Public Support for Science and Innovation

A supplementary submission to the Productivity Commission from CSIRO responding to the draft report

December 2006

Introduction and overview

CSIRO believes that the draft report on public support for science and innovation makes a substantial contribution to discussions on the rationale for such support and on the benefits that flow to Australia from public investment in science. The findings of the report result from a rigorous analysis of available data using a variety of methods; acknowledge the considerable difficulties that can exist in trying to quantify even the economic returns that result from public sector support for science and innovation; and take a realistically broad view of the range of tangible and intangible benefits that such investment can produce. The report and the debate it generates should provide an opportunity to re-set the baselines for what publicly supported research does, and why.

CSIRO in general supports the findings and conclusions of the report, which are fair, balanced and recognise the uncertainties that will always exist. While the findings that there 'are strong rationales for the provision of public funding support for science and innovation' and that 'there are significant positive economic, social and environmental impacts from publicly supported science and innovation' are not surprising, they are none the less welcome as the conclusions of an independent disinterested, technical study.

Another important feature of the report is that it makes explicit the diversity of pathways through which science can have impact. This puts commercialisation into perspective as only one of many possible pathways to impact, noting that too great a focus on commercialisation can divert attention from some broader and even more important outcomes of research. This emphasises the importance of performance measurement data requirements that do not distort behaviours to produce less than optimal outcomes because of the need to perform in particular ways

One area that the report might have considered in greater detail is that of the need to incorporate 'path to impact' issues into research management processes. It is generally not possible to maximise impact through a simple one-off effort at the end of the research. Managing research to achieve impact, whether commercial or otherwise, has to be a continuous process. Significant outcomes are the result of complex interactions involving continuing engagement with diverse players over a long period. Especially with major innovations, this requires engagement to start early in the research process and preferably at the planning stage.

Economic focus

In providing general support for the report's findings, CSIRO notes that the analytical perspective of the report is primarily an economic one. This is quite properly and appropriately so, given the commission's role and its terms of reference.

Providing an overview assessment built around the economic rationale for public support provides a firm, intellectual foundation from which to examine, qualitatively and quantitatively, the outputs and outcomes of public support for science and innovation. Indeed, CSIRO's submission to the study made this point and suggested that performance indicators and benchmarking processes need to recognise explicitly this rationale, so that they do not distort organisational behaviours or lead to the inappropriate use of public funding or incorrect performance assessments. For this reason we are pleased to see that draft finding 7.1 supports this position.[1]

However, while the economic rationale presented in the report provides sound arguments for government funding, the reality is that researchers and research agencies do not operate in a purely economic world; neither are all stakeholder expectations or behaviours based on rational economic analysis. Political and other practical considerations are part of the environment within which research organisations and other players in the national innovation system operate.

The report provides a useful reminder of the need to keep an eye on the economic rationale but needs to acknowledge that different stakeholders can have quite different perspectives. The variety of stakeholder perspectives and expectations that feed into the political processes that result in decisions about research funding do not always have a strong economic (or even rational) base, but governments cannot ignore them.

As an example, CSIRO's role house model, business models and science investment process all explicitly build on the reasons for public support and the circumstances under which research services require full private funding, a balance of private and public funding, or full public funding. However, putting these principles into practice can be quite challenging – as when the business sector expresses concern about the requirement to cover the full costs of research, the benefits of which will flow to an individual firm; or when shifting effort to longer term, riskier work leads to a decrease in private sector funding and consequent cost pressures for the organisation, or to complaints from industry that CSIRO is becoming less responsive to its needs.

In this context it is useful to emphasise again that while the commission's study is about public support for science and innovation, the operating environment for an organisation such as CSIRO is complex.

[1] As a supporting aside, the impact assessments that ACIL Tasman conducted of CSIRO research using a real options framework certainly challenged CSIRO in requiring it to respond to 'devil's advocate' questioning of the rationale for the use of public funds. However, this led to a more robust counterfactual; provided a more realistic assessment of the value CSIRO research was adding; was of considerable value in refining the organisation's thinking about its general business models and governance processes; and fed directly into those processes.

