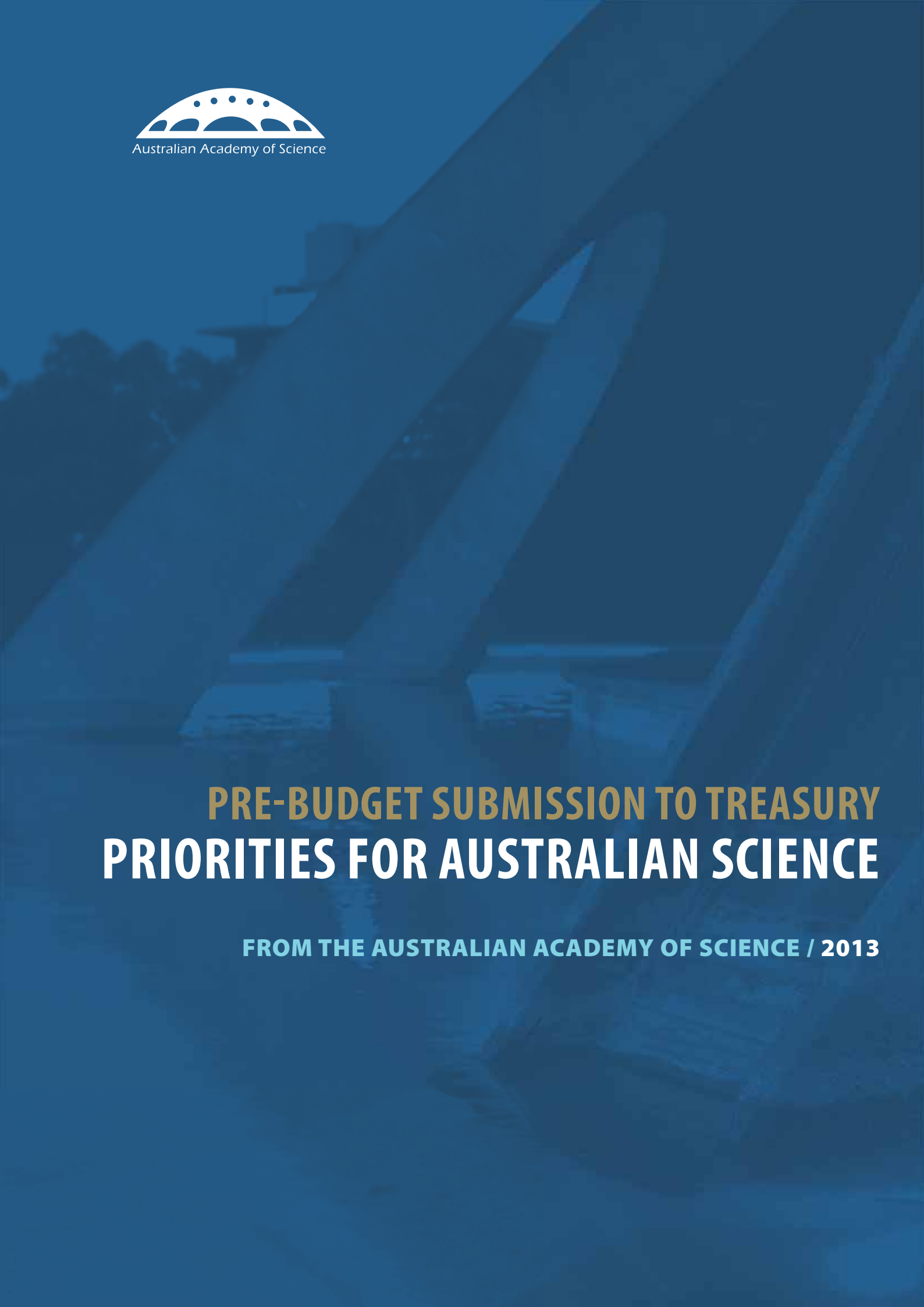

Australian Academy of Science

PRE-BUDGET SUBMISSION TO TREASURY
PRIORITIES FOR AUSTRALIAN SCIENCE

FROM THE AUSTRALIAN ACADEMY OF SCIENCE / 2013

Summary

Whatever the specific economic situation facing the Government when considering the Budget, it is indisputable that Australia must have a scientifically literate population with high skills and the ability to compete internationally in many areas of scientific research and tertiary education. While the Australian Academy of Science is addressing priorities for consideration as part of the 2013 Budget process, we see the issue of support for Australian science and science education as far wider and more crucial; we believe strategic support for science is central to our nation's future, and our proposals should be seen in that context.

