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Cooperative Research Centres Association:

Submission to the Productivity Commission research study into public support for science and innovation in Australia:

Response to the Draft Report

18th December 2006

Overview of submission

The CRC Association (CRCA) welcomes the Productivity Commission's draft report into public support for science and innovation and would like to commend the Study Team on their efforts to date.

The CRCA supports the call for the CRC Programme to re-emphasise the focus on the translation of research outputs into economic, social and environmental benefits and also welcomes the call for greater flexibility of arrangements to be built into the CRC Programme.

While endorsing the general thrust of the Study Team's recommendations, in this submission the CRCA would like to take the opportunity to provide some additional information in relation to the current operation of the Programme to address some misconceptions that appear within the draft report in relation to the CRC Programme. The two key points we are seeking to clarify in this submission are that:

1. The CRC Programme does currently generate considerable economic, social and environmental benefits that are not privately captured by industry participants in the CRC Programme. These non-privately captured benefits are in fact likely to be the most significant benefits that the Programme generates. We believe that as a consequence of the Study Team not fully understanding the extent to which such benefits are being delivered by the Programme, concerns raised regarding large rates of subsidy to business collaborators are considerably overstated within the draft report.

2. The CRC Programme has been making considerable efforts towards facilitating shorter/more flexible interactions. However, recognizing that more needs to be done in this area, to further this, the CRCA makes two extra recommendations for change to the Programme in addition to the five provided earlier viz:

Recommendation Six:

The CRCA recommends that the Government accept the Productivity Commission's draft finding that the original objectives of the CRC Programme - the translation of research outputs into economic, social and environmental benefits - should be reinstated. This is likely to produce better outcomes than focusing public support [only] on the commercialisation of industrial research alone.

Recommendation Seven

CRC Programme funding should be increased – with new funding explicitly earmarked for use in the support of flexible engagement with smaller end user groups. Leveraging of existing CRC Programme

administrative structure in this way will be a more cost effective mechanism for supporting flexible research collaborations with SMEs than incurring the expense of establishing a completely new complementary program as per Draft Finding 9.5

Types of benefits delivered by the CRC Programme

The CRCA strongly endorses the Productivity Commission Study Team's support for focusing government research funding on activities that generate economic, social and environmental benefits for the Australian community. The generation of such benefits should be the primary goal of not only the CRC Programme, but for publicly funded research more generally. A key concern that the CRCA therefore has with the analysis of the CRC Programme in the draft report is that the Commission Study Team has focused overwhelmingly on the direct commercial benefits realised from CRC research and has overlooked the far broader range of benefits that the CRC Programme delivers for Australia.

In large part this misunderstanding of the nature of CRC Programme benefits may be due to the fact that CRCs, as part of the regular performance reporting processes within the Programme, are asked to quantify and value the monetary benefits that they generate. Direct commercial benefits, and benefits accrued by industry through the application of CRC research to improve production processes are the most amenable to such "value" quantification. Hence, these types of benefits from the Programme are the most heavily reported. This does not mean, however, that they are the only – or even the dominant – types of benefits generated by the Programme.

As noted in our original submission to the Commission, the CRC Programme generates benefits through the following key channels:

Application of research. Economic, environmental, health and social benefits are generated through the application by industry or public sector end users (including capital and operating cost savings delivered in the public sector) of new products, processes, policies and resource management techniques enabled by CRC research and research dissemination activities.

Commercialisation of research. Increased economic output is generated through commercialisation of new products based on CRC R&D via spin-off companies or licensing of IP to existing companies.

Enhanced access to international knowledge networks. Australia is less than 1 percent of the global economy and its research output produces around 2 percent of the world's scientific literature. For Australia it is therefore critical that there are strong pathways for accessing internationally generated knowledge. The conduct of high quality research in Australia is generally essential for Australia to gain a seat at the international R&D table, which in turn brings Australia early access to new internationally generated knowledge.

Skills formation. The skills formation that occurs within CRCs, particularly in relation to research student training, delivers a number of economic benefits for Australia such as the development of highly skilled "industry ready" post-graduates who then work in industry and allow industry to be smart adopters and adapters of nationally and internationally generated technology/knowledge.

