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Cooperative Research Centres - Delivering Innovation for Australia

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**Cooperative Research Centres Association:
Submission to the Productivity Commission
research study into public support for
science and innovation in Australia**

20th July 2006

Executive Summary

The key issues of interest to the Productivity Commission in its study into *Public Support for Science and Innovation*, as noted in the *Issues Paper* released in April 2006, are:

- the economic, social and environmental impacts of public support for innovation;
- impediments to the effective functioning of Australia's innovation system; and
- evaluation of decision making principles and program design for public support for science and innovation.

The Cooperative Research Centres Association is pleased to provide this submission to the study team with a view to assisting the Productivity Commission in its investigation of each of these issues. To this end, the CRC Association submission:

- provides an overview of the CRC Programme;
- sets out the role of the CRC Programme within the broader innovation system;
- details the evolution of the CRC Programme since its inception in the 1990;
- outlines the types of benefits delivered by the CRC Programme;
- presents the measured economic impact of the CRC Programme to date;
- discusses the future evaluation of the CRC Programme; and
- puts forwards a number of issues for future CRC Programme performance and suggestions for how these issues should be addressed to optimise future Programme performance.

The CRC Programme has played a pioneering role in bringing together public and private sector researchers and research end users to focus on solving real challenges of importance to Australia. 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 focused 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.

Due to the changes to the CRC Programme over its nine funding rounds, and in particular the changes made in the two most recent funding rounds, the CRC Programme has steadily evolved in terms of both how successful applicants are selected and how CRC outcomes are evaluated. Changes have been made with a view to steadily enhancing end user engagement within CRCs, ensuring that there are clear pathways for the adoption of the CRCs' research, and to adding increasing rigour and transparency to evaluating the performance of the CRCs within the Programme.

The CRC Programme delivers benefits to Australia through a number of mechanisms including the direct commercialisation of research, the application of research outcomes by industry or public sector end users, enhanced access to international knowledge networks, skills formation and the generation of “industry ready” post-graduates, and through establishing long-term collaborations between public and private sector researchers.

The 2005 CRC Impact Study commissioned by the Association demonstrated that the CRC Programme is meeting “third stream” objectives and the prima facie case for its continuation is clear. The Programme has made a strong positive net contribution to Australian’s economic welfare. The CRC Programme’s performance also appears to be improving over time with the majority of benefits from past investment still to be delivered.

Given Australia’s relatively high levels of public funding for research compared to its levels of business investment in research, the central role of the CRC Programme in encouraging public-private research collaboration and in enabling research end users to access and apply the excellent research generated by our strong public research base remains as important as ever.

Notwithstanding its strong track record in delivering outcomes, a number of issues now confronting the CRC Programme need to be successfully addressed in order to ensure strong performance into the future. These issues include the:

- level of future CRC Programme funding and funding certainty;
- forthcoming Research Quality Framework and its potential impact on the Programme;
- taxation environment for CRCs and for research commercialisation in general; and
- the importance of proper integration of the CRC Programme with other Federal and State R&D funding programmes.

To address these issues, the CRC Association puts forward the following five recommendations for the consideration of the Productivity Commission study team.

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 and State R&D funding programs should be investigated.

Overview of the CRC Programme

The CRC Programme was established in 1990 to improve the effectiveness of Australia's research and development effort through bringing together researchers in the public and private sectors with the end users of research. The overall objective of the Programme is to enhance Australia's industrial, commercial and economic growth through the development of sustained, user-driven, cooperative public-private research centres that achieve high levels of outcomes in adoption and commercialisation.

The CRC Programme links researchers with industry and government to focus R&D efforts on progress towards research application. The close interaction between researchers and the users of research is the defining characteristic of the Programme. Moreover, it allows end users of research to help plan the direction of the research as well as to monitor its progress. This facilitates a more rapid uptake and use of the research – it avoids the situation of “technology looking for a market”.

This provider/end user collaboration is borne out in the strong and steadily rising levels of industry researcher involvement within CRCs. Industry researchers within CRCs now represent over 20 percent of all researchers involved in CRCs. This reflects a doubling in the representation of industry researchers over the past decade. Strong industry contribution to CRC education programs, with a view to producing “industry-ready” graduates, is another manifestation of the focus on provider/end user collaboration within the CRC Programme.

