Public Support for Science and Innovation

Australian Academy of Technology Sciences and Engineering

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Productivity Commission Draft Research Report

PUBLIC SUPPORT FOR SCIENCE AND INNOVATION

SUMMARY
The Australian Academy of Technological Sciences and Engineering (ATSE) commends the Draft Research Report for its recognition of the value of investment of public money in research and the comprehensive analysis it provides of the present position.

The Academy notes that Australia's R&D intensity is behind that of the OECD average, and that while the majority of OECD countries have established growth targets for R&D intensity, Australia has not. It considers the Draft Report as too complacent, in seeing no need for fundamental change in direction and assuming that present policies will enable Australia to sustain its recent growth performance, regardless of possible future downturns in the commodity price/demand cycle.

The Academy questions whether this 'steady state' approach, with relatively minor changes at the margin, is appropriate given the long-term nature of investment in the science and innovation system. A stronger approach is needed

Another theme of the Draft Report, relating to the basis for public funding of research causes the Academy some discomfort. The Academy considers that the driving force for allocation of public funding should be research excellence in terms of quality and impact, and the need to maximise benefits, regardless of where the research is carried out.

Accordingly, the Academy strongly recommends that it is essential that Australia develop a suite of polices which encourage:

- **An increased level of business expenditure on R&D (BERD).**
- **Higher level of collaboration between industry and universities and publicly funded research agencies (PFRA). In particular, the Co-operative Research Centres (CRCs) need to continue to be supported with some changes in the guidelines to address the problems identified.**
- **Innovation and practical outcomes in PFRAs, should the Federal Government be intent on introducing a Research Quality Framework (RQF) to allocate public research funding.**

1. INTRODUCTION

The Academy is impressed by the Draft Research Report ("Draft Report') analysis of the Australian Science and Innovation system and agrees with the conclusion that Australia is well served by the public funding support currently provided.

At present, economic growth and international trade performance are underpinned by the strength of demand and high prices for commodities. Commodities historically have exhibited cyclical demand patterns. The Academy is concerned that not enough of the proceeds of the current boom are being invested in the research, innovation and skills development required to sustain growth once the demand for commodities turns down.

The Academy shares some of the Productivity Commission's concern about the trend to shift public funding of research towards commercialisation objectives at the expense of basic strategic science and innovation. Public funding needs to support additional research, not subsidise commercially oriented work that would probably be done in any case, funded by the potential beneficiaries. It is however still appropriate to provide public support for high quality, high impact, commercial research which would not otherwise be undertaken, even though it would be better categorised as applied rather than basic.

The Academy agrees that public support for research should maximise socially valuable outcomes but this should be but one of the objectives. In particular, in targeting support to small and medium enterprises, this should not be to the exclusion of large enterprises that generally have greater capacity to provide follow on investment in commercialisation.

2. COMMENT ON THE DRAFT FINDINGS

The Draft Report makes a number of very important recommendations that ATSE generally supports, with a number of qualifications as noted below. For those Findings not specifically listed here, it can be assumed that the Academy is generally supportive.

Draft Finding 3.1 - Provision of public funding support
The Academy strongly endorses the finding that there are strong rationales for the provision of public funding support for science and innovation.

Draft Finding 4.1 – Impacts of publicly supported science and innovation
The Academy believes that not only are the economic, social and environmental impacts both positive and significant but that the level of unmet demand in various competitive granting programs indicate that these positive impacts would continue to grow should expanded public support for research be provided.

Draft Finding 5.1 – Impediments to innovation
The Academy agrees the identified impediments need to be addressed and is particularly supportive of the need to address science and mathematics teacher shortages. While greater flexibility in pay structures will obviously be necessary, this alone will not be sufficient to solve the problem.

Draft Finding 6.1 – Outcomes from university research
The Academy does not believe that it is necessary to make a trade off between commercialisation and social returns for university research outcomes. The management of research needs to emphasise maximising quality and impact regardless of whether the outputs are captured through commercialisation or disseminated and spill over as a broader social benefit.

Draft Finding 7.1 – Performance evaluation
The Academy supports evaluation of research performance and reporting but cautions that this is not a trivial exercise. By its nature publicly funded research is likely to (and certainly should) be at the earlier-stage, higher-risk end of the spectrum where outcomes are often unclear or hard to assess against a base case in which no research was performed. It would be a shame to see research funding shifted from undertaking research to financing evaluations which, in the end, are of limited use.