Collaboration of public and private sector researchers. Through providing an opportunity for industry and academic researchers to interact/collaborate, CRCs broaden and improve the skills of both, and hence their future innovative productivity. The Programme promotes the development of a new breed of research managers that understand research provider and end user perspectives and the importance of actively planning for and managing the route to application of research.

Encourages industry investment in research. By virtue of their dual academic/industrial character, the culture of CRCs' research and management practices forms an effective "bridge" between industry and academe, encouraging industry to invest in research. Such investment is less forthcoming where industry invests directly with academia.

The breadth of the CRC Programme across its six focus areas, the wide range of channels through which the Programme delivers benefits for Australia and the Programme's unique role in encouraging long-term and deep collaboration between research providers and research users together explain the high profile that the CRC Programme has had compared to the relatively small proportion it represents of total Australian Government science and innovation funding.

In the recent study on the economic impacts of the CRC Programme commissioned by the Department of Education, Science & Training (DEST), fifty examples were included of the beneficial application of CRC research. In these solid, quantified examples, only the clearly, measurable components of the outcomes were included in the calculation of the net economic impact of the Programme. However, many of these cases also highlighted considerable "unquantified" social, environmental and health benefits from the application of CRC research. For instance, the report:

- Quantified the change in costs in wine production across South West NSW, North West Victoria and North East SA due to reduced water use resulting from adoption of irrigation approaches partially (50 per cent) developed by CRC for Viticulture. There has been 26 per cent adoption of new approaches across regions totaling 47 135 Ha, with 5Ml/Ha average water use saving per annum occurring at average water costs of $55/Ml. However, in addition to the direct cost saving to wine producers, the reduction in water use ***also carries an environmental benefit for the community that the study does not attempt to attach a monetary value to***.
- Quantified cost savings for tourism operators to be generated between 2003 and 2010 through application of Green Globe standards developed by the CRC for Sustainable Tourism. Based on a sample of end user impacts and known uptake rates, total net cost savings to tourism operators are estimated at over $80 million. However, ***what are left unquantified are the environmental benefits resulting from more environmentally friendly operating practices***.

- Quantified the contribution of the CRC for Cochlear Implant and Hearing Aid Innovation to the revenues generated by spin-off companies plus a small attribution of the gross output of a major industry partner since 1996. However, ***what are left unquantified are the benefits accrued to patients who have experienced improved quality of life as a result of receiving improved hearing through implants.***

In addition to fifty examples of CRC knowledge application where a "market" value of the application was determined, the recent DEST commissioned study into the impacts of the CRC Programme also noted that application of CRC knowledge has often generated benefits to which it is very difficult to attach a short-term "market" value. Examples of some of these "difficult to value" impacts included in the report are:

- The CRC for Tropical Savannas Management's research is focused on increasing knowledge of sustainable, holistic management practices such as the restoration of traditional burning patterns. The incorporation of local knowledge, both Indigenous and non-Indigenous, into resource management strategies has both environmental and social benefits, especially through the CRC's programs which transfer this on-country knowledge and training from older to younger people. Initiatives such as the West Arnhem Land Fire Abatement project, and the Dugong and Marine Turtle project provide employment opportunities for remote Indigenous communities, as well as delivering better environmental monitoring and management.

- The Desert Knowledge CRC aims, through its core projects, to encourage self-reliant regional economic development at the same time as acknowledging the cultural value of desert life. The CRC report on "Population and Mobility in the Town Camps of Alice Springs" was conducted by Indigenous researchers in local Aboriginal languages. Many of these researchers have subsequently been involved in a local eye health project, and in conducting the census in the town camps. In addition to directly increasing skills, employment and information, this has encouraged the valuing of Indigenous knowledge, language and culture.

- The Vision CRC's research has contributed not only to technological advances in treating avoidable blindness, but in improving delivery methods and policy strategies. Impaired vision is estimated to affect around 480 000 Australians, with Aboriginal populations suffering around ten times the levels of blindness as the rest of the community. One of the programs to which Vision CRC research contributes is the VisionCare NSW, which delivers over 80 000 pairs of spectacles a year to low income earners in NSW.