Since the commencement of the Programme, there have been nine CRC selection rounds, resulting in the establishment of 158 CRCs over the life of the Programme. There are currently 54 CRCs in full operation across the six industry sectors in which CRCs operate (Manufacturing, ICT, Mining & Energy, Agriculture & Rural Based Manufacturing, Environment, Medical Science & Technology).

Table 1 **Number of CRCs established by sector and funding round**

	Manufacturing	ICT	Mining and energy	Agriculture and rural based manufacturing	Environment	Medical science and technology	<i>ALL SECTORS</i>
Round 1 (1990)	1	2	3	3	3	3	15
Round 2 (1991)	5	3	2	4	2	3	19
Round 3 (1992)	2	3	2	5	4	1	17
Round 4 (1994)	1	0	3	3	3	1	11
Round 5 (1996)	1	1	3	3	3	5	16
Round 6 (1998)	6	4	2	4	7	3	26
Round 7 (2001)	4	2	3	4	4	2	19
Round 8 (2003)	1	3	3	5	6	3	21
Round 9 (2005)	3	0	1	5	3	2	14
All Rounds	24	18	22	36	35	23	158

Source: Analysis of *CRC Directory 2006*; *CRC Compendium 2000*; *CRC Compendium 1993*; and Mercer & Stocker (1998), *Review of Greater Commercialisation and Self Funding in the CRC Programme*.

Over the nine funding rounds, all parties have committed than \$11 billion (cash and in-kind) to CRCs. This includes \$2.7 billion from the CRC Programme, \$2.9 billion from universities, \$2.1 billion from industry, \$1.3 billion from States and \$1.2 billion from CSIRO.

In terms of Commonwealth Government cash support provided through CRC grants, around \$2.3 billion has been provided between 1990/91 and 2005/06. Current annual Commonwealth CRC Programme funding represents around 3.5 per cent of total annual Commonwealth Government support for Science and Innovation¹.

The role of the CRC Programme within the broader innovation system

The CRC Programme has undergone a number of reviews. Two major Programme reviews have been the 1998 *Review of Greater Commercialisation and Self Funding in the CRC Programme* (Mercer and Stocker) and the 2003 *Evaluation of the CRC Programme* (Howard Partners). These reviews provide important insights into the unique role of the CRC Programme within the broader Australian innovation system.

The key conclusions of the 1998 Mercer and Stocker review were that:

¹ DEST, *Science and Innovation Budget Tables 2006-07*

“The CRC Programme is widely seen as the most successful mechanism in Australia for linking users with research organisations. All countries have sought to develop mechanisms for this purpose but there is no evidence that would suggest that any other country’s experience provides institutional or Programme models that would offer advantages over the CRC Programme. Indeed the CRC Programme has attracted international attention as a successful linking mechanism. The CRC Programme is a bridging mechanism in the innovation system, rather than another contract research mechanism to provide subsidised research to industry.

The CRC Programme addresses important weaknesses in the national innovation system, in particular the disincentives to collaboration among research providers, the weak links between research organisations and users, the lack of critical mass due to the institutional and geographical dispersion of Australian research and research application, the lack of mobility of personnel between government research, academia and industry, and the challenges of effective international links for a country isolated from the international centres of research and innovation. The Programme complements the work of the universities, CSIRO and other research organisations. It stimulates greater industry spending on R&D and greater industry involvement in guiding R&D in the public sector.”

The 2003 Howard Partners review also highlights the distinctive features of the CRC Programme within the broader innovation system. It notes that:

“The CRC Programme is distinguished from a range of other public programmes designed to foster closer links between research users and research providers by the size of the Commonwealth payment – ranging from \$12m to \$30m – and the timeframe of commitment – typically seven years. The Programme also differs in that it requires the formation of a managed relationship between CRC participants in the form of a formal joint venture partnership. This differs from the gift-based (or unrequited) relationships that underlie many other research grant programmes.”

The 2003 review also notes that since the start of the Programme there have been significant changes in Australia’s research and innovation culture and that:

“To accommodate these changes it has been necessary to develop a capacity to carry out partnership-based research and innovation, business development based on research commercialisation, and for scientists to engage in public programme design and delivery. The CRC Programme has been an important contributor to that capacity building.”

