



Australian Academy of Science

PRE-BUDGET SUBMISSION TO TREASURY PRIORITIES FOR AUSTRALIAN SCIENCE

FROM THE AUSTRALIAN ACADEMY OF SCIENCE / 2014

AUSTRALIAN ACADEMY OF SCIENCE – PRE-BUDGET SUBMISSION

Australia's best hope for increasing resilience, productivity and competitiveness is through investing in science and research, and ensuring that we have a highly skilled population. But Australia is not investing nearly enough. Recent budget cuts and expiring programs are occurring at a time when other governments around the world are investing in science to ensure their long-term prosperity.

PREMISE

Achieving the Government's aspiration of delivering a budget surplus of at least 1% of GDP by 2023-24ⁱ will require difficult revenue and expenditure decisions. The only way to achieve this objective will be through innovation-led strategies that will play a significant part in productivity gains. Irrespective of the specific economic conditions facing the Government when considering the Budget, it is indisputable that Australia's future prosperity and well-being is dependent on having a population with the skills and the ability to compete internationally in many areas of scientific research and tertiary education, and to use the benefits to contribute to wealth creation.

Our nation faces a raft of challenges, each of which is a threat to the long-term sustainability of the budget position and which collectively threaten our quality of life. Failing to plan and adequately respond to challenges such as these is the single biggest long-term risk facing Australiaⁱⁱ. Our best hope for creating a strong and competitive economy, addressing the significant environmental challenges that lie on the horizon, and improving our quality of life is through investing in science, innovation and education.

Strategic support for Australian science and science education is essential to sustainably grow Australia's economy over the long term, and to deliver the budget surpluses envisioned by the Government.

PART ONE – A SECTOR HAMPERED BY SEVERE CUTS

Australia's relatively low (and falling) level of investment in research and development (R&D) continues to threaten the long-term sustainability of the budget. Our future prosperity and ability to meet the challenges that lie ahead in this century depend on the creation and use of knowledge acquired through research. Australia languishes in 13th place in the OECD in terms of percentage of GDP invested in R&D, and is significantly below the OECD averageⁱⁱⁱ. Our competitors have had far more difficult financial and economic problems to contend with over the past six years, but continue to see investment in science as fundamental to economic growth, prosperity and well-being. In January 2013, President Obama stated in his State of the Union Address that 'Now is the time to reach a level of research and development not seen since the height of the Space Race'. The UK Government once again moved to protect the science budget this year in the context of cuts being made elsewhere. In our region Japan is investing 3.3% of its GDP in R&D, whilst Korea invests a world-leading 4.4%^{iv}. Singapore is set to triple R&D spending between 2010 and 2015^v. Further afield Finland is now investing nearly 4% of its GDP in research^{vi}. However, the most recent figures show

that Australia is investing just 2.2% of GDP in R&D^{vii}, and the Chief Scientist has predicted that this will probably fall below 2% by the end of 2013^{viii}.

Instead of making efforts to arrest Australia's declining share of investment in R&D, over the past two years, the Australian Government's support for science, research and innovation through the budget and other appropriations has decreased by approximately \$470 million^{ix}, a decrease of 5.2%. In addition, the former government made further substantial cuts to higher education funding, including to university research funding. These cuts amounted to between \$3.2 and \$3.8 billion, (depending on the measures used to calculate them). The negative impact is already affecting our universities and any further cuts to the sector will irreparably harm Australia's capacity to produce the science and research that it needs to drive sustainable and responsible economic growth, whilst positioning Australia to address future challenges.

Whilst the Coalition has made a welcome commitment to protect NHMRC funding, the full benefits of this will not be realised if other areas of science are not also strongly supported. Breakthroughs in health and medical research are dependent on advances in fundamental and basic science across the wide spectrum of scientific disciplines. The recent decision by the Government to reduce future ARC Discovery and Linkage program funding by \$103 million, and redirect this funding to dementia, juvenile diabetes, and tropical disease research will inevitably slow research progress in other areas of research vital to future developments in health and medical research. Cuts to one part of Australia's science enterprise have a negative multiplier effect, slowing down research and innovation to all other parts of the research system. Moreover, they are disproportionately felt by early career researchers who will look overseas for new opportunities, thereby further damaging Australia's long-term scientific capability.

Turning the funding tap on and off again is a very inefficient way to fund science, and means that the full value of past investments are not realised. Stop-start funding gets in the way of the long-term approaches that are needed in science to deal with major challenges such as climate change; food and water security; preserving our unique environment; ensuring that our population growth is commensurate with our sustainable resources; addressing obesity-associated chronic health problems; preparing for an ageing population; tackling projected skills shortages; and transitioning from traditional manufacturing to new innovative industries that use our significant intellectual capital.

The Academy calls on the Government to commit to develop a stable 10-year investment framework for science, research and innovation, at a level that keeps pace with our international competitors and nearest neighbours. This framework should be central to the Government's plans for future prosperity.

