Combined Response to the Productivity Commission's Draft Report on Public Support for Science and Innovation in Australia

Combined CRCs

18 December 2006

CRC for Beef Genetic Technologies

CAST CRC

CRC for Innovative Dairy Products

CRCMining

CRC for the Australian Poultry Industries

The Australian Sheep Industry CRC

Vision CRC

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1 Introduction

The Productivity Commission (PC) Research Study into Science and Innovation (the Study) has generated significant discussion about the national economic, social and environmental benefits derived from publicly-funded science and innovation in Australia.

With the release of the Draft Research Report (the Report) in November 2006, the group of Cooperative Research Centres (Combined CRCs), who made a joint submission to the Study (the Submission), is pleased to provide further comment on the specific contribution of CRCs in the context of the Report.

The Combined CRCs are composed of:

- CRC for Beef Genetic Technologies (Beef CRC)
- CAST CRC (CAST CRC)
- CRC for Innovative Dairy Products (Dairy CRC)
- CRCMining (Mining CRC)
- CRC for the Australian Poultry Industries (Poultry CRC)
- The Australian Sheep Industry CRC (Sheep CRC)
- Vision CRC (Vision CRC)

The Combined CRCs have prepared this response to the Report in close consultation with the Cooperative Research Centres Association (CRCA). The Combined CRCs fully support the key points made in the CRCA response, particularly the breadth of the benefits delivered by the CRC Programme and the flexibility of the CRC Programme to meet the needs of small to medium enterprises (SMEs), as well as larger organisations.

The Combined CRCs welcomed the opportunity to engage directly with the Productivity Commission (PC) at the Roundtable held in Canberra on 29 November 2006, and this response is framed around:

- the specific issues raised at the Roundtable, where the PC sought further input
- the Combined CRCs' response to the Report itself.

Reference will also be made to the original submission to the Study by the Combined CRCs. However, no additional new material will be introduced at this stage.

The views and recommendations presented in this submission are those of the individual contributors from each of the Combined CRCs and are not necessarily shared by all participants and partners in the Combined CRCs.

2 The Diversity of CRCs

The CRC Programme is extremely diverse, as demonstrated by:

- the broad range of specialist interest areas covered by CRCs past and present. Since the start of the Programme, 158 Cooperative Research Centres have been established. There are currently 57 CRCs operating in six industry areas.
- the participation of a variety of research organisations and project partners, from companies the size of Rio Tinto and BHP Billiton to SMEs employing a handful of staff, and
- the spectrum of benefits delivered by CRCs, from public health programs in remote communities and developing countries, to corrosion research programs for aircraft giant Boeing.

Such diversity can be difficult to capture in an analysis as broad ranging as the Report. However the Combined CRCs believe this very diversity is one of the strengths of the CRC Programme. The Report would be enhanced by greater recognition of:

- the breadth of experience and range of operating structures of CRCs and
- the lessons learned over the evolution of the Programme, particularly in relation to the efficiencies gained by implementing the 'optimal model'.

The Submission includes recommendations to ensure that the negative experiences of some users of CRCs are minimised. Many past difficulties in dealing with CRCs arose from poor governance structures that generated operational inefficiencies and IP disputes. The 'optimal model' has evolved through learning from good and bad experiences of CRCs. It overcomes many of the structural problems experienced by earlier CRCs, which in turn have created occasionally negative perceptions around the Programme.

As stated in chapter 3.1 of the Submission, the 'optimal model' involves a single uniform structure agreement in the form of Option 2 of the Australian Institute for Commercialisation template agreements. This business model allows CRCs to:

- be an incorporated company limited by guarantee
- have a tailored board with appropriate skills
- own the IP legally and beneficially
- be a not-for-profit company
- reinvest income into R&D
- be tax exempt.

A single uniform structure agreement would eliminate negotiation between the participants with regard to the Participants' Agreement and reduce the associated legal and tax costs.

In delivering these 'optimal model' benefits, Option 2 should be specified by DEST as the default company structure for CRCs. While this structure will be ideal in most cases, such is the diversity of CRCs, there should still be provision for CRCs to opt for an alternative structure if more appropriate.

The Combined CRCs believe appropriately structured CRCs are flexible enough to deal with both short and long term research arrangements and therefore do not

support the PC's statement (Overview of the Report) that 'the CRC program is only suited to longer term arrangements'.