The review also noted that:

“The emergence of public-private research partnerships reflects a fundamental change in the way in which knowledge is generated and applied as well as changes in approaches to the management of industrial research and development. The CRC Programme sits well in the developing system of industrial research built around the production of “knowledge in application”, or “applicable” knowledge.”

While there are now some other “linkage” mechanisms in place within the Australian innovation system, including ARC linkage and a number of State based programs such as the Victorian Science Technology and Innovation infrastructure grants programme, the CRC Programme remains the only arrangement for initiating and supporting long-term large scale linkages that transcend state boundaries. It is also notable that the CRC Programme has served as a model for international “linkage” innovation support programs such as the Canadian National Centres of Excellence programme.

Given Australia’s relatively high levels of public funding for research compared to its levels of business investment in research, the central role of the CRC Programme in encouraging public-private research collaboration and in enabling research end users to access and apply the excellent research generated by our strong public research base remains as important as ever.

The evolution of the CRC Programme

The CRC Programme was the first major research funding Programme to be focused on promoting collaboration between research providers and research users and to adopt a clear focus on the application of research. The Programme faced a challenge in changing the culture within the public research sector from a largely inward looking focus to an outlook that recognised the importance of engaging with a wider audience than the academic community. Unsurprisingly, given the novelty of the Programme’s focus and the strength of the existing culture within the public research sector, in its early days the Programme was perhaps seen by some as “just another pot of money” and not all CRCs had the levels of end user engagement that would now be expected of a CRC.

However, over time, the Programme has evolved and it is clear that in recent funding rounds, to be successful in securing funding, a CRC proposal must be genuinely end user driven and there must be a clear pathway in place for how high quality research is going to find application.

At the same time there has been a shift in the structure of CRCs – with CRCs now being established as incorporated entities rather than unincorporated joint ventures – to promote better governance arrangements within CRCs.

The 2003 Programme review described the evolution of the CRC Programme collaborative model as follows:

“The CRC Programme, which started as a “bottom up” collaborative venture between researchers provided a strong basis for developing trust-based relationships between organisations. With increasing internal resource constraints and the need to set priorities, the Programme has now moved to the next level where collaboration between universities, publicly funded research agencies, business and government is being approached at a more strategic level.”

The 2003 review also noted that:

“The Outcomes Survey provided very positive indications in relation to collaboration. In relation to specific outcomes, about half of the research users indicated that they obtained a high or very high level of value from the collaboration. It would appear that the CRC arrangements are regarded highly for the networking activities and opportunities of the researchers.”

It is important to note that the ongoing shift within the CRC Programme towards greater end-user engagement and clear pathways for application of research has not meant a shift in focus towards the generation of privately captured economic benefits to the exclusion of publicly captured economic benefits.

Alongside a focus on increasing end-user engagement, another area of evolution for the Programme has been the shift towards larger grants being awarded to successful CRC applicants. This shift to larger grants has been made to appropriately respond to the rising costs of conducting high quality research, the ongoing importance of critical mass in research activity, and in recognition of the transaction costs associated with the CRC application process and the costs of establishing incorporated CRC entities.

It should be stressed that transaction costs are not just monetary ones but also include the time associated with the management of CRCs. As was noted in the 2003 Programme Review, CRCs are “managed relationships” and take time and effort to form and maintain because of the challenges involved in bringing together groups from different backgrounds and locations.

Reflecting in part the high value that is attached to the relationships that the CRC Programme incubates, it is possible for CRCs to extend their operations beyond just one funding term. Existing CRCs that wish to apply for an additional term (or terms) must compete with all other applicants and to succeed must be able to demonstrate both a strong track record of achievement and a clear plan for what new directions they will be pursuing. The decision to allow such “new from existing” CRC bids was made because it was recognised that where valuable collaborative relationships have been formed, it is important that they continue to be nurtured.

Table 2, which looks at CRC grants on an average per CRC basis, highlights the move towards larger CRC grants over the life of the Programme.