The proportional contribution of public support to different activities within CSIRO varies significantly and the organisation uses a variety of different mechanisms to ensure that the private sector contributes to research that provides it with benefits. The riskier or more novel the research, the more likely it is that private sector funding will arise towards the end rather than the beginning of the research project. As the commission notes in its discussion of the Australian Growth Partnerships model, this provides an opportunity for the public sector research organisation to receive a return that is proportional to the size of the benefit a firm captures from the research output, rather than to the cost of the research.

Additionality

As discussed in CSIRO's original submission, there are many ways in which additionality can manifest itself. A discussion of this in the final report would be very useful. In particular, it is important to recognise that additionality can have qualitative as well as quantitative aspects – that even if the private sector might perform the work it would do so in a way that leads to fewer spillovers and might result in a less effective outcome. One example is 'behavioural additionality' which is the subject of a recent OECD report[2]. Questions that can help identify such additionality and that the OECD study addresses include: '*Were different types of R&D conducted? Did the firm collaborate more with partners in the public or private sectors? Did the firm improve the management of its R&D activities?'*.

Another example is the additional (options) value generated by a broad array of information and potential innovations which are available to be exploited by either the public or private sectors in unknown future circumstances.

Funding levels

One of the most problematic findings in the draft report is draft finding 8.1 that 'There is no evidence that the overall quantum or mix of public support for science and innovation is currently inappropriate for Australia's needs and aspirations'. This is a neutral statement and one of the key points in chapter 8 notes that '…in practice, the information requirements to determine the optimal scale and mix of public funding for science and innovation are too demanding – these are matters of public judgement, informed by the available evidence'.

Relevance of benchmarking

Attachment C to the draft report argues that after making appropriate corrections for international comparisons (taking into account factors such as industry structure and firm size), Australian research expenditure is not significantly less than that of other countries. However, CSIRO argued in its submission that international benchmarking does not provide a sufficient basis on which to determine funding levels because domestic factors create the need for particular levels and kinds of support.

[2] *Government R&D Funding and Company Behaviour* MEASURING BEHAVIOURAL ADDITIONALITY OECD 2006

The innovation systems of different countries have their own peculiar characteristics; the roles and responsibilities of governments differ between different countries and a significant proportion of public investment in science supports government services; and local conditions affect the nature and scale of, for example, environmental or resource management problems that require a domestic scientific response.

Arguments for increased funding

Quite apart from these considerations, there are factors that support the need for increasing levels of investment if Australia is to maintain its current level of activity (for which funding is only a proxy measure) and the quality of this activity.

The cost of science is increasing beyond the usual indexation rates applied by governments. Technological developments themselves lead to more sophisticated and expensive facilities and equipment – and leading edge equipment is necessary not only to do leading edge science but also to maintain the quality and relevance of scientific outputs. Leading edge equipment makes it possible to address previously unanswerable questions and to significantly increase the productivity of scientists. Spending weeks performing tests which new technology can accomplish in hours is not an effective use of resources. For these reasons, providing access to leading edge technological platforms is a key factor in attracting and retaining world class scientists and in being able to contribute to international collaborations. Similarly, as the commission points out, an appropriate market response to the developing shortages of scientific and engineering expertise is to offer higher salaries such that the salaries for particular kinds of scientist and engineers increase at a rate faster than the general increase.