Draft Finding 8.1 – Quantum of public support

Introduction

The Academy is concerned that a finding that the overall quantum mix is satisfactory betrays a degree of complacency about Australia's position in a world where international competitiveness is increasingly grounded in innovation capabilities rather than the costs of inputs. The Report demonstrates the very high marginal rates of return from investment in science and innovation. It is surprising that the Productivity Commission would not at least accept that the returns from increased public funding should be compared with returns from other targets for discretionary public expenditure.

Background

From an international perspective, it is noted in Appendix C of the Draft Report that:

- Almost all OECD countries have employed targets for science and innovation policy in recent years
- The most common target level chosen is 3%, reflecting the overall European Union R&D intensity target of 3% of GDP by 2010
- The European Commission target represents a 1% public R&D spending target and a 2% BERD spending target
- Apart from Australia, the only other OECD countries that do not employ empirical R&D targets are the two largest R&D performers, the United States and Japan.

From an Australian perspective, it is also noted in Appendix C of the Report that:

- Australian R&D intensity is low by international standards (GERD[1] to GDP ratio of 1.65% for Australia, compared to an OECD Average of 2.2%)
- Australia's BERD which, at just under 1% of GDP, was 0.7% below the OECD average and less than half the EU business R&D target
- Australian government financed R&D is 0.69% of GDP compared to the OECD average of 0.66% of GDP.

It is recognised that

- Adjusting for industry structure, Australia's performance on BERD improves relative to that of the OECD, but remains below the OECD average.
- Doubts have been expressed about the feasibility of the EU achieving its 3% target[2]
- Not only does Australia's manufacturing sector contribute a smaller share of value added than most OECD countries but, more importantly, the specific manufacturing industries that Australia specialises in generally exhibit low R&D/ value added ratios (Appendix C, Report).

Given this, Australia will face further increased competition from overseas for R&D and innovation. Further, data suggest that industries experiencing the fastest-growing areas of world trade and carrying the greatest productivity and employment benefits are concentrated in the high-technology, innovative and knowledge-intensive sectors. It is noted that in the case of those organisations that are actively involved in innovation, there is a greater level of engagement with PFRAs.

The Academy regards the support of innovation as an investment in survival as a developed country. While there is a commodity boom we prosper, though at the cost of a dramatically rising deficit in our balance of trade, as we are forced to import the necessary goods from countries that do operate in the knowledge-intensive sectors. When the cycle turns, our present industry structure may find us desperately uncompetitive although, as the exchange rate for the Australian dollar is basically commodity-price driven, manufacturers might derive some benefit should the value fall relative to major trading partners. If the Australian manufacturing industry is to maintain its strength against increasing global competition (particularly from low- wage countries such as China) in the export and import-competing sector, it must develop new methods and different approaches to address the challenges it faces.[3] This presents challenges for both large companies and SMEs and policy initiatives are needed for both areas.

In Draft Finding 8.1 it is stated that "There is no evidence that the overall quantum or mix of public support for science and innovation in Australia is currently inappropriate for Australia's needs and aspirations." This implies that Australia does not need to shift its expenditure on R&D (as a percentage of GDP). Furthermore, it will mean that it is not possible to gain a competitive edge through using technology widely available to our competitors and will continue to place pressure on the current account[4]. The Academy is strongly opposed to the proposition contained in Finding 8.1 and makes the following recommendations.

General Recommendation
The Academy strongly recommends that the Final version of the report acknowledge that it is essential that Australia develop a suite of polices which encourage:

- *An increased level of business expenditure on R&D (BERD).*
- *High levels of collaboration between industry and universities and publicly funded research agencies (PFRA). In particular, the Co-operative Research Centres (CRCs) need to continue to be supported with some changes in the guidelines to address the problems identified in the Draft Report.*
- *Innovation and practical outcomes in PFRAs, should the Government proceed with the Research Quality Framework (RQF) as a basis for allocation of public research funding.*

In addition, the Academy recommends that consideration be given to setting targets for Australia's R&D intensity.

Based on these recommendations, consequential comments and recommendations are offered in relation to the following Draft Findings:

- Draft Finding 9.1, R&D Tax Concession
- Draft Finding 9.2, Commercial Grant Programs
- Draft Finding 9.4, CRC Program
- Draft Finding 9.5, A Complement to the CRC Program
- Draft Finding 11.1, RQF Program

{Specific comments on these Draft findings are given subsequently}.

