attributable to APMS rises to 837,000 persons, and that for ABS rises to 478,000 persons, in the 2015-16 financial year (to maintain temporal consistency with other estimates);

[6] The 2015-16 values of which remain largely unchanged in dollar value terms

[7] Or: APMS - $313 Billion; and, ABS - $70 Billion; in the 2015-16 financial year.

More not less science will be needed to fuel future industries and wealth generation, with 75% of the fastest growing occupations requiring STEM skills, and almost half of Australia's current jobs at risk of digital disruption over the next 20 years.[8] Without sustained and effective public investment in basic and applied research and in STEM education and skills development from primary school through to vocational and tertiary education, Australia is at serious risk of losing its standing as a leading global economy[9].

Key Priorities and Recommendations

This submission is made in the context of the Australian Government's National Innovation and Science Agenda. It **proposes a series of affordable, practical and realistic investments which would make significant contributions to broadening and deepening Australia's science capabilities, and through this, deliver superior science and innovation outcomes.**

The Academy recommends the Australian Government considers investments in the 2018-19 Australian Budget that will strengthen Australia's capabilities in science and innovation in the short, medium and long-term.

The Academy would be pleased to discuss any of these recommendations in further detail.

1. Improving STEM education in schools

a. **Invest $22 million over four years to enable the Academy to continue to provide evidence-based learning and teaching resources to STEM student and teachers in all Australian schools.** The Academy has a strong track-record developing and delivering programs to support science and mathematics teachers and students. Building on this record and its extensive partnerships, the Academy will work with Australian governments to support the implementation of the **National STEM School Education Strategy** through:

- A single consolidated STEM program that will target all schools in Australia
- Guided inquiry-based approaches across all years of schooling
- Effective digital delivery of contemporary, content-rich resources.

b. **Invest $20 million over two years in scholarships to attract 1,000 university STEM majors into the teaching profession through postgraduate teacher training**. These scholarships will ensure new STEM teachers have the requisite skills and knowledge base for effective teaching. Consideration may also be given to providing these scholarships on a bonded basis.

2. Enhancing support for research funding and infrastructure

a. **Implement the recommendations of the 2016 National Research Infrastructure Roadmap**, as outlined by Australia's Chief Scientist, to ensure Australia's research and innovation sector has the necessary capacity over the coming decades. Particular priority should be given to **national high performance computing facilities and the Australian Animal Health Laboratory**, as recommended in the Roadmap.

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[8] PwC (2015). A smart move. PwC STEM report, April 2015 (available www.pwc.com.au/pdf/a-smart-move-pwc-stem-report-april-2015.pdf)

[9] On current trends, Australia is projected to fall out of the G20 by 2030, losing its place to countries including Thailand, Egypt and Pakistan. PwC (2015). The world in 2050: Will the shift in global economic power continue? (available: www.pwc.com/gx/en/issues/the-economy/assets/world-in-2050-february-2015.pdf)

b. **Create a capital investment fund with capacity to invest approximately $300 million per annum in priority national research infrastructure, as set out in the National Research Infrastructure Roadmap.** Such a fund should be capitalised over three to four years, and structured and governed in a similar way to the Medical Research Future Fund. Consideration should be given to ensuring independent governance of the fund (potentially through Infrastructure Australia), and to allocate to it the existing capital of the Education Investment Fund (established by the Nation-building Funds Act 2008). Importantly, it must provide the necessary funding for the personnel needed to establish and operate the infrastructure.

3. Preserving a strong, secure and globally-connected research and innovation capability

a. I**nvest $4 million over four years to expand long-standing and strategically important bilateral science partnerships with Indonesia**. Indonesia is a key economic and strategic partner for Australia, but is not included in the list of priority economies for science engagement. Scientific diplomacy is a powerful and peaceful tool that can facilitate dialogue in more challenging areas. The Academy recommends that Australia take the opportunity to strengthen diplomatic ties with Indonesia and the region by establishing new bilateral research collaborations to solve common problems. Working in partnership with the Department of Foreign Affairs and Trade, the Academy has established relationships with the Indonesian science sector and is well-positioned to build on these. Examples of the collaborations that could be supported include: developing programs between Indonesia-Australia on blue carbon; exploring the use of Hepatitis B as a model for disease elimination, and using big data and emerging technologies to help address some of Indonesia and Australia's shared challenges.

4. Supporting high-impact, high-return science and innovation priority areas

a. **Invest $10 million over four years to initiate and grow a $100 million Agricultural Translation Fund**. Australia is a world-leader in many areas of agricultural research, but performs at or below international averages in commercialising research findings into new agricultural products and services. Establishment of **a $100 million capital investment fund** modelled on the Biomedical Translation Fund would facilitate investment of matching government and private capital in promising Australian businesses to accelerate translation of more of Australia's great agricultural discoveries. $10 million would be required to establish this fund; $50 million capitalisation from the Australian Government would be matched by private investment and would not directly impact the underlying cash balance. This is a key recommendation of the Academy's Decadal Plan for Agricultural Science developed through broad consultation with research, government and industry stakeholders.

b. I**nvest $300 million over five years in new research that will de-risk mineral exploration in remote Australia; unlocking access to trillions of dollars of non-bulk minerals.** The demand for copper, zinc, cobalt, lithium, rare-earth metals and other non-bulk minerals needed for renewables and technology products is growing exponentially, yet the deep soil and rock layer covering two-thirds of Australia's continent makes exploring for new deposits cost prohibitive using conventional technologies. This investment would enable a coordinated national program of data acquisition, basic geoscience research and technology development stands to boost mineral exploration investment in Australia to the peak levels of the 1980s and 90s and unlock trillions of dollars in export value.

c. **Invest $2.3 billion in the Medical Research Future Fund (MRFF)** in 2018-19, and ensure the Fund is fully capitalised by 2020-21 as per the capitalisation plan presented in the 2016-17 Federal Budget.

5. Building a stronger STEM workforce to sustain the future

a. **Increase funding for research through the Australian Research Council and the National Health and Medical Research Council at or above inflation**. The 2017-18 Budget indicated expected annual increases in research funding through the ARC of 2% p.a. from 2017-8 to 2020-21 and 1.5% p.a. through the NHMRC over the same period. These projections are at and below Treasury's projected increases in CPI over the next three years, meaning that the Australian Government's support for vital research funding through these agencies is declining in real terms at the same time it is placing increasing emphasis on science and innovation. The declining research funding pool has led to historically low grant application success rates and the loss of the skilled workforce needed to sustain research capability for current and emerging industries. Moreover, the government's investment to educate and train these highly-skilled scientists is not being realised.

6. Strengthening rigorous, evidence-based advice to policy-makers

a. **Invest $5.7 million over four years to establish an Australian Parliamentary Science Fellowship Program**. Fellowships modelled on the long-standing Congressional Science and Technology Fellowships in the US would bring technical and scientific insight and expertise into the offices of Federal Members and Senators and enhance the policy skills of the science sector. Funding would support salary and on-costs of 10 Fellowships per annum plus $300,000 p.a. for administration of the program by the Australian Academy of Science.

b. Invest $450,000 per annum to enable the Australian Parliamentary Library to provide accessible reviews of scientific literature relevant to policy issues before the Parliament. This would facilitate evidence-informed policy making using the successful model of the Parliamentary Office for Science and Technology in the UK.