The breadth of science is also increasing. Advances in science themselves enlarge and enhance the number and diversity of opportunities for further science. Some of these opportunities may be critical in providing the understanding that will allow Australia to respond to emerging challenges and changes in the global environment. While it is not necessary (or possible) to explore all new opportunities, some will deserve serious attention within Australia. At the same time, it is important that we do not divert resources away from basic capabilities that provide essential support. There is a need to maintain (and even grow) existing capabilities (such as taxonomy) while working in new areas such as genomics or proteomics that depend on them. Moreover, basic infrastructure, including collections and data, continues to grow and, even with improved technology, has ever higher maintenance and management costs – not least because advances in knowledge allow and require their use in novel applications and can set higher management standards. (Footnote 47, page 61 of our original submission provides an analysis of some New Zealand experience of losing basic capabilities.)

The scale of (and demands set) by problems that require a local solution are also growing – water management, climate change, energy issues, security, public health, etc, and new challenges will emerge. Large scale challenges require a large scale response. While the coordination and redirection of existing effort can and should play a part, these administrative/management processes in themselves can be expensive (as shown by the commission's discussion of the CRC program), potentially leading to lower direct research activity unless there is additional funding; and any diversion of resources leads to the loss of benefits elsewhere.

There is also an international dimension to this issue as Australia's national prestige and international influence require a commitment to address global issues at a level commensurate with our stage of economic development – to show that we are not free riding on overseas research.

Taken together, these factors mean that at the national level, with static real funding: there would be less publicly funded scientific activity[3] and possibly a deterioration in existing capabilities and infrastructure; the level of public investment would not be sufficient to respond to a demand for science-based solutions to emerging national needs that require a government response without threatening existing capabilities; and other countries might start to assess Australia as making a proportionately lesser response to global issues, with the consequent impacts national prestige and influence.

CSIRO perspective on funding

This discussion has addressed the funding issue from a national, system-wide, perspective, rather than from a CSIRO-specific perspective. The draft report notes that in its submission CSIRO did not seek an increase in its public funding allocation, although discussions between the commission and CSIRO identified that the organisation had the capability to support additional worthwhile research, were the funds to do so available.

The reason CSIRO did not explicitly address its funding requirements in its original submission is that, as part of government, CSIRO makes its funding needs known to government through the annual portfolio budgetary processes. This year these will see the government consider a new funding agreement for CSIRO, as the organisation's current triennium funding agreement is due to end on 30 June 2007.

While it is not appropriate for CSIRO to discuss the quantum or nature of the specific funding proposals it has put forward in the budget process, it is important to place on record CSIRO's view that, more than ever before, Australian's future will depend on Australian science. In this context future funding levels for CSIRO will greatly influence Australia's ability to address successfully many of the major challenges it faces in areas such as water resource management, climate change adaptation, low emission transport fuel security, agricultural sustainability, rising levels of childhood and adult obesity, mineral resource exploration and niche manufacturing. Helping deliver solutions to these key national issues also has the potential to create options that will allow Australian industry to exploit the global opportunities that solutions to these issues might offer, particularly in the developing economies of India and China.

[3] Maintaining the current level of activity with constant real funding would be possible only if two conditions were met: first, that there is slack in the system such that it is possible to capture sufficient efficiencies through improved management and/or the redistribution of the existing level of funds; second, that the improved management and or reallocation of funding takes place.

As noted above, any arguments that CSIRO might make for specific, additional funding, would focus on identifying both the need for research to address identified national problems and the particular contributions that CSIRO could make to this research. In this context it is worth emphasising that in managing the National Research Flagships, CSIRO operates as a research funding organisation (acting as an informed purchaser of research services from other organisations through the $97 million Flagship Collaboration Fund), as well as a research performer. As discussed in CSIRO's original submission, Flagships identify and manage the research necessary to address a national problem – they do not search for a problem that existing research capabilities might address and they do not depend entirely on CSIRO's in-house research capabilities. From CSIRO's perspective, a case for additional funding has to rely on the value of the outcomes the additional research will produce.

The Australian innovation system

The draft report contains a good broad-brush picture of the Australian innovation system and how it compares with that in other OECD countries. However, additional analysis of the Australian innovation system is needed in order to identify both Australian-specific rationales for public support and some improvements to the functioning of the overall system in Australia.