Draft Finding 9.1 - R&D tax concession
Recommendations

The Academy recommends that the Productivity Commission should review this Draft Finding and give consideration to the following issues:

- It is not recommended that the 125 per cent tax concession be dispensed with. If the tax concession is removed there is a serious concern that BERD will drop precipitously. The companies that benefits most from the tax concession can take their R&D elsewhere (and some have done so already), if Australia does not provide a climate which is at least as favourable to their investment in R&D as the other countries in which they operate. The problem with the concession is that its value is now so low (7.5 cents in the dollar before compliance costs are taken into account) and it is probably the least generous of its type in the OECD. While it is true that the tax concession does not generate additionality, nevertheless public spillovers from any industry investment in R&D are strong.
- It is not recommended that the tax concession be shifted towards the 175 per cent incremental component. The problem with incremental incentives, in general, is that they do not work effectively. When business sales a soaring, it is hard for firms to increase their R&D spend as a percentage of turnover. But this is when they should be rewarded for doing so. When the economy is not going so well, they can not afford to increase R&D and take up the incremental benefit. The incremental incentive is complicated by the grouping provisions, which means that most companies do not know until after year end if they are going to be able to benefit.
- The R&D Offset needs to be reviewed so that the present upper limit on turnover is increased and the penalties for exceeding it reduced. Furthermore, it appears that many firms only discover that they are eligible for the 175 per cent component or the tax offset after the end of the financial year. This means that there is no incentive effect.
- The final Report needs to accept that there are spillovers and social benefits from any and all business R&D and that additionality should be just one consideration among others.

Draft Finding 9.2 - Commercial grant programs

The Academy shares some of the Productivity Commission's concern about the trend to shift public funding of research towards commercialisation[5] objectives at the expense of basic strategic science and innovation. Public funding needs to support additional research not subsidise commercially oriented work that would probably be done in any case, funded by the potential beneficiaries. It is appropriate, therefore, that public support for research should maximise socially valuable outcomes, including high quality, high impact, commercial research (including, pre-competitive or industry-wide commercial research), even though it would be better categorised as applied rather than basic. The Academy supports the need to target small and medium sized firms in commercial grant programs, but notes that support should also be available for large enterprises provided the applications meet the selection criteria. In particular, the Academy supports the statement in the Draft Report that this may 'require a substantial increase in overall program funding given the differences in the scale of research activity by larger firms'.

Draft Finding 9.3 - RRDCs

The Academy agrees with the finding that RRDC funding is an excellent investment of public money but is less concerned about its support for industry beneficiaries, providing industry co-funding is commensurate with their prospective benefits. Funding priorities should be guided by the size of the expected spillovers, irrespective of where and how the research is carried out.

Draft Finding 9.4 - CRC program
The Academy:

- Supports the finding that the original objective of the program should be reinstated[6, 7]. Alternatively, or perhaps preferably, consideration should be given to a dual-structure program. One strand could follow the current guidelines, emphasising incorporated structures and focused on commercialisation. The second strand would adhere to the original objectives allowing for public interest outcomes, high levels of spillovers and, if appropriate, permit unincorporated joint venture arrangements between participants.
- Disagrees that the share of public funding should be aligned to the level of social benefits.
- Would support any measures that reduce the bureaucratic and legal requirements placed on CRCs while still maintaining adequate levels of accountability for the expenditure of taxpayers' funds.

Draft Finding 9.5 - A complement to the CRC program
The Academy supports the finding that a complement to the CRC program should be developed with smaller, shorter and more flexible collaborative arrangements[8].

Draft Finding 11.1 - RQF program
The Academy maintains its position in its original submission where it expressed misgivings that the adverse consequences and costs might outweigh any benefits of introducing an RQF.

If the RQF Model were to favour Research Quality over Research Impact, this would have the effect of rewarding academics who pursue academic outcomes over engagement with industry. Accordingly, there would be fewer incentives for academic staff to be engaged with business. This would have major deleterious effects on the level of innovation in industry and in particular the education of the engineers which industry requires - namely, graduates having a realistic understanding of the practical application of the knowledge they have acquired. Less than 10% of science and engineering graduates are destined for research related careers, yet already there are indications that in some Australian universities, new faculty are being employed on the basis of their capacity to write papers for peer-reviewed journals rather than their understanding of industry requirements.