The Combined CRCs refer the Productivity Commission to the specific recommendations on this subject included in the Submission, namely:

Recommendation 7

DEST should be prescriptive by insisting the optimal model (Option 2) is used by newly formed CRCs. DEST should specify that the CRC company has legal and beneficial ownership of their IP.

Recommendation 10

Enforce optimal company structure at the commencement of a CRC.

Recommendation 11

Consider measures to reduce the time consumed in the renewal application process.

Recommendation 13

Enforce the ideal CRC company model as a mechanism to streamline relations between CRCs and other public research organisations.

3 Social Benefits and Spillovers

The Combined CRCs support the desire of the PC to provide good coverage and analysis of the social benefits that derive from publicly funded R&D, and believe that the outcomes of the CRC Programme make a significant contribution to the public good. In this context, the Combined CRCs endorse Draft Findings 6.1 and 9.4 (in part), namely that:

- *Decision making within universities in relation to the transfer, diffusion and utilisation of research outputs should not focus unduly on an objective of commercialisation to the detriment of maximising the social return from the public's investment; and*
- *The CRC program could be improved in several ways:*
    - *the original objectives of the program — 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 on the commercialisation of industrial research alone*

The Combined CRCs believe there is a misconception that CRCs unfairly subsidise the R&D of their industry partners and therefore dispute the second part of Draft Finding 9.4. This is elaborated on in Chapter 4 of this document.

CRCs not only deliver new technologies to industry, they provide a raft of social benefits and other spillovers from the commercialisation process. These spillovers include benefits to:

- public health
- occupational health and safety (OH&S)
- education, training and skills development
- equipping graduates for roles in industry
- encouraging industry interaction to address national issues.

Assessments of the CRC Programme typically focus on economic benefits, overlooking the other important functions CRCs deliver.

The CRCA's response to the Report (p.4) notes 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… 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.*

The Combined CRCs support this statement.

Rather than providing just another research pathway, these additional roles taken on by CRCs are unique and important elements of the CRC Programme. Over time, a number of CRCs have developed very good mechanisms to support specialist areas where a national approach is required. Any changes proposed to the funding time frames and project activities

of CRCs should be carefully considered to avoid compromising the spillovers from the Programme.

The Submission included several examples of social benefits and spillovers, as distinct from direct commercialisation benefits and the specific research conducted by the CRCs (pages 9-10 of the Submission). CRCs have made a particular contribution both locally and abroad in the area of education, skills and training, as demonstrated by the case studies below:

- a molten metal safety course, critical to OH&S, developed by CAST CRC has found popularity throughout the Australian industry and also is currently being sought by a US association. CAST CRC has also been successful in delivering specialised training to Boeing Australia, utilising the expertise of the Commonwealth Defence Science and Technology Organisation
- professional education courses for eyecare practitioners have been developed and delivered at both a national and international level by Vision CRC. The courses leverage products being developed by the CRC to enhance the services delivered by eyecare professionals and have delivered sales improvements of around 66% to the partner SMEs
- the success in widespread skills development by Vision CRC, including in remote Australian communities and through Asia, has provided significant beneficial social impacts through improved treatment of eye conditions locally and around the world
- cross-sectoral cooperation between Beef and Sheep CRCs has promoted post-graduate opportunities in the sheep and cattle industries. The Beef and Sheep CRCs' post-graduate education programs are run collaboratively to encourage post-graduate students to develop a professional network that will serve them well beyond their university days
- the Beef CRC has established a Chair in Meat Science at the University of New England, as well as specialist undergraduate courses in meat science and feedlot management, and a matching meat science program. The latter addresses skill shortages in the beef industry by delivering training from post-graduate level through to workers on the meat works floor, which the 1993 Industry Commission Report noted had the lowest levels of skills and training of all the industry sectors surveyed
- the Sheep CRC has established the highly successful Chair in Wool and Sheep studies at the University of New England
- within Poultry CRC, three major, highly-competitive chicken meat processing companies have collaborated together to address common national issues. By becoming supporting participants in the CRC, their common needs in terms of bird nutrition, health, disease control, welfare and environmental issues could be met without compromising their commercial independence
- the Mining CRC helped to sustain the mining program at the University of Queensland, with the support of significant funding from its industry partners.