- The CRC for Antarctic Climate & Ecosystems's sea ice modelling has enabled better understanding of the implications of climate variability and its impact on sea levels and biodiversity, including possible links between Antarctic and Southern Ocean processes and rainfall on the Australian mainland. Such knowledge is likely to inform future policy decisions on, for example, shipping and fishing regulation. Given the topical and political nature of climate change, robust scientific research into these areas is of national importance.
- The CRC for Plant-based Management of Dryland Salinity has a Salinity Policy project group whose focus is on policy mechanism choice and design, and the design of institutions to deal with dryland salinity. This group's main research impact is to increase the options for stakeholders in managing salinity. While there are substantial economic implications of such research – which may be expected to inform national salinity policy, currently with a budget of around $200 million per year – the main value of this knowledge is in increasing the options for all stakeholders in managing salinity.
- The Invasive Animals CRC provides knowledge about Australian flora and fauna which have evolved in geographic isolation. For most issues concerning invasive animals, scientists cannot simply leverage overseas research; rather, there is a need for the development of local knowledge to apply to local problems. The value of this creation and maintenance of a "critical mass" of research and researchers, therefore, goes beyond the one-off economic impacts of any invasive animal management strategies it may provide. The Vertebrate Biocontrol CRC (a forerunner to the Invasive Animals CRC) contributed substantially to the development of the "Western Shield" program in Western Australia, widely acknowledged as one of the best conservation programs in the world. Western Shield involves baiting an area about three times the size of Tasmania for foxes, four times a year. Western Shield has brought back populations of the tammar wallaby, the quenda and the woylie in the wild to the extent that they have been taken off the endangered species lists in Western Australia. The program also brought back the WA animal symbol, the numbat, from the point of extinction. The fact that it is not possible to place an economic value on such achievements in no way suggests that such outcomes are not valuable.

Attachment A provides information on a further selection of some of the broader, but not economically quantified, benefits that the CRC Programme generates for the Australian community.

The consequence of the Commission Study Team not fully understanding the true nature of the diverse benefits from the CRC Programme is that the Study Team has expressed concerns over the levels of subsidy of industry benefit within the CRC Programme. For the following reasons, the CRCA believes that this concern is misplaced.

Community benefits vs private benefits: As the above discussion indicates, much of the work conducted within CRCs is focused on generating community benefits rather than generating benefits to be privately captured by CRC business participants.

Industry role in adoption: The involvement of industry is often the most effective way to get widespread adoption of research outcomes generated by CRCs. This does result in some private returns to industry; however, generally this only accrues to industry after it spends considerable resources in the further development and application of research outcomes after an industry participant leaves the CRC. However, the fact that industry does apply the research will frequently generate substantial community benefits.

The public funding of CRCs should therefore be primarily viewed as paying for the collaboration required to ensure that research is applied and that such public benefits are generated.

Industry pays to apply research: It should also be noted that, whilst CRCs vary to some degree, ***generally the industry participant does not get free ownership of the outcomes of research*** that does carry the potential for private benefit capture. In most CRCs, a commercial licence must be obtained for developed technologies, or ownership is held in proportion to the level of funding provided by the participant. In general industry is prepared to share the development risk and then pay for success. This further reduces the rate of subsidy to industry within the CRC Programme compared to the levels estimated by the Commission.

For these reasons, the CRCA believes that the rates of subsidy to private industry suggested by the Commission in the draft report are overstated. The CRC Programme in fact generates public benefits far in excess of private benefits and private beneficiaries in general are expected to “pay” for the research that has led to the benefits that they capture.

Increasing flexibility within the CRC Programme

In its draft report (for instance Section 6.28) the Commission outlines the problem of linking research organisations and SMEs. These linkages are in part being addressed by CRCs. Enhanced arrangements to provide for greater flexibility of participation in the work of CRCs would further aid these to formation and maintenance of such linkages.

It is important to emphasise here that one of the benefits of the long-term program continuity of the CRC Programme is that across the CRC Programme there has been room for a breadth of operational structures of CRCs to be tried – some successfully and other unsuccessfully. This has allowed lessons to be learned over the evolution of the Programme.

One such key lesson is that it is hard for smaller end-user stakeholders to commit to be long-term core participants of a CRC. To make room for engagement by such stakeholders it is necessary to provide for shorter-term more flexible modes of participation with CRCs. To this end, a number of CRCs have tried innovative approaches to SME engagement, ranging from outreach/information dissemination activities to the setting aside of some CRC resources explicitly to support shorter-term SME interactions. Others engage SMEs through participation by their industry associations. Some CRCs have also made it easier for participants to enter or withdraw from CRCs over the course of their operations.

