



Submission to the Australian Research Committee (ARCom)

National Research Investment Plan Discussion Paper (July 2012)

The Australian Academy of Science welcomes the opportunity to comment on the Australian Research Committee's (ARCom) *National Research Investment Plan Discussion Paper (NRIP)*.

Research investment is provided through a number of different means and across different areas of government. The development of an NRIP can strengthen and coordinate the national research system. It can be used to inform future research funding strategies to get the best national return on research investments. Therefore, the Academy welcomes the release of this first NRIP discussion paper.

As the Chief Scientist notes in his foreword to the document, the discussion paper focusses primarily on only one key part of the plan, that being identifying the critical areas (domains) where support for research capacity is essential. Accordingly, our comments are primarily focussed on issues raised in the discussion paper. We look forward to further discussion and engagement on the development of future aspects of the NRIP.

The investment that the Australian Government makes each year to support science, research and innovation is fundamental in ensuring our readiness to address existing and future national and global challenges. Ongoing and well-planned investment is critical to our future national wellbeing. ARCom should advance a *National Research Investment Plan (NRIP)* that makes the case for ongoing government investment in research to at least the OECD investment average.

The Australian Academy of Science suggests that further discussion with the scientific community and other stakeholders is necessary prior to defining priority research areas for Australia. The nature and extent of integration between sciences needs to be examined further, as we believe that some areas of scientific and technological endeavour have already moved further than is implied in the Discussion Paper. We agree with the Paper that issues concerning workforce strategy are intimately linked to issues of national research priorities, and that developing new mechanisms for workforce planning is a matter of high priority for Australia. Finally, we urge the Office of the Chief Scientist, and the Government, to accept that the provision of adequate funding to achieve the outcomes presented in the Discussion Paper is a matter of urgency.

This is the Academy's initial response, without the benefit of being able to consult with the wider Fellowship and we would welcome the opportunity to continue an ongoing dialogue with the ARCom during its consideration of the NRIP. The Academy would also encourage ARCom to seek interaction with other key stakeholders not currently represented on the Research Sector Group such as AAMRI (Association of Australian Medical Research Institutes).

Key comments

- 1. The Academy believes that several elements of the national research fabric concept require further review and development. In particular, recognition of the role and importance of the basic scientific disciplines is critical. Their absence from the national research fabric diagram is a major weakness.*
- 2. The Academy proposes that more extensive consultation is required for the identification of enabling capability domains, given the central role they play in the approach that the ARCom is proposing.*
- 3. The Academy agrees with the discussion paper that the 'current balance of research activity is appropriate' and that there would be 'benefit from increasing the level of coordination of Australian Government investment'.*
- 4. The Academy would also suggest that disciplines at risk which are of national significance and/or are enabling disciplines should receive additional attention.*
- 5. Most importantly, the Academy recommends that ARCom develops a case for ongoing government investment in research to grow to at least the OECD average.*
- 6. The Academy suggests that workforce issues such as career pathways, particularly for women, and skills training during higher degrees, require more extensive exploration and consideration by the ARCom.*
- 7. The Academy strongly agrees with the discussion paper that 'The future process for considering landmark scale research infrastructure proposals requires further consideration.'*
- 8. The Academy would go further and emphasises the great urgency of this issue, given the impending conclusion of all existing infrastructure funding schemes.*
- 9. The Academy wholeheartedly agrees with the discussion paper that, 'Australia needs to position itself effectively to leverage greater international engagement to further Australia's strategic priorities.'*
- 10. The Academy strongly agrees with the discussion paper that the 'Australian Government has a key role in encouraging business to innovate and to form strong connections with the publicly funded research capacity in Australia.'*
- 11. Furthermore, the Academy suggests that some of the Government's support for business research investment be focussed on the early stages of science and technology development.*

Comments on: *Australia's National Research Fabric*

Recognition of the role and importance of the basic scientific disciplines within the National Research Fabric is critical. Currently, they are omitted entirely from the diagram on page 9 of the NRIP. Perhaps they need to be represented as a third dimension underpinning all the current domains. Alternatively, they could be represented as the first domain.

The discussion paper does not sufficiently appreciate the significant scientific challenge of integration across the five identified domains (earth, biology, human, technology, and information). Whilst on the diagram there are linking elements such as investment, workforce, infrastructure, collaboration, what is not illustrated is recognition that integration itself is a challenge of knowledge and science. To meet this challenge we need new and genuinely integrative science. Within some areas and disciplines this has already started to emerge, albeit with differing names, such as integrative assessment, system dynamics, systems science and sustainability science to name just a few. A commitment to developing an approach that incorporates the scientific development of integrative perspectives is essential if the National Research Fabric is to be a genuine whole. An example of this approach can be seen in the 2010 PMSEIC report on the *Challenges at Energy-Water-Carbon Intersections*¹.