Further case studies about spillovers from CRC activities can be found in Appendix A of this document.

The Combined CRCs refer the PC to the specific recommendations on the subject of social benefits and spillovers included in the Submission, namely:

Recommendation 3

Ascribe economic and social value to CRCs' contribution to education, skills and training when assessing both individual CRCs and the achievements of the Programme overall.

Recommendation 5

Value should be ascribed to the international activities of CRCs when assessing both the Programme and individual CRCs. This value should be assessed in terms of benefits returned to Australia.

Recommendation 15

Improve the general understanding and acceptance of the highly specific measures appropriate to CRCs and ensure that funding decisions are based on these measures.

Recommendation 16

Support CRCs' flexible but effective approach to commercialisation that guarantees benefits to industry and the Australian economy as the primary aim.

4 Unique Relationship with Industry

CRCs play a unique role as the 'glue' for their respective industries, bringing together key industry players and competitors to collaborate on issues of national importance. It is highly unlikely that individual companies would tackle national issues or high risk R&D on their own, but sharing the risk with competitors and government generates unique co-operation for the good of the industry as a whole.

The core of government funding, supplemented by industry contributions, 'sanctions' the CRCs activities in the eyes of industry. Despite the demonstrated benefits, industry would not collaborate in this way without the impetus of government funding. At the same time the industry participants in CRCs develop a sense of ownership and involvement with the CRC's activities, which cannot be replicated by other publicly funded research organisations, who only ever deal with industry on a contractual basis. This should not be misconstrued as industry participants getting heavily subsidised access to research, as the industry partners typically have to pay for the outcomes of the research.

Beyond their role generating R&D, CRCs are critical to driving cooperation within sectors. Some industry members would not ordinarily communicate with each other if not for CRCs and there is benefit for Australia in this interchange. For example:

- the Poultry CRC enables the smaller egg industry to leverage off the higher level of research funding provided by the chicken meat industry
- the Mining CRC unites major competitors both on a national and international stage
- the Beef and Sheep CRCs bring together producers, feedlotters, processors, and retailers from all sectors of their industries, none of whom had ever collaborated prior to the existence of CRCs.

Case studies relating to the unique industry co-operation generated by CRCs are included in Appendix B.

The unique role of CRCs in mitigating the risk of R&D for industry has a special resonance for SMEs, who are typically least capable of conducting their own research, yet may have the greatest need. Research is often seen by SMEs as either too speculative or, in areas such as manufacturing and agriculture, their profit margins are so low that they can not afford the investment. CRC support allows more innovation to occur and this leads to the growth and in some cases the survival of SMEs. It is the level and continuity of funding that CRCs have that allows targeted SME engagement mechanisms to occur with the blessing of all participants.

In relation to this, the Combined CRCs do not support Draft Finding 9.5, as they believe that the CRC Programme already accommodates the 'smaller, shorter and more flexible collaborative arrangements' recommended, which they agree would be a positive approach.

The Combined CRCs feel that the new Recommendation 7 of the CRCA Response to the Productivity Commission Draft Report is more appropriate, namely that:

> *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.*

CRCs are crucial in linking SMEs with research organisations. Greater flexibility of participation of SMEs in the work of CRCs would aid these linkages. The following example (included in page 7 of the Submission) outlines one of the many novel approaches taken by CRCs to engage SMEs.

CAST's engagement of SMEs

The CAST CRC has the Australian Die Casting Association and the Australian Foundry Institute (Queensland Division) as participants. These organisations have many SME members. The technology needs of SME manufacturing companies are different from the larger corporate entities. SME manufacturing companies tend to have limited resources and technological solutions that need to be met within a timeframe of months rather than years.

To engage these SMEs, CAST has developed the Best Practice Program. The Best Practice Program combines elements of technology transfer and focused short term research projects to provide the technological solutions required by companies. CAST researchers develop or access the technology package for the companies and support the companies to implement the solution. This has led to quantified savings, new capability and improved product.

The program also builds capability within companies. Integration with existing equipment, processes and company culture is required for new technologies to be successfully introduced into companies. The Best Practice Program is involved in all these elements. One aspect of the process includes the aspect of up skilling the companies to support them to develop an innovative culture that continues beyond the life of a single project

The Combined CRCs refer the PC to the specific recommendation on the subject of the unique relationship between CRCs and industry included in the Submission, namely:

Recommendation 16

Support CRCs' flexible but effective approach to commercialisation that guarantees benefits to industry and the Australian economy as the primary aim.