Australia's context, particularly the small size of the domestic economy, the large distance to advanced economies of a substantial size (there are no adjacent markets like those for Canada or European countries) and the lack of large R&D intensive firms, has resulted in a distinct pattern of specialisation in the national innovation system. This should be covered in greater depth in the Commission's report.

Specialisation in terms of the organisations carrying out radical innovation is one example. CSIRO plays this role in Australia whereas the corporate labs of large firms occupy this niche in countries such as the USA, Europe and Japan.[4]

This is one example of how firm size is a critical factor in determining the nature of the R&D activities a firm is able to undertake, as well as the overall size of their R&D effort[5]. Scale makes a qualitative difference to the nature of industrial R&D: large firms do not simply do more of the same kinds of activities as small firms. These qualitatively different activities appear at different thresholds in firm size and firm R&D intensity. The commission's report should explore in more detail the implications of the difference between Australia, with <10% of BERD carried out in firms with more than 10 000 employees, and countries such as the USA (>50% of BERD in firms with more than 10 000 employees).

Australia's domestic market is often too small to provide adequate returns on significant investment in R&D or innovation. Consequently Australian-based firms may need to establish themselves simultaneously in both Australia and a globally significant market. This adds significant additional risks – as well as cost. The high cost of doing this from Australia is an impediment to investing in R&D/innovation.

[4] Mapping Australian Science & Innovation 2003 page 84

[5] The relationship between firm size and the size of their R&D effort is studied in Wesley M Cohen and Steven Klepper *A Reprise of Size and R&D* The Economic Journal 106(437) 925 – 951 (1996)

The small size of markets in Australia is also an impediment to the interaction between inventors and the early and experimental adopters of innovation – interaction that is critical to the adoption and diffusion of non-incremental innovations.[6] There are only a small number of early and experimental adopters of innovation in any market (studies suggest ca.2% of firms[7]). Consequently, there may be only a very small absolute number of such firms in Australia. Public support to increase the willingness of firms to be early and experimental adopters of innovation and to increase the likelihood that they connect with innovators is likely to increase the overall effectiveness of the Australian innovation system.

The point in the previous paragraph is one instance of a generic feature of systems of radical or non-incremental innovation: their effectiveness depends on the performance of a very small proportion of the potential components of the system, be they firms or individuals. The population in the tails of distributions determines the overall performance of the system. An example is that the productivity and impact of researchers follows a Pareto distribution[8]. Australia is a relatively small nation. Consequently, the size of any component of a particular innovation system will be relatively small and the absolute population in the tails of distributions may be very small. Consequently, Australia needs to pay more attention to these "tails" than other countries or regions.

Incremental and radical innovation

The draft report provides a useful discussion of innovation but the commission's final report might usefully draw out more the distinction between incremental and radical innovation, as these are different in nature, as well as in the extent of their influence. Incremental innovation is largely about maintaining competitive advantage, while radical innovation creates competitive advantage, transforms industries and creates completely new opportunities.

Market failures in Australia apply particularly to the area of radical innovation. This is clearly the case in creating the technical opportunities that will allow industry to respond to the challenges it faces, as discussed in CSIRO's original submission. However, radical innovation is also fundamental in the public area where incremental solutions or responses will not be sufficient to address some of the major problems that Australia faces with respect to, for example, water management or the nexus between climate change and energy use and security. This is one reason CSIRO places particular emphasis on the National Flagship Program, because the Flagships aim to produce large scale change – and this requires a distinctive management approach.