Table 2 Average (per CRC) CRC Programme funding by sector and funding round

		Manufacturing	ICT	Mining and energy	Agriculture and rural based manufacturing	Environment	Medical science and technology	<i>ALL SECTORS</i>
Rounds 1, 2 & 3 *	CRC \$m	11.8	13.8	14.3	13.1	10.8	13.4	13.0
Round 4 (1994)	CRC \$m	16.7	-	13.1	15.0	14.5	14.7	14.8
Round 5 (1996)	CRC \$m	21.4	18.6	15.5	16.1	13.5	14.0	15.4
Round 6 (1998)	CRC \$m	15.4	18.9	16.3	14.2	15.3	13.0	15.5
Round 7 (2001)	CRC \$m	13.9	18.2	17.6	17.6	20.6	18.9	19.7
Round 8 (2003)	CRC \$m	14.3	15.0	22.5	24.5	22.6	25.3	21.9
Round 9 (2005)	CRC \$m	34.6	-	20.0	25.9	33.3	24.0	28.7

* Total resourcing data for all sectors in Rounds 1, 2 and 3 only available in aggregate.

Source: Analysis of DEST (2006), *CRC Directory 2006*, *CRC Compendium 2000*, *CRC Compendium 1993*.

When the above nominal values are converted to constant 2006 dollars, average (all sectors) Programme funding per CRC has risen from \$17 million per CRC in Round One to \$29 million per CRC in Round Nine. However, until Round Nine the change was quite gradual. The shift to larger grants was much stronger in the most recent funding round, with the number of grants awarded declining by 33 percent when compared to the previous round but the average grant size increasing by 31 percent when compared to Round Eight of the Programme. The CRC Programme has in effect adopted a “fewer bigger better” approach.

This shift to larger grants sizes was made possible by the boost in funding that the Programme received under the first Backing Australia’s Ability initiative. In addition to addressing issues such as transaction costs, the increase in the size of the CRCs was seen as important to enhancing international collaborations and allowing for greater interaction with SMEs.

In terms of total CRC resourcing, in 2006 dollars average (all sectors) resourcing increased from \$61 million for Round One to a peak of \$118 million for Round Eight CRCs before declining somewhat to \$95 million for Round Nine CRCs. As shown in Table 3, for Round Nine CRCs, the Programme funding as a share of total CRC resources rose to 30 percent, up from the 19 percent level for Round Eight CRCs. This has resulted in a return to the ratio associated with the first four funding rounds for the Programme.

Table 3 CRC Program funding and total CRC resourcing by sector and funding round

		Manufacturing	ICT	Mining and energy	Agriculture and rural based manufacturing	Environment	Medical science and technology	<i>ALL SECTORS</i>
Rounds 1, 2 & 3*	CRC	94.7m	110.3m	100.3m	157.6m	97.5m	94.0m	666.4m
	Total	283.0m	360.0m	330.0m	585.0m	405.0m	290.0m	2353.0m
	CRC%	27.4%	33.3%	30.3%	28.2%	30.9%	32.8%	30.2%
Round 4 (1994)	CRC	16.7m	-	39.2m	29.9m	57.9m	14.7m	379.6m
	Total	48.4m	-	180.5m	127.0m	207.0m	40.7m	1260.0m
	CRC%	34.6%	-	21.7%	23.5%	28.0%	36.1%	30%
Round 5 (1996)	CRC	21.4m	18.6m	46.5m	48.4m	40.5m	70.2m	245.6m
	Total	61.2m	58.0m	241.4m	189.1m	198.5m	309.7m	1057.9m
	CRC%	35%	32.1%	19.3%	25.6%	20.4%	22.7%	23.2%
Round 6 (1998)	CRC	92.2m	75.4m	32.6m	56.9m	107.3m	39.1m	403.5m
	Total	434.5m	479.7m	157.3m	293.9m	458.7m	145.0m	1969.1m
	CRC%	21.2%	15.7%	20.7%	19.4%	23.4%	27.0%	20.5%
Round 7 (2001)	CRC	55.5m	36.3m	52.7m	70.5m	82.3m	37.8m	335.1m
	Total	261.7m	152.0m	290.8m	377.3m	421.2m	242.2m	1745.2m
	CRC%	20%	24%	18%	19%	20%	16%	19%
Round 8 (2003)	CRC	14.3m	44.9m	67.6m	122.6m	135.3m	76.0m	460.7m
	Total	64.9m	269.4m	344.2m	474.6m	628.6m	637.7m	2419.4m
	CRC%	22%	17%	20%	26%	22%	12%	19%
Round 9 (2005)	CRC	103.9m	0	20.0m	129.4m	99.9m	47.9m	401.1m
	Total	299.2m	-	75.7m	497.7m	332.3m	131.6m	1336.5m
	CRC%	35%	-	26%	26%	30%	36%	30%
TOTAL Rounds 1 - 9	CRC	398.7m	285.5m	358.9m	615.3m	620.7m	379.7m	2648.8m
	Total	1452.9m	1319.1m	1619.9m	2176.3m	2651.3m	1796.9m	11016.4m
	CRC%	27.4%	21.6%	22.2%	28.3%	23.4%	21.1%	24.0%