PART TWO – THE GOVERNMENT'S VISION FOR AUSTRALIAN SCIENCE

'The Coalition will provide the long-term, stable policies and vision that our nation's scientists and researchers need to excel in their work. We will cut the red tape that accompanies government research programmes, as well as providing our scientists and researchers with the certainty to plan.'^x

The Australian Government has a crucial role in setting the policy agenda to ensure the right balance of research and innovation is being undertaken, in setting the policy parameters to encourage private sector investment in science, and ensuring that the workforce has the science, technology, engineering and mathematics (STEM) skills it needs to thrive in a competitive global economy. The Prime Minister has recently made a compelling case for strong investment in science and has a clear expectation that Australian science should have a global impact, stating that *'It will be the research of our scientists today that will change the lives of millions people around the world tomorrow'*^{xi}.

This is a critical time for science in Australia. Investment in science has been falling, with the previous government making substantial cuts to science and research in their last year in office, and there are gaping science policy gaps in areas such as international science and research infrastructure funding. Past inadequate investment in STEM education is now having an adverse effect, so much so that the Chief Executive of the Australian Industry Group recently stated that this issue was holding back the national economy^{xii}. The Australian economy is going through a period of transformation, seeing a decline in traditional manufacturing industries^{xiii}, but opportunities for hi-tech manufacturing and services are emerging. In this context, allowing science in Australia to diminish should not be seen as an option. The Government must clearly articulate its vision for science in Australia, set out its aspirations and targets, and harness the full power of the investment it makes.

Whilst the quantum of the Australian Government's investment in science, research and innovation needs to steadily and purposefully grow, it is essential that optimal value-for-money be delivered from its current investment. Both the *National Research Investment Plan*^{xiv} and the Chief Scientist's STEM Strategy^{xv} provide constructive ways in which Australia can harness its investment in science efficiently. The Academy, and other influential bodies such as the Business Council of Australia (2013)^{xvi}, have recommended that this STEM Strategy be adopted. These plans can help deliver the Government's vision for Australian science, ensuring maximum value is gained from Australia's science investment.

The Academy urges the Government to

- **back a stable 10-year investment framework with a clear vision for science in Australia**
- **use the federal Budget to show leadership, set high expectations, and signal that Australian science is open for business**
- **make Australia the best place in the world to conduct world class research and innovation.**

PART THREE – HIGH PRIORITY AREAS REQUIRING EMERGENCY ACTION

The lack of clear vision from the previous Government about its expectations for science, and the uncoordinated way in which it was funded (and subsequently de-funded) has resulted in a number of high priority areas being neglected. This has seriously hampered Australia's research effort, and has undermined the scientific infrastructure necessary for world-class research. Australia no longer has a plan for how it will fund and operate large research infrastructure, it has no international science strategy, and with the potential lapsing of the Future Fellowship scheme, it will have no research fellowships to retain our best mid-career researchers.

The Academy calls on the Government to urgently address these three areas, and ensure that they form part of the Government’s long-term vision for science in Australia.

INTERNATIONAL SCIENCE STRATEGY

One of the previous Coalition Government’s most successful science policies was to put in place a productive 10-year International Scientific Linkages program that provided strategic support to the international collaborations that invigorate our national research effort, and allow Australia to collaborate and compete on the international stage. Regrettably this successful program was allowed to lapse in 2011 under the previous government, and since that time international scientific collaboration has been largely confined to two country-specific (China and India) funds. This has left Australia at a strategic disadvantage, unable to effectively lever its research activities with the 96% of the best internationally recognised research that occurs overseas. In contrast, our competitors see international science collaboration as an essential part of their research effort. For example, the European Union is investing nearly €80 billion over seven years (2014-2020) in the Horizon 2020 program. This program is international in scope and assists researchers to overcome national barriers that stand in the way of science and innovation^{xvii}

International scientific collaboration is a competitive undertaking. The high quality of Australian science gives us a competitive advantage because international scientists, particularly those in the emerging science super-powers in Asia, want to collaborate with us. Unfortunately, as Australia is unable to fund partnerships, other nations are able to take advantage and seize the strategic opportunities that come with collaborating with those nations investing heavily in science in our region. Without strategic international engagement Australia will be less competitive on the international stage in 10 years’ time, given global research investment trajectories and increasing international competition for collaboration.

The Academy calls on the Government to deliver on its election promise to deliver the urgently needed long-term plan for international science collaboration. This should include an integrated international science program with an investment of \$25 million per year for 10 years, as outlined in the Academy’s paper on international science collaboration^{xviii}.

RESEARCH INFRASTRUCTURE

A strategic approach to science in Australia must include paying careful attention to how major national research infrastructure and major research facilities are funded so that investments are carefully planned and are able to deliver outstanding research outcomes, as well as value-for-money.

Previous long-term schemes have sensibly promoted collaboration between research institutes and universities to avoid unnecessary duplication of major research infrastructure. This has ensured better value for money, whilst also allowing a greater range of research infrastructure facilities to be built and made available to researchers. Unfortunately, these funding schemes have now come to an end and major national research infrastructure facilities that have been built at a cost of hundreds of millions of dollars of public funding now sit underutilised and underfunded, and their very survival is at risk.