There is nothing inherent in the structure of the CRC Programme or of CRCs to prevent such SME engagement activities. However, there is an important practical constraint to the extent of resources a CRC can allocate to such activities. This comes via the selection process for CRC funding applications. To secure funding, it is necessary for prospective CRCs to have concrete plans for the allocation of CRC Programme funds and there is a strong perception that simply indicating that some share of the Programme funds are to be reserved to support future collaborative engagements with SMEs is likely to result in funding applications being unsuccessful. Unless selection panel guidelines explicitly acknowledge that it is unrealistic to have future engagements with SMEs pre-defined (potentially years in advance of the activity occurring) and allow instead for CRC bidders to describe the mechanism by which future interactions will be managed, CRC bidders will continue to pre-assign most of their resources to research themes that can be clearly described in advance. The consequence of this is that there will be limited resources available to support further opportunities for SMEs once the CRC is in operation.

A final point that is worth noting is that there does need to be a degree of realism in expectations regarding how streamlined and low cost genuine, collaborative, research endeavors can be. As is highlighted in the recent CHASS report, *Collaborating across the sectors: the relationships between the humanities, arts and social sciences and science, technology, engineering and medicine sectors*, collaborative activity does inherently involve higher administrative and transaction costs than do single participant activities. For geographically and institutionally diverse collaborators to build mutual understanding, trust and effective shared practices takes time and resources. However, as is demonstrated by the strong track record of the CRC Programme in delivering net economic, social and environmental benefits for the Australian community, sustained investment in long term, collaborative research activity is an excellent investment that Australia must continue to make.

Recommendations

The CRCA would like to reiterate the recommendations made in its initial submission to the Study Team and make two further Recommendations (Recommendation Six and Seven) in relation to changes to the CRC Programme.

Recommendation One

The CRC Programme should be funded at the level required for each bi-annual funding round to award at least fifteen to twenty grants per round with each grant carrying an average value of at least $40 million in current dollar terms. This would provide a strong incentive for Universities, CSIRO and industry to continue to engage in the CRC Programme and would, by directing additional resources into highly outcomes-focused research, help deliver a better return for Australia on such resources.

Recommendation Two

The early announcement of the 2006 and 2008 funding rounds for the Programme has engendered confidence and encouraged investment by industry and research parties. Such medium term planning and announcement of funding rounds should be continued.

Recommendation Three

To ensure that the RQF encourages research of highest benefit to Australia, the CRC Association recommends that within the RQF the end impact of research is given a weighting of 50 per cent within overall RQF funding outcomes and that the impact of research is reported separately from the academic quality of research within the RQF.

Recommendation Four

The potential for improved alignment between Government innovation policy objectives and Australian Taxation Office interpretation of legislation relating to the taxation treatment of business R&D expenditure should be investigated.

Recommendation Five

The potential for better integration of the CRC Programme with other Federal programs and State programs that fund R&D should be investigated.

Recommendation Six:

The CRCA recommends that the Government accept the Productivity Commission's draft finding that the original objectives of the CRC Programme - the translation of research outputs into economic, social and environmental benefits - should be reinstated. This is likely to produce better outcomes than focusing public support [only] on the commercialisation of industrial research alone.

Recommendation Seven

CRC Programme funding should be increased – with new funding explicitly earmarked for use in the support of flexible engagement with smaller end user groups. Leveraging of existing CRC Programme administrative structure in this way will be a more cost effective mechanism for supporting flexible research collaborations with SMEs than incurring the expense of establishing a completely new complementary program as per Draft Finding 9.5

Attachment A: Further selected examples of Health, Social and Environmental benefits generated by application of CRC research

The following provides just a small set of the many examples of CRC research application generating positive health, social and environmental outcomes.