Given the extensive implementation costs associated with the RQF, and the need to expand Australia's R&D intensity, there is a need to allocate more funding on a performance basis under the RQF model. This could be done via an increase in the allocation for block funding. If additional budget allocation is not forthcoming, then part of the operating grant[9] could be distributed via the RQF process.

The Academy recommends that:

- There must be at least equal funding for Research Impact compared to Research Quality
- Additional funding should be made available for the RQF
- This additional funding could come from a further budget allocation or, if such a source is not available, by making part of the current operating grant to universities subject to distribution via the RQF.

Consequently, if the above conditions are not likely to be met, then the Draft Finding that the adoption of the RQF be delayed is supported. The Academy was surprised and disappointed that, subsequent to the release of the Report, the Government announced its intention to proceed with an RQF, particularly as it appears that its original model, the RAE in the UK, is to be virtually abandoned.

3. GENERAL POINTS - Encourage More Collaboration

Background

It has been found that only 8% of firms have cooperative arrangements for their innovation activities[10] and, of these, about one-third had these arrangements with universities. A fifth of those firms in the top quintile by innovation expenditure had collaborative arrangements for innovation with PFRAs, including universities. Clearly, as more firms become actively engaged in the innovation process, they will inherently wish to engage with the PFRAs, particularly if such agencies are prepared to actively market the services they can provide.

As noted previously, the Academy strongly supports Draft Finding 9.5. However, the Report needs to go further in making findings in regard to collaboration between industry and PFRAs. Reference has been made previously to the CRC Program and the RQF[11]. Further, and by way of illustration only, another area is noted below (Knowledge Exchange Networks). Clearly, a comprehensive range of policy settings need to be addressed.

Knowledge Exchange Networks

A frequently quoted statistic is that Australia generates some 2% of the world's knowledge, so must seek the remaining 98% overseas. Many countries, particularly in Europe, are making major investments to strengthen their access to international knowledge, through a variety of programs. The same level of investment for similar programs does not exist in Australia.

As the knowledge economy continues to grow, there are significant opportunities to establish "Knowledge Exchange Networks". The purpose of these Networks is to link, via innovation/technology borders, the knowledge base with appropriate firms (with a focus on SMEs) and PFRAs. Such networks should also undertake the roles outlined for "Intermediaries" on page 6.33 of the Report. There has been only limited support for such 'networks' programs in Australia.

Recommendation: There is a need to provide substantially increased funding to support 'outreach' programs, based on the establishment of "Knowledge Exchange Networks".

4. THE WAY FORWARD

The Academy is not comfortable with the Commission's preference for public support for research with high levels of spillovers. This preference is understandable (indeed it should guide funding priorities) but the reality is that follow-up investment is more likely when reward is high relative to risk. Government returns from investment in research subsequently taken up by private industry will frequently be higher in terms of employment, exports and taxation revenue than a plethora of firms making a lukewarm commitment to new technology which affords them no competitive advantage.

It is evident that there is a strong correlation between a thriving knowledge base, excellent (and

well-supported) innovation and a ‘booming’ economy. If Australia is to ‘ride out’ the resources boom and become a key player in the global market, we must make greater strides down the technology/ innovation path. Australia must embrace the more innovative industries instead of focusing predominantly on our basic resources. In addition, industry must be encouraged to adopt more technological innovation in order to become more productive and effective. To do this, business people need to feel comfortable with technology and the role that it has in innovation (for example, via closer collaboration with PFRAs). Further, Australia must reduce its relative dependence on commodity exports and develop exports of technological goods and services. The nation’s ability to do this depends on its capability in science, engineering and technology. The Academy believes that government has a key role in:

- increasing the encouragement provided for industry to undertake innovation
- expanding and streamlining those polices that support industry-research links, such as the Cooperative Research Centres and ARC Linkage grants
- developing new “knowledge exchange clusters” that focus on particular industry sectors and technologies and
- providing suitable incentives and reforms to stimulate knowledge-based training.

5. THE ACADEMY

The Australian Academy of Technological Sciences and Engineering (ATSE) has some 750 elected Fellows, consisting of the leading applied scientists and engineers in the country. The Academy is one of Australia's four learned Academies (the others being Science, Social Sciences and Humanities). The mission of ATSE is to promote the application of scientific and engineering knowledge to the future benefit of Australia.

