FASTS Submission

Productivity Commission Draft Research Report
Public Support for Science and Innovation

Introduction

The Federation of Australian Scientific and Technological Societies (FASTS) welcomes the Productivity Commission's draft report in to public support for science and innovation.

In FASTS view, the Draft Report makes a considerable contribution to science and innovation policy through its opening up of science and innovation policy beyond the current concentration on a narrow view of commercialisation. The report does the considerable service of providing a more realistic framework for understanding and supporting investment in science and innovation through, for instance, the identification of the role played by public science in terms of preparedness and reducing risks in an uncertain world.

FASTS are broadly supportive of many – but not all – of the draft findings. We welcome the Commissions finding that there are significant positive economic, environmental and social impacts from publicly funded science and innovation however we would like to make some comments on the Draft Report in relation to

- Business programs
- Internationalization
- Higher education, particularly in respect of block grants;
- Human resource development, and
- The adequacy of current investment levels.

Science and innovation policy – a broader context

FASTS notes that the review is taking place at a time of significant public debate and media focus on climate change, carbon emissions, energy sources including nuclear, drought, water management and concern over a range of biosecurity threats.

That is, the review has coincided with a period when science and innovation – particularly publicly funded science and innovation – are absolutely fundamental to understanding and addressing key national and global challenges.

Governments, industries, industry groups such as the Australian Business Roundtable on Climate Change, individual firms and citizens routinely make decisions based on publicly funded, publicly accessible science. Indeed, it is all but impossible to make decisions in relation to climate change, energy sources, water usage or carbon emissions without direct or indirect reference to science. Moreover, a considerable proportion of the science that informs these decisions is Australian science.

Yet, ironically, it seems the more pervasive the science, the more invisible it becomes in terms of understanding, recognizing and valuing its contribution. A key political justification of the proposed RQF, for instance, is skepticism of the impact of Australian research.

It is FASTS contention that a significant part of the problem is that the current science and innovation policy framework exhibits a narrow and unrealistic understanding of the range of impacts and uses of public science through;

1) a failure to take full account of the necessity and value of 'preparedness';
2) a failure to understanding the role of public science in helping Governments, firms and individuals minimise risks in an uncertain world;
3) a limited view of the multiple pathways for extracting economic value from public science and innovation;
4) undermining national capacity building through underinvestment in education and research; and
5) increasing imposition of inefficiencies and high transaction costs on universities and other institutions through increased use of small, targeted programs to address perceived gaps.

FASTS believes the Commission's Draft Report has addressed some of these issues in a coherent and constructive way and FASTS believe it is critical that future policy and evaluation incorporates some of these insight.

Evaluating Backing Australia's Ability (BAA)

The notion that preparedness constitutes an important and useful outcome from public science is particularly important with regard to the forthcoming evaluation of the *Backing Australia's Ability* (BAA) package. It is therefore important that the general concept is translated into specific guidelines and recommendations over how research funding is allocated and how research outcomes are assessed. In order to reduce the risk that the evaluation of BAA may overlook useful preparedness outcomes, it would be useful if the Commission's Final Report highlighted the need for DEST to define how preparedness can be articulated within current program evaluation guidelines and norms.

Internationalisation and the need for a more strategic approach to research

In FASTS view, the Commission's Report could be significantly enhanced by putting more emphasis on internationalization of science and innovation. It is often suggested that as Australia produces about 1% of the world's knowledge the real task is to access and utilize the other 99%. One problem with this implied 'fast-follower' scenario is it presupposes all knowledge is equally relevant which is absurd. Australian science will often produce 100% of the knowledge in areas of specific national relevance. Australia cannot rely on the world to do the science and research specific to our geography, climate and biodiversity, nor can we simply be a passenger.

As part of developing the Government's Energy White Paper, *Securing Australia's Energy Future* , the energy taskforce provided a strategic evaluation of energy technologies and sought to classify the sort of Australian R&D effort that was required; Market leader, fast-follower or Reserve.

Table 1: Energy Technology Assessments

Market Leader	Fast Follower	Reserve
Play a lead role in international R&D efforts	Strongly position Australia to follow international developments quickly	Position Australia to monitor international developments and follow as needed.
Energy supply technologies		
Advanced Brown Coal Geosequestration Hot dry rocks Photovoltaics Remote area power systems Coal mining and extraction	Advanced Black Coal Natural Gas Wind Biomass Wave	Hydrogen Tidal Large-scale hydro Nuclear
Energy Demand technologies		
Solid Oxide Fuel Cells	Intelligent Transport Systems Energy efficiency Advanced conventional vehicles Hybrid electric vehicles	Other fuel cells

Source: Energy Taskforce, *Securing Australia's Energy Future*, PMC, Canberra 2004, table 3, p. 32

While FASTS does not necessarily endorse the actual choices made as to which technology belongs in which categories, we do believe this is a valuable strategic exercise that should be generalized throughout other sectors as part of a 'whole-of-Government' strategic approach to National Priorities.