---

[6] G S Lynn, J G Morone and A S Paulson *Marketing and Discontinuous Innovation: The Probe And Learn Process* California Management Review 38(3), 8 – 37 (1996).
Gina C O'Connor *Market Learning and Radical Innovation: A Cross Case Comparison of Eight Radical Innovation Projects* J Prod Innov Manag 15, 151 – 166 (1998)

[7] E Rogers *Diffusion of Innovations* The Free Press, New York. 1962

[8] See, for example, John J Gilman *Research Management Today* Physics Today 44(3) 42 – 48 (1991)

Too great a focus on incremental innovation through the support of individual and unrelated projects will decrease the potential overall impact of publicly supported research. This is because the major impacts will arise from programs that deliberately target radical innovation and recognise the need for a systems-based approach. The downside is that such projects are also the most risky – but this also means that they will have a high degree of additionality and fall well within the rationale for public support.

Characteristics of radical innovation

Radical innovation is complex, iterative, requires many players with different skill sets, and at any one time draws on support from a range of different institutions. Unlike incremental innovation, which can result from activity within an individual firm or organisation, radical innovation operates across sectors and industries. As a result, the management of radical innovation is complex, has to encompass ambiguity, promote flexibility, extend beyond a single organisation to include a variety of relationships with a diversity of players, and has to be opportunistic.

Using techniques developed to manage incremental innovation when aiming at radical can have a stifling effect.[9] Moreover, each instance of a successful radical innovation is unique.

There is no single path to radical innovation and the more significant the innovation, the more likely it is to depend on the concatenation of a unique set of circumstances. Even in the commercial arena, achieving a major innovation is often beyond the capabilities of any individual firm or organisation but requires complex partnership and other arrangements in which diverse players work towards an often ill-defined outcome. One reason for this is that it is not possible to predict either the opportunities that other players will recognise as flowing from the original application of an idea, or how these new opportunities reflect back on the original innovation or relate to the capabilities and needs of different countries.

Implications for public policy

One important conclusion from this emerging understanding is that public policy needs to create an environment in which all the players can act in diverse ways. The intention should be to encourage and facilitate interactions and to promote impacts, rather than to set proscriptive rules or encourage particular routes to impact. Major policy objectives should be to maintain (and further develop) Australia's capability to respond to opportunities as they arise, to create new options for development and to facilitate the flexibility necessary for individual players to change track, as it becomes apparent that circumstances require a new approach or a redirection of effort.

A further conclusion is that public support should preferentially target radical innovation from considerations of both spillovers and additionality.

- Radical innovation can create a broad range of options relevant to a greater diversity of players than can the far narrower scope of incremental innovation. This means that spillovers have the potential to be larger. Radical innovation

[9] Richard Leifer, Christopher M. McDermott, Gina Colarelli O'Connor, Lois S. Peters, Mark P. Rice, Robert W. Veryzer, Mark Rice. *Radical Innovation: How Mature Companies Can Outsmart Upstarts.* Harvard Business School Press, 2000

is also linked with spillovers much more strongly than incremental innovation.[10]

- The probability of failure of any individual radical innovation project is high, yet the impact of a large enough portfolio of projects is very high.[11] Consequently there are substantial additional benefits from sufficiently large portfolios of radical innovation projects, compared with portfolios that are less than a critical size. This is related to the size the R&D/innovation effort in an organisation; however it's a benefit of scope rather than scale.[12]
- Because of their small size, it is difficult for individual Australian firms to establish a portfolio of individual projects sufficiently large to manage the risk. However, CSIRO is able to do this.
- The Commission should extend the discussion of size of R&D/innovation efforts from simply the scale of a single effort ("Indivisibilities" page 3.28 of the draft report) to also cover issues connected with the scope of a coherently managed effort (as exemplified by National Research Flagships).

Research planning and management

The draft report supports the concept of the innovation system and recognises that achieving impact from research requires complex and often iterative interactions between different parts of the system. In an effective system the different components use planning and decision making processes that reflect their differentiated roles and responsibilities. Over recent years CSIRO has put considerable effort into refining its own priority setting and performance management systems and welcomes the commission's draft finding 10.1 that aspects of CSIRO's approach may have wider applicability within Australia. CSIRO believes that in particular, the National Research Flagship model deserves broader consideration, a conclusion also reached by the independent committee that recently reviewed the Flagship program.