5 Technology Diffusion

The PC expressed an interest in an improved understanding of the interaction between elements of the R&D community and the mechanisms used to diffuse the technologies developed in publicly funded bodies.

CRCs play a pivotal role as integrators of knowledge and technology, particularly in transferring technologies out of universities and into SMEs and industry. CRCs' unique relationship with industry means they can match the level of technology to the absorptive capacity of the industry player and tailor the type of technology (such as productivity increases, cost reductions, new material science) to the industry need (such as adjustment to globalisation).

The flexibility of CRCs mean they structure innovation mechanisms around different sectors and markets and can meet the broader collaboration goals proposed by the PC, such as the suggested 'complementary program' in 9.5 of the Report.

The Combined CRCs agree with the CRCA response to the Report (page 4) in stating that the CRC Programme delivers benefits through the following channels:

- Application of research
- Commercialisation of research
- Enhanced access to international knowledge networks
- Skills formation
- Collaboration of public and private sector researchers
- Encourages industry investment in research

Commercialisation is seen by the Combined CRCs as only one pathway to this broader transfer of IP, albeit an effective pathway that is central to the work of CRCs. In this context it is important to note that whilst CRCs vary to some degree, generally the industry participant does not receive free ownership of the outcomes of the research. In most CRCs, a commercial licence must be obtained for developed technologies, or ownership is held in proportion to the funding provided.

The Report recommends a complementary commercialisation funding model that encourages like companies to work together. The Combined CRCs feel this is already accommodated by the Commercial Ready program. However it is important to address impediments to CRCs participating in this program, in order to generate synergies between CRCs and other relevant public programs.

In relation to this issue, the Combined CRCs support Recommendation Five of the CRCA response to the Productivity Commission Draft Report, that:

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

CRCs' emphasis on industry over self-interest has resulted in more effective and diverse approaches to commercialisation than those used by other public research organisations. It is for this reason that the Combined CRCs developed Recommendation 14 in the Submission (see below). On occasions, CRCs have forgone royalties and patents to ensure that the CRC can deliver new technologies to the industry. Often the result is greater stimulation of technology spin-offs to other sectors and social benefits, as demonstrated below.

Examples of different paths CRCs have taken to ensure utilisation and uptake of technology by industry include:

- The experience of Beef CRC in delivering its science through the Meat Standards Australia program clearly demonstrates the direct application of technology in industry rather than taking an IP or trademark position, to ensure industry adoption ($244 million delivered value to June 2006 - CRCA Economic Impact Study 2) rather than returns to the organisation. The key partners, Meat and Livestock Australia and the Beef CRC, made a conscious decision that the science was best placed in the public domain to achieve greatest economic impact.
- In its work with DNA markers, the Beef CRC took an IP protection approach to give delivery partner, Genetic Solutions, the security they required through exclusive licenses to further co-invest to develop and commercialise the diagnostic DNA tests associated with beef eating quality.
- One of the important utilisation functions that a CRC can provide is to make available information to the industry in a form that is easily accessed. The Sheep and Beef CRCs have pursued this through working together to establish an internet based livestock library.
- Vision CRC has taken a number of paths to commercialisation and technology transfer, including licensing to international companies, spinning off companies, and selling training packages or eyecare models.

More detailed case studies of innovative approaches by CRCs to technology diffusion are included in Appendix C.

The Combined CRCs refer the PC to the specific recommendations on the subject of technology diffusion included in the Submission, namely:

Recommendation 14

Improve the alignment of KPIs for universities and CSIRO with CRC Programme. Objectives.

Recommendation 16

Support CRCs' flexible but effective approach to commercialisation that guarantees benefits to industry and the Australian economy as the primary aim.

Recommendation 17

Identify and address regulatory and tax impediments to commercialisation, especially IP/copyright considerations, research ethics schemes and the effect of capital gains tax on commercialisation opportunities.

Recommendation 18

Government should reconsider criteria which limit CRCs' ability to apply for commercialisation funding, such as COMET and Commercial Ready programs.