What is not discussed in the White Paper, however, is what does it actually mean in terms of investment, human capital, international linkages, international S&T diplomacy and so forth for Australia to be a world leader, a fast-follower of merely to monitor.

FASTS contends that to even adequately do the lowest-threshold of monitoring requires some capacity and capability.

For instance, for academics to adequately 'monitor' means something more than merely reading the journals. To do that is, in some fields, to be 3 – 4 years behind the game. Even refereeing or editing international journals means you can be 6 – 18 months behind. The only effective ways to really monitor new developments is to have informal linkages through student/post-doc placements and/or participation in reputable international conferences. Both of these presuppose the 'monitor' has research credibility and currency to bring to the table as leverage .

That does mean that there does need to be a degree of diversity and breadth in the national research effort that sits underneath investment in niche areas of specialization.

It also means that there is an imperative for increasing investment in Australia's capacity to network internationally through;

- increasing support for participation in international conferences/ exchanges,;
- formal recognition of the role played by professional societies in organizing international conferences and informal global networks;

- expanding or supplementing the CRC program, ARC Centres of Excellence and similar programs to enable formation of international CRCs and Centres of Excellence; and
- a stronger focus on geopolitical considerations including ramping up S&T diplomacy (as outlined in FASTS first submission)

However, networks are only part of it. As stated above, it is imperative that Australia has credible, excellent research to 'trade' in the international S&I arena.

Higher Education

FASTS notes that the Commission has judged that crucial science and innovation issues particularly on the teaching and learning side are outside the scope of the report.

One consequence is the Commission's comments on funding higher education research seem to lack some context that would be provided by a more holistic view of universities.

FASTS believes that the Commission has erred in disaggregating teaching and research functions in universities because the two activities are deeply enmeshed in terms of funding and organisation.

There is a clear and important connection between teaching and research, at least in 3rd year and honours programs in science and most technology disciplines.[1] Accordingly, funding regimes that further disaggregate teaching and research may have some very serious long term consequences for the quality of teaching and research in Australian universities.

It should also be noted that in the past decade or more there has been increasing demand for more diversity in teaching programs. It is to be expected therefore, that this leads to greater diversity in research.

Since 2000/1, university block grants have declined significantly as a share of total university research funding and the national competitive grants scheme increased. The problem is not simply that competitive grants have increased as a share but rather the requirement for universities to provide matching funds (generally of the order of about $1:$1) means universities now have very little discretionary funding.

In a policy sense, the problem is a lack of diversity in the funding system. While FASTS are strong supporters of the ARC and NHMRC programs they do not, and should not, cover all possible modes of research.

One advantage of block grant funding that contributes to research in universities and other non-specific funding sources (such as revenue from overseas student fees) is that is allows for managerial discretion in resource allocations. In theory, each university is free to set its own strategic directions for research and to allocate internal resources accordingly.

[1] FASTS Submission, Building *University Diversity: Future Approval and Accreditation Processes for Australian Higher Education,* http://www.fasts.org/index.php?option=com_content&task=view&id=2

This ability to define distinctive missions can be important with regard to achieving an adequate articulation of *excellence* and *relevance* in research. The growing importance of competitive funding sources both directly and indirectly through the requirement for institutions to provide matching funds means that the university-based research effort is tending to prioritise the criteria laid down in the competitive grants programs.

FASTS experience is that the increasing leverage of competitive grants in combination with the 30 year steady decline in funding per student has resulted in a somewhat myopic sector where gaming of the system becomes an increasingly powerful driver. The gaming is exacerbated by the increasing use of small, targeted funding programs designed to fill a specific 'gap'. This has lead to an increasing transaction costs for universities to access the various small funding programs.

This form of micromanagement along with the decline in discretionary funds for universities through leveraging competitive grants reinforces the myopia of the sector.

FASTS are deeply concerned that Australian universities are not sustainable under the present funding and policy settings and there needs to be an increase in both the teaching and block grants.

Block funding, Strategic Planning and HR Profiles

One role of public policy is to think about the socio-economic objectives of research and that consideration should be part of the national priorities and cognate policy efforts (eg connections between water R&D and the National Water Initiative)

It is the role of the ARC, NHMRC, universities and public sector research agencies including CSIRO, ANSTO and Geoscience Australia to ensure Australia has the disciplinary capacities to deliver socio economic objectives.

FASTS are concerned that there is a lack of strategic capacity to;

- evaluate the various disciplinary inputs into socio-economic objectives,
- ensure the 'integrative capital' exists both within public sector institutions (flagships. Centres of Excellence) and across industry, research sectors (CRCs and other 'clustering' initiatives); and
- evaluate the human resource requirements and availability to ensure that the socio-economic objectives can be met.

It is not clear to FASTS that it is well understood how many disciplinary inputs (RFCDs in the ABS Australian Standard Research Classification) there can be to socio-economic objectives (SEO categories in the ASRC).