The importance of role clarification

Understanding the role that an organisation plays in the innovation system, when combined with a sound appreciation of the rationale for public support, helps create an explicit framework that can help an organisation manage its resources in the way that is most likely to achieve the outcomes it is there to produce. CSIRO's own processes have evolved in line with the organisation's work to clarify its role and responsibilities within the overall innovation system, given the very significant changes that have taken place in this system over recent years.

---

[10] See, for example, Emmanuel Duguet *Innovation height, spillovers and TFP growth at the firm level: Evidence from French manufacturing* Economics of Innovation and New Technology 15(4-5) 415 – 442 (2006)

[11] See, for example, Walter L Robb *How Good Is Our Research?* Research Technology Management 34(2) 16 – 21 (1991) and Greg A Stevens and James Burley *3,000 Raw Ideas = 1 Commercial Success!* Research Technology Management 40(3) 16 – 27 (1997)

[12] See, for example, Rebecca Henderson and Iain Cockburn *Scale and scope in drug development: unpacking the advantages of size in pharmaceutical research*. Journal of Health Economics 20, 1033 – 1057 (2001)

CSIRO's experience provides strong support for the commission's draft finding 11.1 that universities 'systematically examine whether current procedures within institutions are sufficiently rigorous to promote quality and impact of block-funded research'. This is not to say that they should adopt the same procedures as CSIRO but only that developing procedures based on a clear understanding of the role you are playing and what can help fulfil this has many benefits and can improve outcomes.

Aligning processes with role

Appropriate planning and management processes can play an important role in ensuring that public support does not substitute for private support and that public support leads to a high level of additionality. The draft report has suggested that CSIRO might strengthen its processes in this regard by incorporating into its Science Investment Process an explicit set of quantitative and qualitative criteria to assess the case for (and possible extent of) CSIRO involvement in research where public and private benefits co-exist. The report also suggests that it might be useful to change CSIRO's legislation to clarify that CSIRO's support for industry should target high spillover research that would not otherwise take place.

Changing the legislation is a political process requiring parliamentary scrutiny and is a matter for government. There is also another, perhaps less onerous, route through which the government could make its intentions clear regarding CSIRO's responsibility to support industry. This would be to use the Statement of Expectations that ministers will provide under the Uhrig reforms.

As the draft report acknowledges, the current Science Investment Process (SIP) criteria already reflect many of the Victorian Department of Primary Industry Principles that the commission suggests using to assess the case for public support. In particular, the SIP criteria require consideration of whether CSIRO should engage in the proposed activity and what role it should play. This explicitly covers the relevance of the work to CSIRO's mandate and consideration of CSIRO's role compared to that of other members of the national innovation system. It would not be a major change to ensure that issues relating to the role of government and to equity in funding become explicit rather than implicit criteria. These are already embedded in the business models that support the SIP process.

While CSIRO accepts the importance of examining the rationale for public support as part of its investment process, it is important to acknowledge that it is not always possible to make a clear-cut assessment of this issue. There can be ambiguity or uncertainty about the data on which it is necessary to base decisions, about the level of potential spillovers, and about possible outcomes. Interesting aspects of this assessment can include the extent to which business has options that are not available to Australia as a nation (for example by moving overseas); and the potential that public funding might have to facilitate the faster and more widespread diffusion of a technology (related to safety or health, for example) even when there may be sufficient incentive for individual firms to fund the work themselves but to use the technology in a proprietary way. The ACIL Tasman impact studies of CSIRO work provided to the commission include discussion on some of these issues.

Cooperative Research Centres

CSIRO is the largest single participant in the CRC program and as of March 2006 was participating in 48 of the 68 centres then operating. Through its involvement in this program and in collaboration with the many CRC partners, CSIRO has been able to deliver many positive benefits to the Australian community and industry.