The conversion of world class research capacity (a comparative Australian strength) into entrepreneurial or innovative activity (a comparative Australian weakness) itself should also be the subject of concerted and coordinated attention. Apart from social gains via improved productivity, greater application of science in our society fosters greater private investment in science. Government policy can drive this by optimising our workforce capacities, infrastructure and international collaboration. To do this, further exploration of the 'Translation' and Demand' arrows connecting the 'National and Global Challenges' is required.

While difficult to represent in one illustration, focusing on the development of capabilities (domains) without clearer reference to the science-engineering-business reality appears naive. Pursuant to this, the relationship between capability areas and productivity growth ought to include or make some policy reference to risk appetite.

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Comments on: *Enabling capability areas (domains)*

The identification of enabling capability areas (domains) within the discussion paper is fundamental to the approach that ARCom is proposing for the NRIP. The critical domains are said to be those where research capacity is essential to ensure that the Australian Government's investment in research can be appropriately directed to those areas that will contribute towards increasing national wellbeing (through increased productivity growth and through solving national and global challenges). However it is unclear what process has been used to identify these domains. Gaps

¹ http://www.chiefscientist.gov.au/wp-content/uploads/FINAL_EnergyWaterCarbon_for_WEB.pdf

certainly exist and, given the important role of the domains within a future NRIP, attention should be given to their identification through a consultation process that is wider than the current invitation-only consultation.

At present there appears to be some significant oversights within both the domain identification and with the identified capabilities. There is an absence of basic sciences (see above), in particular chemistry, physics and maths, within the capabilities; there is an absence of the consideration of much of the humanities; and it is unclear where national security fits. We would suggest that to ensure that the identified domains and the final NRIP reflect the latest research and disciplinary developments further consideration by the broader research community is warranted on the scope of each domain. In the case of the Science disciplines we suggest directly consulting with the National Committees² on the identified domains, and the respective identified capabilities. One of the strengths of consulting with the National Committees is that it will ensure that there is a high level of consultation and engagement with respective scientific communities and that advice will be provided with the benefit of relevant international context.

2. The Academy proposes that more extensive consultation is required for the identification of enabling capability domains, given the central role they play in the approach that the ARCom is proposing.

Comments on: Fundamental elements of the research system

The discussion paper asks that key structural or policy issues that need to be addressed to further strengthen the research system be identified. The Academy agrees on the need for the development of a clear, coordinated policy for investment.

Public research investment

The Academy emphasises the need for ARCom to advance a NRIP that makes the case for ongoing government investment in research to at least the OECD investment average.

The Academy notes that diversity of funding avenues is standard practice in leading research nations and that the current set of funding mechanisms (ARC, NHMRC etc.) is working well, providing researchers with diverse funding options and reviewers. Growth in funding for NHMRC and ARC should be planned and committed as far as possible in advance, and a careful balance between investigator-driven and directed funding should be maintained. Some amalgamation of smaller needs-directed philanthropic funds could be encouraged, to achieve critical mass.

Research areas where sustainability is at risk (e.g. agricultural science, maths) should be given priority attention and attract targeted funds to ensure their ongoing viability. Consideration should be given to the creation of an additional Fund (whole-of-government, i.e. cross-departmental) that can be used for major national priorities (akin to but not replacing CSIRO Flagships, CRCs).

Efforts should be undertaken to remove historical silo barriers e.g. ARC funding barriers for medical research institutes.

² <http://www.science.org.au/natcoms/>

3. *The Academy agrees with the discussion paper that the 'current balance of research activity is appropriate' and that there would be 'benefit from increasing the level of coordination of Australian Government investment'.*
4. *The Academy would also suggest that disciplines at risk which are of national significance and/or are enabling disciplines should receive additional attention.*
5. *Most importantly, the Academy recommends that ARCom develops a case for ongoing government investment in research to grow to at least the OECD average.*

Workforce

The *Research Skills for an Innovative Future*, and the *Health of Australian Science* report both highlight areas where there is a significant shortage of skilled researchers across science fields. These issues are complex and often relate to issues surrounding career development and structure. It is important our investment in people is carefully coordinated with our investment in research.

Without continued attention our strong research base faces the prospect of ongoing depreciation. The global market for the very best scientific talent is highly competitive. World class research requires world class researchers, and we need to ensure that we attract and retain the very best. A significant threat to the national research fabric will emerge if further and more considered investment in sustainable career paths is not forthcoming. Whilst there have been a number of welcome initiatives in recent years to enhance fellowship support, there are major bottlenecks that lie ahead in the short term. For example it is not clear where the current 1,000 Future Fellows will find their next five or ten years of salary support when their current Fellowship finishes.