For example, as table 2 shows, there are approximately 50 RFCD codes that input into the renewable energy SEO in the 2002 ABS data. Moreover, this is showing RFCD codes at the 4-digit not the fine-grained 6-digit level.

Table 2: Percentage of RFCD codes at 4-digit level in SEO 6602: Renewable Energy

Percentage breakdown of different types of renewable energy R&D by Research Fields, Courses and Disciplines (RFCD) codes (%) 2002 data	Socio-economic objectives classification of R&D								
	TOTAL RENEWABLE ENERGY	R&D not classified at the 6 digit level	Hydro-electric	Wind	Ocean	Solar-thermal	Solar-photoelectric	Solar-thermal electric	Renewable energy not elsewhere classified (e.g. geothermal)
	6602	660 200	660201	660202	660203	660204	660205	660206	660299
230100 mathematics	3.7		-	-	-	1.9	0	-	11.8
239900 other mathematical sciences	0.1	-	-	-	-	-	0.2	-	-
240200 theoretical and condensed matter physics	0.7	-	-	-	-	4.6	0.4	-	0
240300 atomic and molecular physics; nuclear and particle physics; plasma physics	0.7	-	-	0.2	-	4.1	0	-	0.6
240400 optical physics	9.6	-	-	-	-	12.5	16.9	57.8	-
240500 classical physics	0.2	-	-	0.1	-	0.2	0.1	-	0.8
249900 other physical sciences	7.3	6.1	-	6.3	-	5.8	0	-	0.6
250100 physical chemistry (incl. structural)	2.5	-	-	13.4	-	1.2	1.1	-	5.8
250200 inorganic chemistry	0.3	-	-	0.3	-	0.3	0	-	1
250300 organic chemistry	0.6	-	-	0.4	-	0.3	0.6	-	1.2
250400 analytical chemistry	0	-	-	0	-	0	0	-	0.1
250600 theoretical and computational chemistry	0.3	-	-	-	-	-	0.7	-	-
259900 other chemical sciences	2	-	-	2.2	-	1.8	0	-	7.3
260100 geology	0.7	-	-	-	-	0.8	0.1	-	2.3
260200 geophysics	0.3	-	-	-	-	0.4	-	-	1.2
260300 geochemistry	0.6	-	-	-	-	0.7	0.1	-	1.8
260400 oceanography	0.2	-	-	-	-	0.2	-	-	0.6
260500 hydrology	0.2	-	-	-	-	0	-	-	0.8
260600 atmospheric sciences	1	-	1.4	-	-	0.3	-	-	4
269900 other earth sciences	0.2	0.1	-	-	-	0.1	-	-	0.2
270100 biochemistry and cell biology	0.6	-	-	-	-	0.1	0.6	-	1.4
270200 genetics	0.2	-	-	-	-	0.2	-	-	0.9
270300 microbiology	2.6	-	3.2	-	-	0.1	5.8	-	0.5
270400 botany	1.1	-	-	-	-	0.1	1.2	-	2.4
270700 ecology and evolution	0.1	-	-	-	-	0.1	-	-	0.2
270800 biotechnology	2	-	-	-	-	0.2	3.5	-	2.3

279900 other biological sciences	0.1	-	-	-	-	0	-	-	0.6
280100 information systems	0.6	-	-	-	-	0	0.2	-	2.2
280200 artificial intelligence and signal and image processing	0.4	-	-	-	-	0	0.2	-	1.3
280300 computer software	2.2	-	-	0.5	-	2.5	3	9.6	1.8
280400 computation theory and mathematics	0.1	-	-	-	-	-	0.1	-	-
289900 other information, computing and communication sciences	0.7	-	-	-	-	-	-	-	3
290200 aerospace engineering	1.8	-	-	36.4	-	-	0.4	-	0.1
290300 manufacturing engineering	4.2	-	-	1.5	-	10.1	4.2	19.3	3.3
290400 automotive engineering	4	-	-	0.1	-	22.3	-	-	5.4
290500 mechanical and industrial engineering	6.4	-	12.8	29.9	-	15.8	-	-	11.9
290600 chemical engineering	0.3	-	-	-	-	0	-	-	1.3
290700 resources engineering	2	-	-	-	-	2.1	3.8	9.6	-
290800 civil engineering	0.7	-	12.9	-	-	0.5	-	-	1.2
290900 electrical and electronic engineering	18.5	0.4	-	3.9	-	-	38.4	0.5	8.9
291000 geomatic engineering	0.1	-	3.2	-	-	0	-	-	0.1
291100 environmental engineering	9.3	7	-	0.4	-	0.5	5	3.1	0.1
291300 metallurgy	1.6	-	-	1.7	-	1.4	0	-	5.9
291400 materials engineering	1.9	-	39	0.5	-	0.9	1.2	-	1.3
291500 biomedical engineering	0.2	-	-	0	-	1.4	0	-	0
291600 computer hardware	0.5	-	-	-	-	-	1.2	-	-
291700 communications technologies	0.1	-	-	0.1	-	0.1	0.1	-	0
291800 interdisciplinary engineering	1	-	6.4	1.1	-	5.1	0.1	-	0.3
299900 other engineering and technology	5.6	-	19.3	1	-	1	10.1	-	3.1
all other rfcd codes	3.7	86.3	-	-	-	1.9	0	-	11.8
TOTAL	**100**	**100**	**100**	**100**	**-**	**100**	**100**	**100**	**100**

Source: FASTS analysis derived from detailed unpublished ABS R&D data.