* Total resourcing data for all sectors in Rounds 1, 2 and 3 only available in aggregate.

Source: Analysis of DEST (2006), *CRC Directory 2006*, *CRC Compendium 2000*, *CRC Compendium 1993*.

The cash that the CRC Programme provides acts as the “glue” that holds the CRCs together and provides the necessary incentive for individual partners to invest the time and energy required to form new collaborations.

The provision of higher CRC Programme funding as a share of total resources in Round Nine reversed the long term declining trend over previous funding rounds. In part this was done to ensure the continued “additionality” of the CRC Programme. The relative funding increase recognised that if Programme funding falls too low as a share of total CRC resourcing, the risk increases that the Programme would, rather than initiating the formation of new collaborative partnerships focused on delivery of relevant research, simply be providing “top up” funding for collaborations that would have occurred in any event. The recent increase in CRC Programme funding as a share of total CRC resourcing is therefore in keeping with the overall goal of the Programme to foster the production of research of an excellent standard that would not have been undertaken otherwise.

The changes to the CRC Programme over its nine funding rounds, and in particular the changes made in the two most recent funding rounds, have been made to ensure i) the continued relevance of the Programme in a changing innovation environment and, ii) that the Programme continues to play a key role in bridging the gap between the generation of knowledge and its application to deliver real benefits for Australia.

Types of benefits delivered by the CRC Programme

The CRC Programme delivers a wide range of benefits for Australia. Such benefits include:

- **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.
 - *The 2005 Economic Impact Study of the CRC Programme commissioned by the CRCA details a wide range of direct economic benefits that have resulted from the CRC Programme that are additional to those that otherwise would have occurred. The outcomes achieved were only possible due to the CRC Programme bringing together researchers and end users and providing a critical mass of resources to outcome driven research.*
- **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 or processes enabled by CRC generated IP.
 - *While such benefits are often very hard to attach a definitive “value” to, as detailed in the 1998 and 2003 Programme reviews and the 2005 Impact study, the CRC Programme has generated positive outcomes across a wide spectrum of areas through the dissemination of research findings which are then applied by end users. As noted in the 1998 review “the wide dissemination of new knowledge, rather than its appropriation by a few firms, is vital if it is to have a significant commercial impact.” The application by end users, resulting from means other than direct*

commercialisation, of CRC generated knowledge is particularly important in delivering environmental, agricultural productivity and health benefits from the programme.

- **Enhanced access to international knowledge networks.** Australia is less than 1 percent of the global economy and in relation to 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.
 - *As noted in the 2003 Programme Review, a key objective of the Programme is increased collaboration with international research networks. A substantial increase in the number of international collaborations (from 508 to 935) was noted between 1996 and 2001. Outside the USA, the largest number of collaborations were within Australia's region.*
- **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 that then work in industry and allow industry to be smart adopters and adapters of internationally generated technology/knowledge.
 - *The 2003 Review of the CRC Programme noted that "One the most positive aspects of the CRC Programme has been the contribution to the training of PhD students. CRC based training of PhD students has an advantage in that these students develop a tacit knowledge of the importance of application and adoption of research and how to interact with industry. This positive externality will greatly assist in developing a culture of adoption and application within Australian industry and government."*
- **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 manager's than understand both research provider and end user perspectives and the importance of actively planning for and management the route to application for research.
 - *The 2003 Review of the CRC Programme noted that "The capacity to collaborate largely resides in the cohorts of researchers who have passed through the CRC system. Their experience and training has exposed them to knowledge in different disciplines and sectors. It has also exposed them to a greater diversity of research problems than would otherwise have been the case." and that "The enhanced capacity for inter-disciplinary and inter-sectoral work allows complementary intellectual assets to be brought together to do new things in new ways. This is the foundation both for leading-edge research and for successful innovation."*
- **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.