6 The Global Context

The Roundtable in Canberra included discussion of the importance of considering the global context of Science and Innovation in Australia and our competitive position against emerging nations, such as China and India. The Combined CRCs believe this is an essential and unavoidable backdrop to the activities of Australian scientists, researchers and industry. CRCs have both international partners and activities, linking them effectively into the global arena, without necessarily 'selling off' Australian R&D to be developed elsewhere for the benefit of other countries.

The Combined CRCs therefore recommend that the PC consider the global context in the final version of its Report.

Not only the research undertaken by CRCs and the technologies they develop, but also the CRC format itself has proven popular internationally. CRCs have been extremely successful in attracting international partners and associates, through both industry and academic linkages. These alliances support exchanges of post-graduate students and research personnel working on collaborative projects and these exchanges result in publications and valuable research outcomes. Most of the CRCs contributing to this submission have at least one foreign contributor, and all have established strong international alliances.

International activity creates invaluable brand awareness around Australian innovation and R&D capabilities. Heightening this profile ensures Australia continues to attract top overseas talent to complement local researchers or to fill skills gaps where they exist. International research collaboration can open strategic markets not only for the CRCs and the technologies they develop, but also for the industries represented.

CRC activities draw interest from many researchers internationally, and CRCs receive numerous applications from foreign post-graduate students annually. The engagement of these students also helps to redress the shortage of PhD students in particular sectors.

Collaboration with international research institutions can serve to improve the quality of Australian research by overcoming the limitations of critical research mass in Australia. For example, Beef CRC's collaboration with US institutions in conducting gene expression research is overcoming the lack of essential but very specific expertise that is not currently available in Australia. The collaboration is aimed at developing Australian capability in the new fields of research as well as speeding up delivery of genetic and non-genetic options to improve beef herd productivity and profitability.

Other examples of the multinational collaboration of CRCs are included at Appendix D.

The Combined CRCs refer the PC to the specific recommendations on the subject of the international activities and impact of CRCs, included in the Submission, namely:

Recommendation 4

Consider decreasing the financial barrier to universities that enrol overseas students who work through CRCs to deliver benefits to Australian industry.

Recommendation 5

Value should be ascribed to the international activities of CRCs when assessing both the Programme and individual CRCs. This value should be assessed in terms of benefits returned to Australia.

Recommendation 6

Improve access to international partners by adjusting the funding model for CRCs in relation to DEST's International Science Linkage program.

7 Conclusion

The Combined CRCs believe that the vibrant discussion generated by the conduct of the PC's Study will make a valuable contribution to refining the public policy framework that underpins Science and Innovation in Australia.

The Combined CRCs applaud the PC's emphasis on the spillovers and benefits to the public good derived from publicly funded Science and Innovation. The CRC programme is ideally positioned to generate significant benefits of this type and to integrate the efforts of scientists, researchers and industry in the national interest. The recommendations for improvements made by the Combined CRCs will ensure that the programme operates as efficiently and effectively as possible.

Science and innovation are critical elements of Australia's future economic performance and societal well being. The Combined CRCs are pleased to be active contributors to this future by addressing industry needs and driving innovation across a wide range of sectors and partners.

Appendix A

CRC contributions to social benefits and spillovers

Avian Health Online

In 2005, the Poultry CRC, in collaboration with the University of Melbourne, funded the development of Avian Health Online (AHO). The online post-graduate courses within the AHO project are designed to satisfy the global demand for veterinary scientists with formal specialist qualifications in Avian Health. Avian Health Online currently comprises:

- Post-graduate Certificate in Avian Health (2 units)
- Master of Veterinary Studies (Avian Health) (6 units).

These courses enable professional veterinarians to continue working while studying part-time. The Learning Units offered include:

- Poultry Industry Fieldwork
- Pathology and Diagnosis of Disease
- Microbiology and Serology for Disease Control
- Food Safety
- Public Health and International Trade
- Poultry Production and Financial Analysis Skills
- Research Dissertation.

Towards the end of 2005, the University of Georgia approached the University of Melbourne to discuss the establishment of an international avian health online course. With the consent of the Australian Poultry CRC, a memorandum of understanding was agreed between the two universities in early 2006 to achieve this objective.

Molten Metal Safety Course

Die shops, foundries and smelters by their very nature present a wide range of workplace safety issues that need to be properly managed. Appropriate risk assessments, engineering designs, training, maintenance, monitoring and control are required for a range activities in the cast house environment. One such risk is working with molten metal.