The policy challenge is that research *relevance* – which is captured to some extent by the socio-economic objectives classification of R&D – can be limited by disciplinary-based RFCD-based peer-assessments. This is not to suggest that relevance trades-off against excellence in a general sense, but rather that under some circumstances disciplinary-based resource allocations associated with competitive discovery research grant selection processes can limit the ability to fund important socio-economic objectives.

When RFCD-based funding allocations align with socio-economic objectives excellence and relevance need not involve trade-offs. However, when RFCD-based funding allocations based on excellence do not align well with the socio-economic objectives that generate relevance then trade-offs may have to be made. This suggests that:

- the ability of the research funding system to achieve both excellence and relevance rests on how well RFCD concerns are aligned with socio-economic objectives; and
- the capacity of institutions to invest in the sort of collaborations required to develop coherent research with strong SEO orientation.

However, the pressure on block grants has reduced the capacity of institutions to support research that falls outside the competitive grants processes.

Table 3 for instance, demonstrates the reliance of renewable energy research on general university funds in the apparent absence of sustained support from competitive grants programmes.

Table 3: Source of funds for Renewable Energy Research in Higher Education Institutions – 2002

Source of Funds	660200 RENEWABLE ENERGY not elsewhere classified at 6 digit level	660201 Hydro-electric	660202 Wind	660203 Ocean	660204 Solar-thermal	660205 Solar-p	660206 Solar-thermal electric	660299 Renewable energy not elsewhere classified (e.g. geothermal)
C'wealth Competitive Grants Schemes	28	41	55		280	1550	70	190
Non-C'wealth Competitive Grants	0		0		0	0		1
State and Local Gov't	0	1	5		44	79	22	68
Other C'wealth Gov't	389	5	118		134	480		426
Business	13	24	53		203	955	81	283
Donations, bequests, foundations		2	0		153	0		2
General University Funds	1464	262	366		892	2171	72	2108
Other Australian		7				39		23
Overseas	74	6	1		2	363		9
Total	1968	348	599		1707	5638	246	3110

FASTS encourage the Commission to incorporate a more detailed examination of the adequacy of funding for research, particularly in relation to a reliance on General University Funds (as distinct from national competitive grants schemes).

In particular, it is important to examine the extent to which important socio-economic objectives do not appear to be well aligned with RFCD-based research funding allocations as seems to be the case in renewable energy.

FASTS do not suggest that the Commission necessarily carry out such an assessment, but we do recommend that the Commission's final report stress the importance of such an exercise as part of the forthcoming evaluation of BAA.

It is also valuable to examine the number of human resources in key economic and environmental areas as energy supply and environmental Management (see table 4 and Appendix A respectively)

These tables suggest that Australia has a broad scope of research – and that diversity is important from a risk and preparedness perspective.

But there are some areas of very low HR levels. Nearly 50% of the environmental management 6-digit codes areas have 3 or less academics (refer appendix A).

Table 4: Human resources engaged in Energy Supply R&D in the higher education sector 2002

Socio-Economic Objective: 660000 ENERGY Supply	**Total**	**Academics/ Researchers**	**Post-graduates/ Researchers**	**Other staff**	***Three or less ac academics/* researchers**
660000 ENERGY SUPPLY	0.00	0.00	0.00	0.00	
660100 ENERGY TRANSFORMATION	1.24	0.64	0.50	0.10	√
660101 Coal - electricity	16.09	4.27	10.81	1.01	
660102 Coal - conversion to liquid fuels	0.00	0.00	0.00	0.00	√
660103 Coal - other purposes	10.33	1.94	8.23	0.17	√
660104 Nuclear	2.34	0.28	2.00	0.06	√
660105 Refined oil and gas	2.01	0.53	0.63	0.85	√
660106 Gas - conversion to liquid fuels	8.98	0.88	8.10	0.00	√
660107 Oil shale and tar sands - conversion to liquid fuels	0.00	0.00	0.00	0.00	√
660199 Energy transformation not elsewhere classified	40.79	6.96	31.65	2.18	
660200 RENEWABLE ENERGY	10.95	9.45	1.50	0.00	
660201 Hydro-electric	7.19	4.31	2.66	0.23	
660202 Wind	8.89	1.47	7.01	0.41	√
660203 Ocean	0.00	0.00	0.00	0.00	√
660204 Solar-thermal	19.83	4.59	12.50	2.74	
660205 Solar-photoelectric	40.55	12.90	14.07	13.58	
660206 Solar-thermal electric	0.80	0.03	0.00	0.77	√
660299 Renewable energy not elsewhere classified (e.g. geothermal)	39.98	11.24	23.51	5.23	
660300 ENERGY STORAGE AND DISTRIBUTION	0.62	0.22	0.00	0.40	
660301 Electricity transmission	62.93	10.31	42.25	10.37	
660302 Gas distribution	0.95	0.27	0.34	0.34	√
660303 Energy storage	4.82	3.03	0.78	1.01	
660304 Energy systems analysis	10.88	1.27	8.78	0.84	√
660399 Energy distribution not elsewhere classified	90.98	15.67	65.69	9.63	
660400 CONSERVATION AND EFFICIENCY	6.10	2.23	3.87	0.00	√
660401 Industry	48.37	14.50	27.49	6.38	
660402 Residential and commercial	10.97	2.67	7.64	0.66	√