The Academy has identified seven priorities to inform the preparation of the 2013–14 Federal Budget, to which a commitment is required. These are:

1. Long-term strategic investment in Australian science
2. Enhanced development and utilisation of our talented research workforce
3. Further investment in science and maths teaching
4. Augmentation of international science linkages
5. Ongoing investment in major research infrastructure
6. Provision of true research costs
7. Improvement of research productivity by reduction of the administrative burden

We must build on our current investment in education and research to take forward new ideas and develop them so that we remain a competitive and productive nation.

Premise

Irrespective of the specific economic conditions and forecasts under consideration by Treasury and the Government when considering any Federal Budget, it is essential Australia continues to be in a position where it can develop and use its science, talents, knowledge and skills to secure a better Australia for all. While we are fortunate to possess substantial mineral resources in high demand, in the long term it will be our economic innovation and productivity that will allow us to maintain a high standard of living. We must build on our current investment in education and research to take forward new ideas and develop them so that we remain a competitive and productive nation.

1

Long-term strategic investment in Australian science

The slowdown in Australia's productivity growth in the past decade has been greater than the average slowdown in OECD countries [1]. Productivity is underpinned by technology adoption, innovation and education performance, which require significant and sustained long-term investment. We believe that the following proposals and the broader strategies that underpin them should be central to consideration of all policy and spending proposals in the next financial year and beyond.

At present, Australia spends 2.2% of its gross domestic product (GDP) [2] — or around $900 per person per year [3] — on research and development (R&D), putting us 13th among OECD member countries, behind Israel, Finland, Korea, Sweden, Japan, and significantly below the OECD average [4]. This relatively low level of investment is concerning, when our key competitors are investing relatively more from a relatively worse financial position.

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The government has stated that undertaking high quality R&D to drive innovation is essential to increase productivity and competitiveness [5]. Current levels of research and development need to rise across the economy and throughout all sectors, so that industry and government are able to innovate to increase productivity.

This proposal is not about a short-term or one-off initiative; indeed, short-term one-off initiatives can be counterproductive unless each is seen as part of a strategic approach. This proposal calls for a generational commitment in terms of investment. The target for investment in R&D needs to rise at least to the levels of comparable countries and one that places Australia towards the top of the OECD table, just behind Sweden and Japan and on a par with the United States and Germany.

While some of the necessary increase needs to come from the Australian Government in the form of sustained, dependable investment in our universities, research grants and science organisations, imaginative but determined efforts need to be made to improve the levels of R&D commitment from business and organisations in Australia.

We propose that Australian research and development expenditure should rise from 2.2% of GDP to 3%, at a rate of 0.2 percentage points per year, half of which should come from the Commonwealth via funding agencies and government research institutions, with the remainder to come from industry, philanthropic and international sources brought about through policies that reward investment, promote collaboration and remove development impediments.

2

Enhanced development and utilisation of our talented research workforce

We must strive to ensure that we attract and retain skilled scientists and mathematicians in our workforce. The problem must be seen in an international context; in many research fields Australia is but one of several major players, and scientists are willing to move to any country that offers the best research opportunities.

Career pathways for PhD graduates

Over the past ten years the number of PhD students registered for research in Australia has increased by almost 70 per cent. A total of 6700 PhDs are awarded annually by Australian universities [6], of which 4800 go to domestic students. Doctoral students are the engine room of scientific advance, and we need to increase the number of science graduates carrying out doctoral research and contributing to its translation into social and economic benefits for Australia.

The Academy, through its Early and Mid-Career Researcher Forum, which includes over 3000 active researchers working in science, has found that there is a high level of dissatisfaction among researchers over the absence of viable career paths for PhD graduates. Recent research carried out for the Secretariat of the Australian Council of Learned Academies has come to similar conclusions [7]. Over half of the respondents surveyed stated that the worst aspect about a career in research was the uncertain job and career prospects that faced them. This problem is particularly acute for women researchers, who often face the challenge of trying to establish a career while also starting a family. It is important that steps are taken to ensure that this vital pool of talent, comprising half the PhDs awarded in Australia, is not lost from the workforce.

Further efforts are needed to develop long-term sustainable research positions that allow our best researchers to remain at the forefront of cutting-edge scientific discovery (see further below). However, given that approximately 80% of PhD graduates do not end up as academic researchers, it would be highly beneficial for the Government to actively support steps to ensure that every PhD student is exposed to other potential career paths and can develop skills that are needed by employers outside of academia.

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Ongoing research career development

In Australia, ongoing salaries for many researchers depend on their continuous success in round after round of competition for 3–5 year fellowships and grants from either the ARC or NHMRC. The Academy is aware that each of these schemes is under intense pressure and that many talented individuals consequently miss out and eventually change professions.