Not addressed in the discussion paper but a significant policy issue that requires ongoing attention is ensuring the maximum participation of women within the scientific workforce. The 2009 report prepared for the Federation of Australian Scientific and Technological Societies (FASTS), *Women in Science: Maximising Productivity, Diversity and Innovation*, found that there is a high level of attrition in the post-doctoral phase of women's scientific careers, and that there is a small number of women in leadership positions in the science and technology sectors. The result of this is that we are not harnessing all of our intellectual ability, and so we are leaving Australia less competitive internationally, and have a lower return on educational investment.

Each year Australia graduates over 6,000 PhD students, the majority of which are in STEM disciplines. However there are currently more graduating PhD students than there are long-term university research careers. It is important that the best return is made on this investment in education and research, and that other industries are able to benefit from the many skills of these graduates. Both PhD graduates and also other researchers need to be equipped with transferable professional skills such as personnel and business management, commercialisation, effective communication and teaching skills. This will enable researchers to move more easily between different industries throughout their careers and will help ensure that high quality research and researchers provide benefits beyond traditional academic forums.

- 6. The Academy suggests that workforce issues such as career pathways, particularly for women, and skills training during higher degrees, require more extensive exploration and consideration by ARCom.*

Infrastructure

It will not be possible to realise the benefits of a National Research Investment Plan if a corresponding plan to deliver the necessary funding in research infrastructure continues to be absent. The conclusion of funding for NCRIS on 30 June 2011, and the exhaustion of funding from the Super Science Initiative will result in a gap in the support for research infrastructure. Certain other schemes currently addressing capacity gaps in Australia's research infrastructure such as the Australian Space Research Program (ASRP), and the Space Policy Unit (SPU) also conclude in the next 12 months. The *2011 Strategic Roadmap for Australian Research Infrastructure* highlighted the need to sustain those high performing facilities that continue to remain a national priority.

It is essential that a continuity plan for existing high performing facilities is in place if we are to realise the full value and potential from our infrastructure investments. This will require a successor scheme to NCRIS to be developed. The new scheme will need to fund both the establishment and the ongoing running costs (including expert management and technical support) of large national facilities such as the Australian Synchrotron, the Australian Genome Research Facility, the GMP cell preparation centre, as well as the ASRP and SPU.

A replacement NCRIS scheme should take into account the need for national and international collaborations, and be provided on a competitive basis. This would allow both existing high performing, but also new facilities to leverage and grow expertise. Without ongoing investment there is a danger that expertise that has been built up in nationally important areas will be lost when current schemes come to an end.

- 7. The Academy strongly agrees with the discussion paper that 'The future process for considering landmark scale research infrastructure proposals requires further consideration.'*
- 8. The Academy would go further and emphasises the great urgency of this issue, given the impending conclusion of all existing infrastructure funding schemes.*

Collaboration

The discussion paper rightly identifies the importance of international collaboration, and it is encouraging to see it described as a fundamental element of the research system. As confirmed in the Chief Scientist's (2012) report the *Health of Australian Science*, Australia performs strongly relative to the size of its population, but it is a small part of the international research effort. Transnational scientific engagement is more important this century than the last due to the increasingly collaborative nature of research and the growing interconnectedness of people and ideas. Australia's international scientific engagement efforts are in retreat; at best it is a strategy-free best-efforts approach by multiple short-term research schemes and by individuals. The most harmful impact of the 2011 termination of the International Scientific Linkages program is that

Australia's ~\$9billion p.a. research effort is currently being undertaken without the benefit of a contemporary understanding of the international context.

A new strategic international research collaboration program is necessary to maximise Australia's technology based opportunities in the 21st century by providing strategic guidance and support to properly leverage past and future investment in Australian science and our existing international relationships. In the Academy's submission to Ken Henry's, Australia in the Asian Century white paper, the Academy set out the case and a potential remedy. This paper *Australian science in a changing world: innovation requires global engagement, 2011*³, builds upon the Academy's 2010 Position Paper, *Internationalisation of Australian science, 2010*.⁴

9. The Academy wholeheartedly agrees with the discussion paper that, 'Australia needs to position itself effectively to leverage greater international engagement to further Australia's strategic priorities.'

Business research Investment

Structural or policy issues that would strengthen the research system include continued efforts to redirect research and development taxation benefits towards start-up and small enterprises. Consideration should also be given to supporting venture capital investment into early stage science and technology development, i.e. TRL levels 3 to 5.

The impact of not addressing these issues will be continued lower-than-average commercialisation rates of Australia research.

10. The Academy strongly agrees with the discussion paper that the 'Australian Government has a key role in encouraging business to innovate and to form strong connections with the publicly funded research capacity in Australia.'

11. Furthermore, the Academy suggests that some of the Government's support for business research investment be focussed on the early stages of science and technology development.

³ <http://www.science.org.au/reports/documents/Innovationrequiresglobalengagement.pdf>

⁴ <http://www.science.org.au/publications/documents/Internationalisation-of-Australian-Science.pdf>