660403 Transport	17.89	8.07	6.56	3.25	
660499 Other	20.93	6.11	13.87	0.94	
660500 PREVENTION AND TREATMENT OF POLLUTION	0.00	0.00	0.00	0.00	
660501 Energy transformation	22.14	4.98	14.23	2.93	
660502 Renewable energy	9.94	0.79	6.42	2.73	√
660503 Energy storage and distribution	11.30	2.35	6.20	2.76	√
660504 Conservation and efficiency	5.29	1.87	2.99	0.43	√
669900 OTHER	1.62	0.53	1.00	0.09	√
669999 Other	6.48	1.41	4.91	0.15	√

FASTS believes no conclusions can be drawn from this data per se. Rather, it highlights a significant short-coming in Australia's current policy environment – the inability to strategically map the interplay between socio-economic objectives, investment in human capital and the flexibility to ensure institutions can deploy resources strategically and flexibly.

FASTS submits that the Commission does need to consider the importance of having reliable data and the policy capacity to engage in such strategic evaluations.

Commonwealth Support Overstated

FASTS would like to point out that the Commission has overstated the Commonwealth's support for higher education by approximately $700m. Figure I p. XX – which is sourced from table 3.1.3 of *Australian Science and Innovation System: A Statistical Snapshot 2005* (DEST) – shows the Commonwealth invested $2.938b for R&D in higher education in 2002.

Not so. According to the Science and Innovation Budget Tables, the Commonwealth invested $1.972.8b in higher education R&D in 2002/3 (including the ARC). In addition, universities would also have received approximately 70% of the $291.3m grants awarded by the NHMRC.[2]

The $700m error is because DEST have misread the ABS data (8111.0). General University Funds (GUF) includes non-Competitive Commonwealth funding but also includes non-commonwealth funds including student fees from international and domestic students and other commercial activities carried out by universities. FASTS understands the definition of GUF will be clarified in subsequent ABS publications.

Business

There are good reasons why Governments should support private investment in science and innovation.

FASTS submits that the primary policy intent of public support for business innovation should be to maximize competitive advantage of Australian firms in the global economy (a point of specific relevance given the persistent decline in Australia's balance of trade performance despite recent record terms of trade in commodities).

[2] The *Australian Government's 2006-07 Science And Innovation Budget Tables*, DEST, Table 1

As has frequently been commented upon, Australia has a low BERD to GDP ratio. Despite significant growth and a record high of 0.95% in the latest data, it remains significantly lower than the OECD average. This is typically explained by the structure of the Australian economy.

FASTS do not share the Commission's rather sanguine position on 'benign differences' between Australia and other nations on BERD as a % of GDP. FASTS are familiar with the structure argument but note the Commission's own estimate that Australia is still below the OECD average once BERD is adjusted for structure (refer figure c.5, p. c.15). FASTS do not think Australia should be relaxed about being a bit closer to the OECD average, when that level of investment is increasingly being considered too low in Europe in view of the level of US investment and the rising strength of China and India's research capacities.

FASTS agrees that BERD is a limited indicator as;

- R&D in firms is a dependent variable and its efficacy is reliant on management and strategic capabilities; and
- there are quite different forms of innovation some of which do not rely on formal R&D.

We also note that Australia's BERD had probably been higher than previously reported due to methodological problems with the ABS survey methodology[3].

Nevertheless, the level of business investment on R&D is highly relevant when thinking about publicly funded R&D. That is because capturing the value of public sector research is greatly enhanced when there are companies that themselves have an R&D capability and an active program of turning research into new products and processes.

Recent contributions to the Australian innovation literature have tended to try and explain away the importance of BERD to innovation.[4] Part of the problem with such analysis is it is based on a one-dimensional view of BERD in firms.

BERD is not simply about products and processes to market. From a preparedness perspective, an in-house R&D capability is critical for firms making assessments of, and tapping into, the external knowledge base for advanced warning (and opportunities) of risks such as disruptive technologies.