The dangers of working with molten metal are known to the industry. However, the dissemination of industry best practice across the many companies involved with handling molten metal has been greatly improved through the development and delivery of a course by the CAST CRC. The knowledge and experience resident in the detailed course has benefited the whole industry from large aluminium smelters through to small die casting shops.

The course is structured on TAFE Engineering Competencies as part of an accredited training package suitable for a range of production staff.

The international aluminium industry has recognised the quality of the CAST molten metal course which will shortly be presented to companies in the United States as part of an international education collaboration between the CAST CRC and the North American Die

Casting Association (which is affiliated with the Australian Die Casting Association: a core participant of the CAST CRC).

Aircraft Corrosion Course developed for Boeing Australia

The CAST CRC project managed, developed and delivered a two-day training program on Aircraft Corrosion to Boeing Australia. The education model employed has also been successfully utilised in the die-casting and light metal industries. The success and ease of implementation of the model revolves around the intimate industry, research and academia networks inherent in the CRC.

The Aircraft Corrosion course utilised the expertise of DSTO research staff and the skills of senior teaching academics. The blend of technical detail and adult learning principles coupled with previous project management skills associated with shop floor course delivery produced a well received and highly regarded course.

The development of this course had the additional benefit of capturing knowledge held by a senior DSTO expert with a lifetime of experience in the corrosion of aircraft materials, and making this knowledge available so that further industrial and economic benefit could be obtained.

Professional Development for Eyecare Practitioners

The eyecare market is directly influenced by the knowledge and skills of eyecare practitioners. In its various forms, Vision CRC has taken a unique approach to expanding the market through education. The Presbyopia Education Program (PEP), for example, is a collaborative project between the CRC and Essilor International to deliver education about presbyopia (the age-related inability of the eye to focus on near objects) and its treatment to Asia Pacific eyecare practitioners and educators.

Many eyecare practitioners in the region know little about the condition or its effective treatment with the latest vision correction devices. CRC education programs are changing this, and they are a vital component of the development of the market in Asia. One of the most important innovations of PEP is that it targets both practitioners and educators. While improving the skills of practitioners has an immediate effect on the eyecare they provide, improving the knowledge and materials of educators has an ongoing effect on all the future practitioners they teach.

Education Programs specifically developed by Beef CRC

The innovative Meat Science Program for Australia was initially developed by Beef CRC at the University of New England, but is now delivered nationally by 6 universities. The CRC achieved funding for a new Chair in Meat Science at UNE as the basis of development of the program. The Meat Science undergraduate and post-graduate courses have also been modified and customised for use as training materials for Meat Standards Australia (MSA) graders and meat processors, TAFE college modules, Agricultural College course materials and into the agricultural high school syllabus.

Meat workers were previously identified by the 1993 Industry Commission as the least skilled workers in Australia and the Meat Science Program has achieved enormous improvement in the national industry standards for this sector.

Academic and research positions funded by Mining CRC

Mining CRC funds several full-time academic positions and numerous full-time research positions at its member universities. In 2005-6 the CRC funded three chairs: the chairs of mining engineering and mechanical engineering at The University of Queensland (UQ) and the chair of mining geophysics at Sydney University. In addition, the CRC funded a senior lecturer's position and a lecturer's position in mechanical engineering at UQ and a lecturer's

position in mining engineering at UQ. It fully-funded a research scientist at The University of Newcastle and two senior scientists positions at Curtin University.

Sheep CRC: Hub and Spoke Model for National Delivery

At the commencement of the Sheep CRC all sectors of the Sheep Industry and the academic community recognised that sheep and wool education had been badly neglected for approximately ten years. The Sheep Industry represents export earnings for Australia of approximately $4.5 billion annually, yet no specialist training program was available anywhere in Australia. No university was prepared to take on the task of investing in courses with low student numbers. The Sheep CRC coordinated a national program to rewrite education resource material for all aspects of the sheep industry. With co-investment from Meat and Livestock Australia, Australian Wool Innovation and from the Australian Wool Education Trust, the CRC commissioned industry experts and leading academics throughout Australia to write lecture topics in areas of their expertise.

The result has been development of an up-to-date set of resource materials covering ten full semester courses at undergraduate level. The courses are being delivered nationally through an innovative hub and spoke model. The University of New England at Armidale has taken responsibility for delivering all the material via distance education combined with residential schools for practical classes. Courses, using the same resource material, are also delivered through cooperating universities in Western Australia, Tasmania, Sydney and Melbourne.