While any action on the commission's findings on the CRC program will be a matter for government, CSIRO believes that the available data support the conclusions the commission has drawn in its draft report and provides the following additional information:

- Official DEST figures may under-report the level of total contributions made by public sector research providers so that the support provided to the end-user is even higher than the commission suggests. This is because the research infrastructure overheads for CRC-funded staff are in almost all cases borne by the research provider and the CRCs generally do not report them to DEST. The amounts involved are roughly equal to the Commonwealth funding to CRCs (around $200m pa).
- Current practices may result in less than full cost reporting by CRCs and this can result in the CRC community under pricing research.
- On average, publicly funded research providers bear around 70% of the full CRC project costs with the remainder shared by the Commonwealth CRC grant and the research users roughly in equal proportions

CSIRO notes the report's draft finding 9.5 on the scope to develop a program complementary to that of the CRC program to support shorter, more flexible collaboration. CSIRO believes that his proposal has merit, especially given the administrative costs incurred by CRCs. The draft report notes a survey which shows that the share of resources devoted to administration by all CRCs averaged 8.5% of total program resources. Another way to consider the administrative workload associated with CRCs is to note that these administrative overhead costs represent around 30% of the Commonwealth grant.

- That is, of the $208m invested in CRCs by the Commonwealth for R&D in 2005-06, some $62m were used to fund overheads similar to those already existing in the research provider institutions leaving only $146m invested in R&D, commercialisation and education.

Any changes that would help reduce system-wide costs, including the costs faced by CRC participants could help increase efficiency.

One problem may be that the motivation of some CRCs to become self-sustaining through IP revenue is probably unrealistic and can become counter-productive when it is the cause of protracted IP negotiations (and administrative costs).

- Australia does not need an additional set of permanent R&D institutions competing with the 40 universities and six federal research agencies.
- The more flexible collaborative arrangements proposed by the commission would help provide the dynamic element in the national innovation system, leaving the universities and the research agencies to provide the base support.

The commission might wish to consider the Industrial Affiliate Program of Belgium's IMEC institute as a possible basis for a more flexible type of program which could be run out of CSIRO and research intensive universities. See: http://www.imec.be/wwwinter/business/IIAPbrochure.pdf

As an aside, CSIRO also notes that the CRC Association's submission to the commission's study (and the DEST commissioned impact study) present statistics about outcomes from CRCs compared to those from universities that have the potential to lead to inappropriate conclusions. This is because direct comparison between the figures is not possible as the output ratio for CRCs is based on only 25% of inputs (the Commonwealth grant) while the ratios for universities, which exclude their outputs via CRCs, are based on about 80 to 90% of inputs (Commonwealth funding).

More generally, CSIRO believes that although the recent economic impact studies for CRCs provide a useful indication of the benefits of publicly funded R&D, as have similar studies for universities and research agencies, it might have been possible to use a more appropriate counterfactual. This is because the counterfactual analysis in the CRC studies assumed that the funds used for CRCs would otherwise have been used for general government administration purposes or to reduce taxes. Since the CRC program is about fostering collaboration in R&D, it is possible to argue that a more appropriate yardstick would be the return from R&D achieved by the research providers acting in their own capacity with research users, rather than as part of a CRC. That would enable a more realistic comparison to be made of the cost and benefits of collaboration in R&D via overhead intensive CRCs.

Conclusion

CSIRO believes the draft report provides a clear and explicit rationale for the public support of science and innovation and that the evidence it provides for the benefits of such support are convincing. There is no doubt that the final report will be an important reference document and have influence across many organisations well into the future. Policy analysts and those directly involved in public sector research will make considerable use of it, as will those evaluating public sector programs and activities. We believe that paying more attention to the system nature of innovation and the other matters we have identified in this supplementary submission would help make the document even more useful and we are happy to expand on any of the points raised in this submission, should the commission wish us to do so.