The experience of many Australian researchers is it is easier to talk to multinational firms than many local firms because companies such as IBM, DuPont or Roche have considerable in-house scientific expertise and R&D is a 'naturalized' part of their corporate culture.

Enhancing the link between private and public sector research is, therefore, a crucial area of public policy.

[3] ABS, *Research And Experimental Development,* Businesses, 8104.0, 2004–05

[4] see, for example, BCA, New Concepts In Innovation: The Keys To A Growing Australia, BCA March 2006; Thomas Barlow, *The Australian Miracle: An Innovative Nation Revisited,* Sydney: Picador, 2006

Over the years, successive Australian Governments have developed a variety of innovative policies to support industry-research links, including Cooperative Research Centres and ARC linkage grants.

However, in an increasingly knowledge-based economy, a key role of public sector research in industry innovation is transferring ideas, highly trained personnel – notably PhD graduates – and elements of systematically gained knowledge, not commercialisation of technologies.

The recognition that there are multiple pathways to adoption of research by industry is evident in the growing debate about the prospect of Australia introducing a 'third stream' or 'knowledge transfer' funding program.

The key premise of such a program is the recognition that it is the quality and dynamism of the partnerships between universities, industry and other knowledge-users that will determine its success.

In FASTS view, such funding may be useful in addressing what we consider to be the biggest weakness in the Australian innovation system – inadequate demand-side capacity to leverage public sector science and innovation.

Business programs – draft findings

FASTS wishes to make some comment on the draft findings in relation to business programs.

Tax concession

FASTS believes the primary role of public support for business science and innovation is to produce economic benefits. We are concerned that the Commission may have placed too much emphasis on additionality in making its assessment of the 125% tax concession. While FASTS accepts that a proportion of the activity would occur without the concession that is not reason in and of itself to dismantle the 125% base concession.

The advantage of the concession is it provides a fair, stable and certain basis for firms to plan their R&D activities. By way of contrast, firms could only deal with the tax concession incremental scheme *ex post*.

FASTS notes that a move to a 175% incremental concession would require each firm to undertake the same level of compliance as the 125% but with less certainty that they will qualify for the increment.

Moving to an incremental scheme based on turnover is not a good idea and indeed FASTS notes the Government eventually rejected that option in 2001 following advice and comment from DITR and industry. Our primary concern is that this would make R&D a particular hostage to business cycles. FASTS submits that maintaining the decoupling of sales and R&D expenditure may help smooth fluctuations as there are good general reasons why R&D becomes more important when sales are in decline.

FASTS are particularly concerned that current thresholds for the tax offset are inappropriate. The real issue is the $1m cut off for R&D spend which is quite absurd as it 'punishes' firms

who spend $10 over the limit and may reward some SMEs who aren't necessarily going anywhere with their R&D. There are a number of possible solutions including allowing firms who over shoot the $1m to hold over the difference for future claims, cap the offset at $1m with no penalties for spend above that figure or use a number of step thresholds so that firms receive less and less as the figure rises above certain limits.

Commercial Ready

In one sense, Commercial Ready is simply a re-badging of a variety of different programs such as BIF into a general program with more detailed compliance features.

Lifting the compliance requirements such as business plans and commercial strategies has been useful in encouraging discipline in SMEs in respect of planning issues and presenting proposals. Indeed, a positive spin-off may be a more confident SME innovation sector better able to leverage their exposure to Commercial Ready by adapting the compliance requirements and skills to access other programs and private funds.

One of the key policy problems Commercial Ready seeks to address is difficulty in raising capital. Therefore we suspect that the Commission's concern on social returns may be somewhat misplaced.

FASTS believe, however, that the $50m cap is unrealistically low and should be lifted, particularly as access to capital is risk dependent not size dependent (although size, track record and so forth obviously impact on a firms' capacity to access capital)..

We are also concerned that the program is becoming a bit more risk averse in its operations. Anecdotal experience suggests some convergence on more conservative projects which are a bit closer to the market are getting supported. Preliminary analysis of the data shows some volatility on the frequency of the size of grants.

FASTS do not have the supporting evidence but we speculate that the program is supporting 'safer' options and there does appear to be more risk avoidance in Commercial Ready than in its predecessors R&D start and BIF.

RRDCs

The Council of the RRDCs are members of FASTS nevertheless FASTS remains strong supporters of the RRDC program as it remains one of the most effective, 'demand-driven' cluster mechanisms in the Australian R&D landscape.

It is our view that the Corporations RRDCs work effectively and work well with high levels of adoption of R&D.

FASTS are concerned that the Commission has undervalued a wide range of important spillovers from the program, for example, in tourism and recreation (from wine and fishing industry R&D Corp) and deepening of human capital in rural industries.

The RRDCs are in a position to leverage other investments in R&D by CSIRO and universities and it may be useful to get a clearer idea of the true subsidy to such research.