Indicative of this problem is the Australian Synchrotron in Melbourne, built at a cost of \$200 million. It is used for many different forms of world-class research in areas ranging from microbiology to nanomaterials, and from forensics to agriculture. The synchrotron is an excellent facility and is the largest stand-alone piece of scientific infrastructure in the southern hemisphere, and scientists from around the world come to Australia to use it. However, since it opened in 2007 it has been left underutilised, with only nine beam lines out of a potential 38 having been built. Along with Australia's other major national research infrastructure, it is impossible to get maximum value and return on investment from such infrastructure when there are no long-term funding plans in place for its ongoing operation. It is not in the public interest, and it is not cost-effective, to invest considerable sums of public funds in large research infrastructure with no ongoing plan on how it is to be sustained and operated.

At the conclusion of the previous funding scheme (NCRIS), the former government put in place stop-gap short-term measures to allow these facilities to temporarily remain open. This is an inefficient way to fund, plan and undertake research, and a long-term approach is needed.

The Academy calls upon the Government to develop a long-term sustainable plan to properly operate and maintain Australia's major research facilities, which are fundamental for the national research effort.

MID-CAREER FELLOWSHIPS

Global competition for talent makes it essential that Australia is an attractive place for the world's brightest researchers to work, and this means providing opportunities at different stages of careers. Australia has ongoing awards and fellowships for early-career researchers, and for distinguished researchers, but unfortunately there is no ongoing fellowship program for mid-career researchers. Mid-career fellowships come at a critical stage in a researcher's career, and are vital to ensuring that Australia is able to retain its most capable researchers. Without such fellowships many of very best researchers would be forced to move overseas to further their careers because of a lack of opportunities in Australia.

The need to arrest the 'brain drain' and provide opportunities for mid-career researchers in Australia was recognised by the Australian Government and in 2009 a four-year terminating ARC Future Fellowship program was put in place. Since then this program has revolutionised the way in which Australia retains the very best and brightest researchers in Australia, and also attracts back to Australia outstanding researchers who have moved overseas.

The recent evaluation of the scheme has shown that it has been a tremendous success^{xix}, and the Minister for Education recently noted:

'The ARC's Future Fellowships scheme is coveted by researchers throughout Australia as it provides the funding boost that can change the course of a career, and enable them to make a crucial contribution to solving major problems'

Minister for Education, The Hon Christopher Pyne MP, 14 November 2013

The Academy was heartened that the new Government continued with an additional 2013 Future Fellowship round, and is pleased that a government spokesperson has confirmed that the

Government has agreed to consider how funding for mid-career research fellowships will be funded in the context of developing this Budget^{xx}. At present the scheme is set to expire and this will result in a significant reduction in investigator-led research and an increased brain drain as Australia becomes a far less desirable place to undertake research. There are no other programs that support mid-career research Fellowships across the full range of disciplines.

The Academy recommends that the Government ensures that Australia is an attractive place in which to undertake a career in research by committing to ongoing funding for a new continuing ARC mid-career fellowship scheme. This scheme should be of a similar size and scope to the previous Future Fellowship program.

PART FOUR - SCHOOL SCIENCE EDUCATION

The Academy welcomes the commitment and support of the Government for the Academy's two prize-winning school science education programs *Primary Connections*, and *Science by Doing*. These programs should be recognised as worthwhile long-term investments, delivering real benefits long into the future. They are reinvigorating interest and competence in science among schoolchildren, and are playing a vital part in arresting and reversing the decline in engagement and skill that is holding Australia back. This investment will boost university science enrolments, and ultimately provide a deeper pool of talent to drive forward this country's innovation.

The major uptake of these programs across the country is already demonstrably increasing interest and competence in science among schoolchildren. We look forward to working with the Government to ensure that maximum value can be gained from this investment by developing a long-term and sustainable plan for their ongoing development and application. This will ensure that these programs will be taken up by schools right across the country, delivering lifelong benefits for the schoolchildren and for Australia.

ENDNOTES

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- ^{iv} OECD (2014) *Main Science and Technology Indicators*. Available at: http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
- ^v Royal Society *et al* (2013) *Fuelling prosperity*. A joint statement from the Academy of Medical Sciences, the British Academy, the Royal Academy of Engineering and the Royal Society. Available at: <http://www.britac.ac.uk/templates/asset-relay.cfm?frmAssetFileID=12529>
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- ^{xv} Office of the Chief Scientist (2013) *Science, Technology, Engineering and the Mathematics in the National Interest: A Strategic Approach*. Available at: <http://www.chiefscientist.gov.au/2013/07/science-technology-engineering-and-mathematics-in-the-national-interest-a-strategic-approach/>
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- ^{xvii} European Commission (2013) *What is Horizon 2020?*. Available at: <http://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>
- ^{xviii} See Australian Academy of Science (2011) *Australian science in a changing world: innovation requires global engagement*. Available at: <http://science.org.au/reports/documents/Innovationrequiresglobalengagement.pdf>
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