The measured economic impact of the CRC Programme

In 2005 the Cooperative Research Centres Association commissioned a study into the economic impacts of the CRC Programme since its inception. The goal of the 2005 Allen Consulting Group study was to undertake a highly rigorous and transparent assessment of the delivered impacts to date of the CRC Programme.

The objective was to be able to demonstrate the real and incontrovertible benefits that have been generated by the CRC Programme. The study was very definitely not about delivering a "big number" for benefits that, while making researchers feel good, would not stand up to scrutiny. To be included in the economic impact quantification component of the study, an impact had to meet the following criteria:

- The benefit must have been clearly attributable to the activities of CRCs – benefits must have been unlikely to have occurred in the timeframe under consideration without the presence of the CRCs.
- The benefit must have been a delivered benefit, not an anticipated future benefit – quantification of expected future outcomes is an uncertain process and will always be open to differing opinions.
- The benefits must have been verified and quantified by the end beneficiaries of the CRC generated knowledge, rather than by CRCs as the generator of the knowledge – for instance in the case of improved productivity through application of CRC technology in an existing industry, it had to be the industry users of the CRC technology, not the technology generators that quantified the impact.

This study was unique in that it measured only the quantified and verified (by end users) delivered net benefits of a major Government R&D funding program in Australia.

Even with the exclusion of a number of significant but unquantifiable benefits generated by the CRC Programme, the study shows that the CRC Programme has delivered a clear net economic benefit for Australia. Through modeling using the Centre of Policy Studies Monash MMRF CGE model of the Australian economy, the CRC Programme was shown to have resulted in cumulatively an additional \$1.14 billion in Gross Domestic Product and \$763 million in Real Consumption compared to what

would have occurred if the money invested by the Government in the Programme had instead been allocated to general Government expenditure.

Given the strict criteria used for inclusion in the study, these returns should be viewed as the absolute minimum calculation of benefits that have been delivered by the CRC Programme. Actual returns are likely to be significantly higher than those shown in this study, both now and into the future.

Beyond the issue of quantification of delivered impacts from the CRC Programme, the 2005 CRC Impact Study highlighted a number of important points in relation to the nature of the benefits delivered by the CRC Programme and in relation to CRC Programme relative performance in areas such as direct commercialization activity, industry engagement and research student training.

Measured benefits from the Programme have primarily been delivered through the application of research by industry to reduce costs and increase productivity and through the sale of new products (by existing or new companies) that are based on CRC research. The time lag between the commencement of a CRC and the achievement of these quantifiable economic impacts can be significant, with lags of between 4 and 12 years (average of nine years) observed in the case of the events that were included in the economic impact assessment.

The study demonstrated that over time the CRC Programme's performance, especially in relation to industry engagement, has been improving and the pipeline of future potential benefits from the CRC Programme looks strong. Over the life of the Programme, CRCs have sourced 19 percent of their resources from industry. This is significantly higher than the average 5 percent industry contribution to R&D in Australian universities over the same period².

Even given the fact that the majority of measurable benefits delivered to date by CRCs have come through the application of CRC generated knowledge to improve end users existing products and processes, when compared to the wider university system CRCs have a strong demonstrated track record in relation to the direct commercialisation of research outcomes.

Table 4 Commercialisation outcomes from universities and the CRCs in 2002 (units per \$ million of Commonwealth Government research funding)

Commercialisation activity	Universities	CRCs
Inventions disclosed	0.26	0.50
Patent applications filed	0.23	0.51
Patents issued	0.06	0.17
Licenses executed	0.11	0.32

Sources: Commercialisation performance data from DEST, (2004), *National Survey of Research Commercialisation*; Commonwealth expenditure data from DEST, (2004), *Australian Science and Technology at a Glance*, Chart 36.