This submission is based on comments received from Fellows.

APPENDIX: ATSE SURVEY ON THE CRC PROGRAM

The Cooperative Research Centre (CRC) program has been developed as a major initiative to improve the effectiveness and application of Australia's research and development effort. However, the Australian government's funding for the CRC program has no forward commitments beyond 2010-11. Given that recent reports have demonstrated that CRCs provided an excellent return on taxpayers’ money, the Academy was interested to identify those issues that may lead to an enhancement of the CRC program. The Academy recently distributed a survey to those Fellows who were identified as having an involvement with CRCs. Based on the responses to the survey, it is noted that:

- The Cooperative Research Centre (CRC) program delivers great benefit to Australia
- The current focus on commercialisation of research is supported but Australia needs an equivalent scheme to facilitate collaboration in the “public interest” area
- The CRC Committee should actively encourage applications that are aligned with priority areas of research including the National Research Priorities and the industry Action Agendas
- CRCs should not be expected to be self-funding after seven years although some measures need to be adopted to encourage them to become more self reliant
- There is merit in funding cooperative research programs that are smaller than accepted under the current CRC Guidelines. Such an initiative could be funded under a revised

CRC program, when the benefit-cost ratio is high, or alternatively by implementing a special program
- There was some concern that the perceived need for significant up-front commitments by companies acts as a deterrent to participants.
- The bureaucratic requirements in relation to applications, contractual negotiations, reporting, review and meeting agreed commitments are seen as onerous and counterproductive.

Other issues that were identified from the responses to the survey were:

- Incorporation can act as a disincentive for participation by universities and research agencies. Conversely good reasons exist for an incorporated model; namely, that it imposes on participants the need to collaborate as opposed to being representatives in a funding scheme
- It is recognised that while the reporting and legal requirements are onerous, it is not unreasonable for the Commonwealth to expect comprehensive reporting when tens of millions of dollars of taxpayers money is provided to a CRC
- A well balanced and targeted CRC research program (defined by the Board) is essential for the development of vibrant CRCs, rather than separate ad hoc research contracts
- While the host Department for the CRC attracted comment, more importantly were issues of the quality of the operational guidelines and the people administering the program, and that consideration could be given to publishing examples of structures (in sufficient detail) to give guidance to interested parties on what works and what does not work
- Given the number of positive reviews of the CRC program, comment was made on the need to have a regular schedule of future reviews
- The CRC program requirements to define all milestones in advance for 7 years are an impediment to adaptive, best-value research.

Footnotes

1. In this ATSE paper, the abbreviations adopted are the same as those defined in the Productivity Commission Draft Research Report.
2. However, there is abundant evidence that the setting of the target and the other support activities being pursued under the Lisbon agenda, are having a positive effect on national government policies in support of R&D and innovation.
3. Achieving Global Fitness, Manufacturing Futures. April 2006. Australian Industry Group
4. ATSE Submission to the House of Representatives Standing Committee on Economics, Finance and Public Administration into the State of Australia’s Manufacturing Industry Now and Beyond the Resources Boom.
5. The Academy notes that there can be wide differences in the interpretation of the term 'commercialisation'. Throughout the Draft Report it is possible that the term 'commercialistion' is used to mean different things. Accordingly, a definition of the term would be appropriate, together with consistent usage of that term.
6. Support for this finding is given in the attached Appendix, ATSE Survey on the CRC Program
7. The Draft Report finds that the original objectives should be reinstated. The genesis of

this draft finding arises from the recent CRC program evaluations that have emphasised economic benefits. This appears to a result of the report prepared by the Allen Consulting Group (on behalf of the CRC Association) which was asked to focus on the economic benefits. Social and economic benefits arising from the CRC Program are both numerous and significant; the difficulty is that the social benefits are more difficult to quantify and analyse.

8. Support for this finding is given in the attached Appendix, ATSE Survey on the CRC Program
9. It is noted that the current operating grant allocated to universities is for teaching, research and other activities. The distribution of these funds is on the basis of teaching load, with no reference to research intensity.
10. Trewin, D and Paterson, M, Patterns of Innovation in Australian Businesses 2003, Australian Bureau of Statistics, Canberra 2006.
11. ARC Linkage Grant projects, which are a very important mechanism for collaboration, attract little attention in the Draft report.