It is FASTS experience that there remains some important tensions between agricultural imperatives and environmental sustainability issues. FASTS accordingly believe it is worth examining what relations could be developed between the RRDC program on the one hand and Landcare, National Heritage Trust programs, for example, on the other. This may provide for some important overlaps in human capital development and also provide additional opportunities to maximise social and environmental spillovers.

CRCs

The CRC Association is a member of FASTS.

FASTS remain strong supporters of the CRC program but feel that recent changes to the selection criteria are accentuating limitations in the program. The evidence is that there are less applications and that there are more 'new from old' CRCs.

The original concept was for cooperative research between researchers from Universities, public research organisations and companies. That pre-supposed that the companies in the CRC had research laboratories and employed research scientists and, indeed, that was the case in the most of the initial CRCs. For example, ICI contributed research to the CRC for Polymers and Telectronics to the CRC for Cardiac Technology.

The way the program has developed using incorporated models means that more CRCs are divided between the research providers and the research users where the CRC is providing funds to the former to do research for the latter. Some funds are provided to the former to do 'CRC research' which can end up in a spin-off company.

The result of this has been quite a subsidy of company research by the Government and at a higher level than the Commercial Ready program.

Rather than frame the issue in terms of reinstating the original objectives, FASTS believes the program needs to be re-invigorated by looking ahead by providing for greater flexibility and diversity in the program. That means allowing for CRCs with a range of desired outcomes including

- international CRCs which have Australian companies, Australian research providers, Chinese companies and Chinese research providers (or Indian or combinations of countries particularly in the Asia Pacific region).
- three year CRCs
- public good CRCs where there is a public institution such as a Government Department as the research user.

The CRCs have relatively high transaction costs and some may have quite complex IP and/or governance arrangements. That is, there are good arguments to develop far more flexible governance arrangements.

These are not new issues and FASTS notes and supports recommendation II-9 of the Howard Partners evaluation of the CRC program of 2003.

The Department of Education, Science and Training explore the feasibility of legislation for CRCs to be established with a specific status. The objective would be to resolve uncertainties and complexities in corporate and taxation status and provide a sound basis for a public private research partnership. The legal status could also be relevant to other public-private research partnerships such as MNRFs and Centres of Excellence .[5]

Collaboration

FASTS strongly supports developing more agile collaborative arrangements to complement or extend the CRC program for bodies that can enhance 'cluster' approaches and provide for more strategic, demand-driven collaborative behaviours. In particular, FASTS believes the action agendas may prove to be fertile ground for developing such instruments as the firms have demonstrated an interest in cooperative, strategic approaches by virtue of joining an action agenda.

[5] Howard Partners, *Evaluation of the Co-operative Research Centres Programme*, DEST, July 2003.

Appendix A: Human resources engaged in Environmental Management R&D in the higher education sector 2002

Socio-economic objective: 770000 ENVIRONMENTAL MANAGEMENT	Total	Academics / Researchers	Post-graduates/ Researchers	Other staff	*Three or less ac academics/* researchers
770100 CLIMATE AND WEATHER (not classified at the 6 digit level)	4	1	2	1	
770101 Climate change	89	27	46	16	
770102 Climate variability	37	10	18	8	
770103 Weather	20	5	9	6	
770199 Other	19	3	14	2	√
770200 ATMOSPHERE (EXCL. CLIMATE AND WEATHER) not classified at the 6 digit level	2	0	2	0	
770201 Atmospheric composition	35	2	30	3	√
770202 Atmospheric processes	43	14	23	6	
770300 MARINE ENVIRONMENT not classified at the 6 digit level	57	7	45	6	
770301 Air quality	24	3	17	3	√
770302 Living resources (incl. impacts of fishing on non-target species)	135	36	83	16	
770303 Control of pests and exotic species	22	7	13	2	
770304 Physical and chemical conditions	30	8	15	8	
770305 Oceanic processes (excl. climate related)	84	25	46	13	
770306 Integrated (ecosystem) assessment and management	78	19	53	5	
770307 Marine protected areas	48	13	28	7	
770399 Other	38	11	21	7	
770400 COASTAL AND ESTUARINE ENVIRONMENT not classified at the 6 digit level	27	8	15	4	
770401 Air quality	4	1	3	1	√
770402 Land and water management	201	66	105	30	
770403 Living resources (flora and fauna)	124	27	79	18	
770404 Control of pests and exotic species	4	1	2	1	√
770405 Physical and chemical conditions	40	9	27	4	
770406 Integrated (ecosystem) assessment and management	97	24	56	17	
770407 Remnant vegetation and protected conservation areas (both terrestrial and	9	2	7	1	√
770408 Rehabilitation of degraded coastal and estuarine areas	23	4	17	3	
770409 Estuarine and lagoon areas	38	7	26	5	
770499 Other	29	7	17	5	
770500 URBAN AND INDUSTRIAL ENVIRONMENT not classified at the 6 digit level	11	1	7	3	
770501 Air quality	24	6	17	2	
770502 Land and water management	109	30	66	14	
770503 Living resources (flora and fauna)	12	2	9	1	√
770504 Control of pests and exotic species	14	6	2	5	
770505 Integrated (ecosystem) assessment and management	29	5	22	2	
770506 Remnant vegetation and protected conservation areas	5	2	3	0	√
770507 Industrial/degraded areas	14	5	9	1	
770599 Other	29	7	20	3	
770600 HIGH COUNTRY (INCL. MOUNTAINS) not classified at the 6 digit level	8	1	7	0	