² DEST, *Science and Innovation at a Glance 2004*

Another important finding from the 2005 Impact Study is that impacts of the Programme in the area of postgraduate student training is strong. The number of postgraduate students involved in CRCs has risen steadily over the life of the CRC Programme. There is also evidence of positive outcomes associated with the CRC training environment, including: higher student satisfaction with faculty quality; higher student satisfaction with equipment quality; more positive views of career prospects; and a stronger interest in pursuing a research career in industry.

Furthermore, the unique linkage between the CRCs and industry exposes the postgraduate students to industry related employment and realities, which can enhance the employability of CRC trained postgraduates. Reflecting this, to date over 2,500 CRC trained post-graduates have taken up employment within Australian industry.

A 2004 study³ that compared the experiences of CRC-related and non CRC-related PhD students enrolled in science-based disciplines at two research intensive universities suggests that CRC-related PhD students have a more positive experience on a range of important measures. This study reported that the CRC-related students were:

- More likely than non CRC-related students to rate the quality of their university department highly.
- More likely than non CRC-related students to rate the quality of access to specialised equipment highly.
- More likely than non CRC-related students to aspire to a research position within industry.
- More likely than non CRC-related students to feel positive about their career prospects.

In addition, the study found that CRC-related students were:

- Less likely than non CRC-related students to feel 'trapped in their area of specialisation.
- Less likely than non CRC-related students to feel that 'research links with industry threaten traditional academic values.

These results, while based on a survey at only two institutions, do suggest that the training delivered within CRCs may contribute to students having a more positive training experience and to students having more positive attitudes towards working within, or collaborating with, industry in the future. Further research into the impacts of CRCs on student outcomes would be valuable, providing a stronger base of information to inform future training practices across the research sector.

³ Harman, K., (2004), *Producing 'industry-ready' doctorates: Australian Cooperative Research Centre approaches to doctoral education*, Studies in Continuing Education, Vol. 26, No. 3, November 2004

Overall the 2005 CRC Impact Study demonstrated that the CRC Programme is meeting “third stream” objectives and the prima facie case for its continuation is clear. The CRC Programme’s performance also appears to be improving over time with the majority of benefits from past investment still to be delivered.

Future evaluation of the CRC Programme

The 2005 Impact Study noted that to improve CRC Programme evaluation in the future, there needs to be a stronger focus on tracking of final outcomes achieved by CRCs. This is a particularly difficult challenge for CRCs where the benefits are widely diffused – such as in the agricultural sector. However, since the 2005 study a number of CRCs have been doing some very interesting work in relation to better tracking, verifying and quantifying their impacts. Again, this highlights the willingness of the CRC Programme in general and individual CRCs in particular to respond to constructive suggestions for change and strive to improve their performance and performance management.

Given the deliberately limited scope of the 2005 study, in order to develop a more complete picture of the benefits of the Programme the Department of Education, Science and Training has recently commissioned Insight Economics to extend the work of the 2005 study to quantify the full benefits from the CRC Programme. To this end Insight Economics will be looking to both update the 2005 study’s findings through inclusion of end impact information that was not available at that time, as well as conducting some additional levels of economic impact assessment. In this way, it is hoped that a more complete picture of the impacts of the CRC Programme will be able to be developed.

The commissioning of this new study, and the active support for this study that is being provided by the CRC Association and its members, reflects the ongoing commitment of the CRC Programme to playing a leadership role within the Australian innovation system, through its establishment of best practice performance monitoring and performance accountability practices.

Issues confronting the CRC Programme

Notwithstanding its strong track record in delivering outcomes, a number of issues now confronting the CRC Programme need to be successfully addressed in order to ensure strong performance into the future. These issues include the:

- level of future CRC Programme funding and funding certainty;
- forthcoming Research Quality Framework and its potential impact on the Programme;
- taxation environment for CRCs and for research commercialisation in general; and

- the importance of proper integration of the CRC Programme with other Federal and State R&D funding programmes.

Each of these issues and recommendations relate to the Productivity Commission's terms of reference, specifically, the need for the study to identify "impediments to the effective functioning of Australia's innovation system".