For example, we note that this is the last year for the Future Fellowship scheme, which has been a great success and has funded many outstanding early to mid-career researchers. Currently no replacement scheme has been proposed; nor is there a satisfactory senior fellowship scheme to allow the most successful Future Fellows to continue to progress their careers in Australia.

To ensure that we continue to attract and retain the brightest and best science, maths and engineering graduates in research, both domestically and internationally, the Academy recommends that Australia undertake a review of its research career fellowship schemes, with a view to expanding the number of fellowships and ensuring that the balance of opportunities at each stage (early, mid-career and established) is appropriate.

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We propose that

- support and training be provided during PhD and postdoctoral training to broaden career options for graduates
- a review is undertaken of ARC and NHMRC 'career fellowship schemes' with a view to expanding the number of fellowships and rebalancing the number of fellowships at different career stages (early, mid-career, established)
- the successful ARC Future Fellowship scheme is continued for a further five years.

3

Further investment in science and maths teaching

Australia ranks in the bottom half of OECD countries (20th out of 30) when it comes to the per capita number of university graduates emerging with a science or engineering degree [8]. Continued action is needed to raise student participation rates in science and engineering disciplines at the university level.

School education in science and mathematics is of exceptional importance for Australia's future, for two reasons. The obvious one is that we need a highly trained scientific and technical component in our workforce and therefore we must start with the identification and training of those who are talented in mathematics, science and engineering. Just as importantly, we need a scientifically literate community because many of the complex challenges facing Australia over the coming decades will require the community as a whole to be able to assess scientific argument and technical data. This is true for issues such as climate change, environmental and biodiversity protection, the implications of new technologies and ageing for the health system, the ethics and practicalities of genetic modification of crops and animals, and new approaches to defence.

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In the 2012–13 Federal Budget the government recognised the importance of science and mathematics literacy via a range of instruments that included the Academy's primary and secondary school science education programs, and programs to improve training and support for science and maths teachers. As the 2012 Chief Scientist's report the *Health of Australian Science* makes clear, teachers hold a unique and central position in influencing students' interest in and attitudes towards science [9]. By continuing and broadening such investments, Australia would help to arrest the long-term decline in the proportion of high school students studying science courses such as physics, chemistry and advanced mathematics [10].

We propose that

- a major boost is made to teacher training and higher teaching degree training specifically for maths, science and technology teaching, in both primary and secondary schools. The boost should be tied to outcomes in maths, science and technology teaching and should include professional development for practicing teachers in need of further training.
- enhanced career pathways be established to promote the recruitment of science PhD graduates into teaching. This would provide an alternative path for PhD scientists who wish to move out of research careers. It would also ensure that schools have science teachers who are not only passionate about science but are able to draw on their research skills and expertise to engage students in 'learning by doing' — an approach which has already been shown to increase student performance [11].

4

Augmentation of international science linkages: a strategic investment to meet the challenges of the 'Asian Century'

The 2012 Australia in the Asian Century White Paper recognises that international scientific collaborations are crucial to Australia's future prosperity and relevance internationally. The paper states that partnerships with international science communities, particularly in Asia, are crucial to supporting Australia's ability to access and share new ideas and build future competitiveness, and that partnerships must be strengthened if we are going to be able to benefit from Asia's growth as a global science and innovation hub [12].

The White Paper stresses the importance of investing in international science collaboration, a position that is entirely consistent with that taken by the Academy in its 2011 paper, *Australian science in a changing world: innovation requires global engagement* [13]. In this paper, the Academy sets out a series of recommendations that the Government needs to consider if Australia is to avoid missing out on the benefits of research collaboration, both in Asia and more widely. As the White Paper acknowledges, we cannot take our collaboration opportunities for granted; we need continued investment and stewardship to maintain and build upon our present links.

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Establishing and maintaining collaborations with international partners is a competitive undertaking and we are in danger of being left out of future scientific collaborations. Since the termination of the International Science Linkages program in 2011, there has been no formal funding mechanism or comprehensive strategy to identify and realise opportunities for international science collaboration. With the exception of India, and to some extent China, Australian scientists have been unable to participate in the science collaboration efforts that the White Paper sees as crucial in terms of our regional credibility and gaining access to new ideas to help build our future competitiveness [14].

We propose that

- improving Australia's competitiveness, awareness, governance and diplomacy for engagement in international research should be a priority for this and future Budgets
- an integrated international science program with an investment of $250 million over ten years is established as outlined in the Academy's paper on international science collaboration [15].