This ‘hub and spoke’ model has overcome the issue of low student numbers at individual universities studying sheep production, marketing and processing. A national approach and a single source of resource material that is regularly updated mean that students can study sheep production throughout Australia using a model that is financially sustainable within the current university system. Undergraduate student enrolments in these new sheep units have already exceeded the forecast demand.

The extensive resources material created for undergraduate courses also provides a very valuable resource for vocational training and many components are suitable for school level courses. The CRC and its partners are therefore investing in the adaptation of the undergraduate material for use in the vocational training and school areas. This integration of education delivery across university, vocational and school programs is unique to the CRC model.

Opportunities for post-graduate students from CRC involvement

In the early stages of both the Beef and Sheep CRCs it was always a challenge to find high quality post-graduate students, even when both CRCs were providing attractive scholarships. The two CRCs have combined forces to run an annual post-graduate conference and training program involving post-graduate students from both CRCs. The networking between students, made possible through the annual conference, and the perceived benefit of the training program by all students has helped to create a positive awareness of the post-graduate program and its value in career development.

Through close links with industry the post-graduates have found interesting and challenging employment opportunities at the completion of their degrees and this information has also provided positive feedback to students contemplating careers in the sheep and cattle industries. The success of this post-graduate training program has meant that over the last five years there has been a significant and steady increase in the level of interest in scholarship applications and particularly in the quality of the students applying. In response to the most recent advertisement for post-graduate scholarships the applicants outnumbered positions by approximately 2:1 and all successful candidates had first class honours.

Appendix B

Industry co-operation driven by CRCs

Integrating wool and sheep meat industries

Prior to the commencement of the Sheep CRC the wool and sheep meat industries conducted their R&D activities as two separate operations with little, if any, overlap. The Sheep CRC has played a major role in integrating the activities of wool and sheep meat research by focusing on the sheep and the wool-meat interface. The CRC's Board has representatives from the peak industry councils WoolProducers, Sheep Meat Council, Australian Wool Innovation, Meat and Livestock Australia and Australian Meat Processors' Corporation.

This is the first organization in the sheep industry to have such a balance of wool and meat industry interests and the first time that meat processors and producers have worked together in close cooperation on R&D initiatives. Current investment by Meat and Livestock Australia and Australian Wool Innovation in five major sheep CRC projects has cemented a close working relationship between wool and meat industries and created a better understanding of the benefits for sheep producers resulting from better management of the wool/meat interface.

Improved cooperation in the poultry industry

Until the establishment of the Australian Poultry CRC, companies in the chicken meat industry viewed each other only as competitors. The big three companies, Inghams Enterprises Pty Ltd, Bartter Enterprises Pty Ltd and Baiada Poultry Pty Ltd together control over 80% of chicken meat production in Australia. These companies have had a long history of struggle to capture and maintain a share of a highly competitive market.

However, the three companies realised that by becoming supporting participants in the CRC, their common needs in terms of bird nutrition, health, disease control, welfare and environmental issues could be met without compromising their commercial independence. Common problems and different experiences are now shared for the benefit not only of these three companies but of the entire industry. Dr Jeff Fairbrother, Chair of the Australian Poultry CRC and former Executive Director of the Australian Chicken Meat Federation with over 35 years of experience in the industry, summed this up in December 2005 by saying that, because of the CRC, the "big three chicken meat companies were now sitting at the same table and talking".

Other organisations and sectors within the egg industry and chicken meat industry have followed suit since realising the benefits of industry cooperation and communication. For example, free-range egg producers in Queensland are now willingly becoming involved in helping with research into assessing and controlling environmental impacts arising from egg production, a situation which would have been unlikely only a few years ago. Ultimately, both the egg industry and the chicken meat industry have become aware that by working together they can defeat problems common to both because, as is often said, "disease knows no boundaries".

Appendix C

Examples of innovative approaches to technology diffusion

Precision sheep production

The Sheep CRC program of precision sheep production relies on the involvement and commitment of a large number of light industrial manufacturing industries and software companies in Australian and New Zealand. The CRC's ability to integrate and coordinate R&D as well as commercial activities across a broad spectrum of these organizations has made this ambitious task of implementing precision sheep production one that is achievable.