Health Benefits from CRC research application

- The Australian Biosecurity CRC for Emerging Infectious Diseases estimates the value of its research by calculating the costs to industry and the healthcare system of outbreaks of diseases such as foot and mouth disease (FMD), influenza and Severe Acute Respiratory Syndrome (SARS), given the probabilities of such events. It then estimates the role of CRC research in mitigating the impact of these outbreaks – reducing their probability, limiting their extent, or minimising costs in management. The CRC estimates that, for example, in the case of influenza, its research has the ability to reduce the likelihood of a mid-level pandemic from 0.05 per cent probability in any given year to a range of 0.0495 to 0.025. Given the potentially high costs of a flu pandemic – which could reach 0.8 per cent of GDP – the average expected value of achievement of this level of risk reduction would range from $3.9 million to $195 million per annum.

- In 2003, the CRC for Cochlear Implant and Hearing Aid Innovation (CRC HEAR) and Cochlear Ltd released the Nucleus Contour electrode. Around 30,000 were implanted worldwide. Additionally, Cochlear Ltd released the ESPrit 22 behind-ear speech processor, and developed and publicly released the Advance-off-Stylet surgical technique to insert the Contour electrode. Cochlear Ltd staff also continued to support research colleagues in projects in the US and Germany using the centre's CViews and psychophysics software. Through its Clinical Innovations program, CRC HEAR had developed software modules for audiological assessment which can be installed on a PC, enabling the introduction of new procedures into clinics around the world. The use of cochlear implants generates significant social and economic benefits, for example enabling children with hearing impairments to participate in mainstream education which results in estimated savings of $100,000 to $200,000 per student.

- In 2005, the HealthConnect project was trialled in Queensland using Distributed Systems Technology CRC developed technology. Ultimately, this is planned to expand into a national health information system, overseen by the National E-Health Authority out of the Australian Health Ministers' Advisory Council (AHMAC) and the National Health Information Group (NHIG) in 2004. The DSTC developed Pegamento middleware which allows organizations

using different web services to connect with each other, enabling modular and open systems that are not tied to one technology. Additionally, the DSTC's Elvin technology (which limits message access to authorized recipients) increases security in data management architectures. These interoperable technologies are being used in the HealthConnect network, promising significant improvements in communication between health professionals and organizations, particularly in the areas of chronic disease management. This will deliver better patient outcomes in the national health system.

- The CRC for Sensor Signal and Information Processing's collaboration with the Howard Florey Institute has resulted in advances to Magnetic Resonance Imaging (MRI) technology. These MRI technologies are used in understanding brain structure and function, and have application in the diagnosis of conditions such as breast and cervical cancers, and the detection of hearing impairments in new-born infants. Breast cancer is the most common cause of cancer-related death in Australian women, with over 11,000 women diagnosed with breast cancer every year. The annual incidence of this cancer continues to increase, rising from 94.6 per 100,000 in 1990 to 115.3 per 100,000 in 2000. Because the cause of breast cancer is not known, the key strategies for improving morbidity and mortality depend on early diagnosis, in which imaging techniques and devices play an important role. MRI technological advances therefore have the potential to improve the quality and cost-effectiveness of health care systems.
- Distributed Systems Technology CRC has developed XML Metadata through the Titanium Project group. This software product has been made available as an open source tool for the management of digitized collections of Indigenous cultural material. The Centre's XML technology has also been applied to projects in the defense and health sectors. The DSTC spin-off Extensia Solutions is projected to have annual sales of >$10M/annum by 2006-07. The company's major product, the RecordPoint data management tool, uses the Pegamento middleware technology developed at the CRC. It is expected to be used by health care organizations to improve electronic health records management, access and security. The enterprise architecture middleware technology developed by the DSTC has the potential to improve quality of service and reduce costs in the health, social services, and defense sectors.

Social benefits from CRC research application

- The Rainforest CRC has collaborated with the ACF to develop potential models for culturally and environmentally appropriate economic activities for Indigenous communities in northern Australia and Cape York Peninsula. The project concludes that nature conservation must be linked to Indigenous peoples' role on country as the best mode of sustainable economic development in the region. They propose that there is potential for a bush food industry.