5

Ongoing investment in major research infrastructure

Research infrastructure is a foundation investment — without the requisite equipment and skilled technical expertise required to operate it, research in many critical disciplines simply cannot move forward. Nor can we provide the education and training environment for the workforce needed to underpin Australian research, Australian innovation and Australian industry.

Australian research infrastructure ranges from landmark facilities (like the Synchrotron; the nuclear reactor at ANSTO; telescopes, including the SKA; and ocean-going research vessels) to integrated clusters of smaller equipment and instruments. The Australian Government, through the National Collaborative Research Infrastructure Scheme (NCRIS) and before that the Major National Research Facilities (MNRF) scheme, invested more than $1 billion in research infrastructure, and this was matched by a comparable co-investment from State Governments and from institutions. These strategic investments have avoided duplication and increased collaboration across Australia.

The lifecycles of these major national facilities should typically extend over 10–30 years. However, all infrastructure requires ongoing investment to maintain and update capabilities but NCRIS has now come to an end.

This absence of continuing funding is creating uncertainties that are already leading researchers and highly skilled technicians to move on to other opportunities, often in other countries. While CRIS funding provided maintenance level funding until the end of 2014 (by redirecting Sustainable Research Excellence (SRE) funding away from universities), a replacement program is needed to get the best possible research outcomes from existing infrastructure and build on the investment we have made over recent years.

We propose that the Government develop a long-term strategy for planning and supporting major research infrastructure. The strategy must recognise that major research infrastructure is a long-term investment and that we must invest properly at an appropriate level (at a scale of $200M per year). There must be good planning, good governance and a strategy for sustaining these facilities, in order to extract the best value through the whole lifecycle of each facility.

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6

Provision of true research costs

When research programs are undertaken, they should be properly assessed and budgeted and the programs should be fully supported to the extent required to achieve the project outcomes. While there has been a steady increase in direct funding for research through both the NHMRC and the ARC over the last 10 years, these grants do not cover the full cost of research. It takes at least 60 cents for each research grant dollar to cover the indirect or hidden costs such as providing serviced lab space, IT and computing equipment and support, library facilities, insurance, and administrative support [16].

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The Government recognised the real cost of undertaking research in universities through the SRE scheme which was designed to help to cover some of the indirect costs associated with research. The decision in the 2012–13 Mid-year Economic and Fiscal Outlook to reduce spending through the SRE scheme by $499 million over the four year forward estimate period is now causing real damage to the sector, and research programs have had to be significantly scaled back. Unexpected and immediate short-term funding cuts damage the sector's confidence about its future financial position. Existing forward commitments need to be met so that the sector is able plan for the longer-term.

We propose that

- the decision to reduce spending through the SRE is reversed
- adequate funding of indirect research costs should be extended to all public sector research grants, whether to universities, CSIRO, or medical research institutes.

7

Improvement of research productivity by reducing administrative burden

Recent estimates have calculated that the average researcher spends up to 35% of his/her working time on bureaucratic and administrative tasks, which include preparing grant applications and complying with reporting requirements. It is universally held that the level of bureaucracy has increased markedly over the past ten years due to a proliferation of new regulations and poorly designed grant application formats, together with processes to meet recommendations issued by the Australian National Audit Office and other federal and state agencies.

This increase in bureaucracy is of questionable value, does not appear to the Academy to provide increased financial probity or benefits to the community, and the opportunity costs to research leads to a significant net cost to the nation.

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We propose that

- a commitment is made to cut regulatory burden significantly and reinvest the funds in research. A target administrative load for researchers and technologists, of the order of 10% of total time, should be considered (noting that teaching components for many researchers are expected to occupy between 20% and 50% of a researcher's time).
- the roles of regulatory agencies could also be streamlined. A review of state and federal regulatory agency burden upon researchers would be valuable to assess overlap, duplication, confusion, obsolescence, and the emerging technology regulatory requirements.

Conclusion

In a Federal Budget of some $375 billion dollars, in a country universally envied for its escape from the international financial crises of the past decade, an expenditure of less than $9 billion on R&D [17] does not come close to meeting the long-term needs of Australia. We believe that funding should enable policy, not the other way round. The Australian Academy of Science urges the Government to take strategic decisions in this Budget that will create an environment of research growth over the coming two to three decades, providing input into new science-based industries, strengthening our universities, and fostering close links with growing powers in our region. The Academy proposes these priorities in the context of the implementation of reforms within the Australian research sector that will guarantee rapid and positive responses to new challenges, and we will support Government moves to encourage these reforms. The fundamental key to a strong Australian economy over the coming century must be a consistent and committed strategic investment in the people and facilities that comprise our research strength and our international contribution to science.

Endnotes

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