The range of different industry partners includes the radio frequency identification technology (Allflex), electronic weighing systems (Tru-Test and Ruddweigh), sheep handling equipment (Prattley) software and data managements systems (Allstock and Practical Systems), integrators (Sunshine Technologies) and communication technology (Telstra). The CRC participants have developed software and operating systems that integrate and complement the available technologies. Working with this range of organizations in this way the CRC has been able to commercialise and deliver to industry robust systems that transform the management of sheep.

o.d.t. Engineering (casting company) - SME

o.d.t. Engineering is a small family owned enterprise located in Melbourne that manufactures large-scale equipment for the casting operations of Comalco, Alcoa and Hydro Aluminium as well as exports to international cast houses.

These machines are used for ingot casting and direct chill casting of aluminium to form products to be used by cast component and wrought alloy product manufacturers. o.d.t. Engineering competes with European, North American and low cost Asian machine manufacturers in this market and need a technological edge to maintain competitive advantage.

o.d.t Engineering joined the CAST CRC in 2001 to develop new higher productivity casting technologies following an initial contract research project. This research area was also of interest to one of CAST's existing partners and o.d.t. customer, Comalco Aluminium. CAST took a first principles approach to develop o.d.t.'s required technologies, combining science with sophisticated computer simulation techniques to understand the thermal, stress and fluid flow aspects of ingot and direct chill casting.

The result is three patent-protected CAST-developed technologies and related know how that were licensed to o.d.t. Engineering during 2005-06: CASTfill and CASTmould (ingot casting technologies), and AirCAST (direct chill casting technology). These technologies are now available in the marketplace with sales of each product already achieved.

CAST continues to provide technical support to o.d.t to ensure that CASTfill, CASTmould and AirCAST are successfully installed and commissioned in the customer's industrial cast houses. To quote Kurt Oswald, managing director of o.d.t. Engineering, 'With CAST, o.d.t. has gone from an importer to an exporter of leading edge technology'.

Once again, a flexible approach to commercialising technology created an optimal outcome for an SME and considerable spin-off benefits to the industry.

Appendix D

Examples of global collaboration

Light Metals Alliance

The CAST CRC has a number of international collaborations. However, the most significant of these is an international Light Metals Alliance formally established in 2002.

The Alliance involves similar organisations that have a strong industry focus. The members of this Alliance include:

- CAST CRC
- the Leichtmetallkompetenzzentrum Ranshofen GmbH (LKR) (Austria)
- CANMET Materials Technology Laboratory (Canada)
- GKSS Research Center (Germany), and
- Worchester Polytechnic Institute (USA).

These are research centres with established reputations for excellence, strong linkages with industry and are also a pivot point for a number other centres and universities within their country. For example, CANMET coordinates Light Metals collaboration with Canadian universities such as the University of British Columbia, McMaster, Toronto and McGill. Of interest is that LKR is a K-Plus centre and the K-Plus program is modelled on the Australian CRC Programme.

This alliance supports collaborative projects for post-graduate students and research personnel, which have occurred between both researchers and industry participants. Such exchanges have resulted in publications and research outcomes of value to CAST's industry participants.

This collaboration has also opened the door to a number of international companies. At present, CAST is in discussion with a global company regarding licensing of a CAST technology where initial contact with this company was facilitated by one of the Alliance partners.

Wide scope of Vision CRC's international collaboration

Vision CRC is a collaboration of 30 of the world's leading groups in eyecare and vision research, education and delivery. By seeking out these leaders, capitalising on existing knowledge and integrating complementary expertise, Vision CRC is able to tackle world-scale research and development projects. International participants include:

- L.V. Prasad Eye Institute (India)
- Anglia Polytechnic University, Department of Optometry (UK)
- Bascom Palmer Eye Institute, University of Miami (USA)
- Pennsylvania College of Optometry (USA)
- University of Houston, College of Optometry (USA)
- University of Waterloo, Centre for Contact Lens Research (Canada)
- Johns Hopkins University, Department of International Health (USA).

Vision CRC has also successfully attracted collaboration with some of the world's largest ophthalmic companies, for example the contact lens projects conducted with CIBA Vision, a division of Novartis; and education projects conducted with Essilor through a Vision CRC Core Partner, the International Centre for Eyecare Education.