- The Rainforest CRC formed a strategic alliance in 2002 with Queensland Department of Main Roads to apply research to the planning, construction and maintenance of wet tropics roads. The Rainforest CRC contribution included the development of best practice environmental quality guidelines, which were used in the Kuranda Range road upgrade.
- The microTechnology CRC's commercial companies SportZCo, Micro Relay Technology and MNT Innovations had significant input, in collaboration with the Australian Institute of Sport (AIS), into Australian team's training and performance at 2006 Athens Olympic games.
- The CRC for Sensor Signal and Information Processing in 2005 began a collaborative research project with Canon into surveillance technology. The CRC has already developed novel middleware for an internet-enabled video-surveillance system, of which a working prototype has been installed at the University of Adelaide. Fifty networked cameras are installed as part of 24 hour monitoring by Campus Security, and the system has played a key role in resolving several incidents of theft and vandalism.

Environmental and resource management benefits from CRC research application

- Researchers from the CRC for the Great Barrier Reef (GBR)World Heritage Area have worked with tourism operators, making recommendations based on several of the CRC's project groups. The tourism industry has been identified as potentially 'sustainable.' These recommendations have included the development of a code-of-practice for swim-with-the-whales activities, a collaboration with Surf-Lifesaving Queensland to identify stingers and ensure swimming beaches are closed at appropriate seasons, and the development of Eye-on-the-Reef, a web-based site-monitoring program for tourism operators. The Centre's ecosystem knowledge base supported the Reef Water Quality Protection Plan 2003; provided a base for the mapping used for rezoning of the entire Reef in 2004; and was enhanced recently by habitat surveys of high risk shipping lanes in the GBR Marine Park, which will be incorporated into the Oil Spill Response Atlas being developed by the Australian Maritime Safety Authority.
- Use of the CRC for Catchment Hydrology's MUSIC urban stormwater modelling product resulted in reductions of up to 50% in costs of infrastructure works. The MUSIC software provides urban stormwater planners and managers with modeled management scenarios. Melbourne Water is using MUSIC to plan future works and assess land development proposals, and to design stormwater treatment strategies for new and existing drainage schemes. Application of MUSIC has resulted in significant savings on capital works, whilst still satisfying water quality criteria. Brisbane City Council uses MUSIC for urban catchment planning, and to design new stormwater treatment measures in Brisbane. The Centre's

Catchment Management Support System (CMSS) software was designed to enable catchment stakeholders to improve land and catchment management strategies.

- The CRC for Catchment Hydrology had developed catchment modeling and decision-support tools. These have been used to develop management strategies in the Great Barrier Reef, Port Phillip Bay, and Moreton Bay. They will underpin implementation of the Commonwealth Coastal Catchments Initiative, as well as any likely implementation of UNEP's Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities.

- The CRC for Tropical Plant Protection undertook research into diseases affecting the horticultural and agricultural sectors, including cotton, cucurbits, lucerne, fusarium-resistant wheat and avocado crops. The CRC in 2004 conducted research into the effects of the fungus *Colletotrichum gloeosporiodes* or anthracnose in sub-tropical and tropical fruit crops such as mango, lychee and avocado. Anthracnose is the most serious post-harvest disease affecting these crops, and the implementation of recommendations for its improved management has led to a decrease of anthracnose incidence. This has resulted in reduced costs to growers, as well as a reduction of the industry's use of copper-based fungicides. In turn, this has environmental benefits from the lower levels of copper-based fungicide leached into the environment.

- The Australian Cotton CRC developed integrated pest management systems, known as IPM. This has led not only to an economic benefit of $300 million dollars to cotton growers, but has also delivered significant environmental and social benefits to Australia. There has been a dramatic reduction in pesticide use and significant improvement in water quality of the Darling River systems. For example, the percentage of water sample detections of the pesticide endosulfan in the Namoi, Gwydir and Border Rivers has decreased from around 45% five years ago to less than 1% in 2003/04. There has also been increased biodiversity in cotton regions eg bird life and other species.

- Research undertaken by the CRC for Australian Weed Management over several years underpins the Weed Risk Assessment System used by Biosecurity Australia to screen all new plant species before introduction into Australia. A recent paper by US economists (*) demonstrated that this system provides net benefits to the Australian economy of at least $5 to $10 billion. Weed CRC research in 2004 convinced Biosecurity Australia to fast-track a revision of the list of plants permitted into Australia without Weed Risk Assessment and resulted in the removal of >4,000 known weedy species from this list.

* Keller, RP, Lodge DM and Finnoff, DC. (2006) Risk assessment for invasive species produces net bioeconomic benefits. Proc. National Acad Sciences (US)