The level of future CRC Programme funding and funding certainty

The forward estimates show CRC Programme funding is forecast to decline from 2006-07 onwards. At currently projected funding levels, the Programme will either need to reduce the level of funding awarded to CRCs in future funding rounds, which would be a significantly retrograde step for the Programme, or further reduce the number of CRC grants awarded in future funding rounds. Given that only 14 grants were awarded in Round Nine, with a number of high quality bids not being funded, any further reduction in grant numbers would jeopardise the ability of the Programme to continue to operate across its six industry sectors and would result in bid success rates falling so low as to become a major disincentive for bidders to enter future application processes.

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.

Certainty of future funding is particularly important for the business community if it is to commit to long-term research collaborations. Information needs to be available in relation to the size of the funding pool available well in advance of each funding round application process, so that business can properly assess the merits of participation in the Programme.

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.

The forthcoming Research Quality Framework and its potential impact on the Programme

A particular concern for the Programme is that the forthcoming introduction of the RQF. If traditional academic quality indicators rather than indicators of end application and impact dominate in determining funding outcomes, may have the (unintended) effect of forcing the Universities with a

business strategy focused on applied research into a strategy based on academic research. An RQF dominated by academic “quality” indicators could provide a strong disincentive for Universities to participate in impact oriented research activities such as those within CRCs. It is also reasonable to speculate that such an outcome may also further diminish the already low co-investment by Australian industry in public sector research by reducing opportunities for industry to partner with University research groups.

While it may be difficult to demonstrate “final” delivered impacts from research within the assessment cycle of the RQF, there are a number of credible measures of impact that could be presented for assessment within the RQF. For instance, measures of “repeat business” from end users of research, levels of engagement with end users and the extent to which research is in the process of being applied or commercialised could all be provided and assessed within a six yearly RQF assessment cycle. Although less established than some “academic quality” indicators, the availability of a range of valid impact indicators suggests that arguments for downplaying the role of impact within RQF funding outcomes that are based on the asserted lack of suitable assessment tools are not valid.

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.

The taxation environment for CRCs and for research commercialisation in general

The current taxation legislation and rules are driving complex governance arrangements for incorporated CRCs. Tax rules are driving structures which are not necessarily the most efficient or effective. It is appropriate that CRCs (with multi-million dollar budgets and high level research and industry involvement) have high governance standards, and taxation issues should not be a policy driver. As a general principle, participants in collaborative research should have access to all the research and development incentives available to others. The current tax rules limit (or create uncertainty around) access by eligible businesses to the R&D tax concession. This may be a disincentive for industry involvement in CRCs. Legislation to clarify the position of CRCs (and similar public-private partnerships) might be an area for investigation, especially to resolve taxation issues.

As government becomes more concerned with the economic (and social/environmental) impact of research, the taxation system could provide important incentives for commercialisation and other forms of research adoption. The Productivity Commission should look at the current taxation incentives/barriers to research adoption and commercialisation (e.g. the Intellectual Property Research

Institute of Australia's paper on 'Tax Problems in the Commercialisation of Intellectual Property') as part of this study.

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.

The importance of proper integration of the CRC Programme with other Federal and State R&D funding programmes

Better integration of the CRC Programme with other Federal and State R&D funding programs would promote greater efficiency and effectiveness within the innovation system. Currently there is a fragmentation of funding mechanisms focused on promoting collaborative research which leads to overlap and confusion amongst stakeholders (and particularly industry stakeholders). This in turn increases transaction costs and risks sub-optimal resource allocation decisions.

In addition to an increase in recent years in the number of collaboration and outcome oriented funding programs, there is also an outstanding issue in relation to how the CRC Programme relates to other key competitively allocated funding programs. For instance, there is still the perception amongst many University researchers that if you are involved with a CRC it will jeopardize your chances of getting an ARC grant due to unfounded concerns over the potential for grant “double dipping”. The Commercial Ready Program, which occupies a “similar” space to the CRCs, appears to be a potential funding source for incorporated CRCs. However, in practice impediments exist that reduce the ability of CRCs to access funding through this program. Concerns surrounding the potential for, rather than the actual occurrence of, grant “double dipping” seem to exclude incorporated CRCs from accessing this Government program.

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.