Socio-economic objective: 770000 ENVIRONMENTAL MANAGEMENT	Total	Academics / Researchers	Post-graduates/ Researchers	Other staff	*Three or less ac academics/* researchers
770601 Air quality	1	0	1	0	√
770602 Land and water management	38	2	35	1	√
770603 Living resources (flora and fauna)	10	2	6	2	√
770604 Control of pests and exotic species	3	-	2	1	√
770605 Integrated (ecosystem) assessment and management	2	0	1	0	√
770606 Remnant vegetation and protected conservation areas	2	0	2	0	√
770607 Rehabilitation of degraded high country	3	1	2	0	√
770699 Other	-	-	-	-	√
770700 FOREST AND WOODED LANDS not classified at the 6 digit level	11	7	4	0	
770701 Air quality	-	-	-	-	√
770702 Land and water management	53	16	24	13	
770703 Living resources (flora and fauna)	162	40	103	19	
770704 Control of pests and exotic species	19	5	11	3	
770705 Integrated (ecosystem) assessment and management	33	8	18	7	
770706 Remnant vegetation and protected conservation areas	24	4	17	3	
770707 Rehabilitation/reafforestation	13	3	7	4	√
770799 Other	9	2	7	1	√
770800 FARMLAND (INCL. ARABLE LAND AND PERMANENT CROP LAND) not classified at the 6 digit level	6	2	2	3	
770801 Air quality	2	-	1	1	√
770802 Land and water management	148	39	93	17	
770803 Living resources (flora and fauna)	34	7	24	3	
770804 Control of pests and exotic species	44	14	23	8	
770805 Integrated (ecosystem) assessment and management	10	4	5	2	
770806 Remnant vegetation and protected conservation areas	16	4	10	2	
770807 Rehabilitation of degraded farmland	6	2	4	0	√
770899 Other	39	3	33	3	√
770900 SPARSELAND (INCL. PERMANENT GRASSLAND AND THE ARID ZONE) not classified at the 6 digit level	2	2	-	1	
770901 Air quality	-	-	-	-	√
770902 Land and water management	32	6	21	5	
770903 Living resources (flora and fauna)	39	9	23	7	
770904 Control of pests and exotic species	5	3	1	1	√
770905 Integrated (ecosystem) assessment and management	14	2	10	2	√
770906 Remnant vegetation and protected conservation areas	6	1	4	1	√
770907 Rehabilitation of degraded sparseland	3	0	2	0	√
770999 Other	3	1	2	0	√
771000 MINING ENVIRONMENTS not classified at the 6 digit level	4	1	1	2	
771001 Air quality	3	0	2	0	√
771002 Land and water management	14	6	6	2	
771003 Living resources (flora and fauna)	2	0	1	0	√
771004 Control of pests and exotic species	5	1	2	1	√
771005 Integrated (ecosystem) assessment and management	1	0	1	0	√

Socio-economic objective: 770000 ENVIRONMENTAL MANAGEMENT	Total	Academics / Researchers	Post-graduates/ Researchers	Other staff	*Three or less ac academics/* researchers
771006 Remnant vegetation and protected conservation areas	1	-	1	-	√
771007 Rehabilitation of degraded mining lands	43	8	21	14	
771099 Other	3	1	2	0	√
771100 ANTARCTIC AND SUB-ANTARCTIC AREAS not classified at the 6 digit level	2	2	-	-	
771101 Air quality	6	2	3	0	√
771102 Land and water management	6	3	2	1	√
771103 Living resources (flora and fauna)	15	4	10	2	
771104 Control of pests and exotic species	-	-	-	-	√
771105 Integrated (ecosystem) assessment and management	12	4	6	1	
771199 Other	23	3	18	2	√
779900 OTHER (INCL. ISLANDS) not classified at the 6 digit level	68	8	56	4	
779901 Air quality	1	0	0	0	√
779902 Land and water management	76	25	34	17	
779903 Living resources (flora and fauna)	55	10	39	5	
779904 Control of pests and exotic species	15	4	8	3	
779905 Integrated (ecosystem) assessment and management	22	4	16	2	
779906 Remnant vegetation and protected conservation areas	5	1	2	2	√
779907 Rehabilitation of degraded areas	4	1	2	1	√
779999 Other	78	27	38	14	
TOTAL	2,876	719	1,746	411	
Percentage breakdown of total	100%	25%	61%	14%	

Source: ABS