ENSURING A PROFITABLE AND SUSTAINABLE AGRICULTURE AND FOOD SECTOR IN AUSTRALIA

The Australian Government Department of Education, Science and Training welcomes the opportunity to provide this submission to the Agriculture and Food Policy Reference Group Inquiry to improve the profitability, competitiveness and sustainability of the Australian agriculture and food sector. Comment is provided in relation to chapter 6 (Education, skills and labour supply) and 7 (Research, development, innovation and technology).

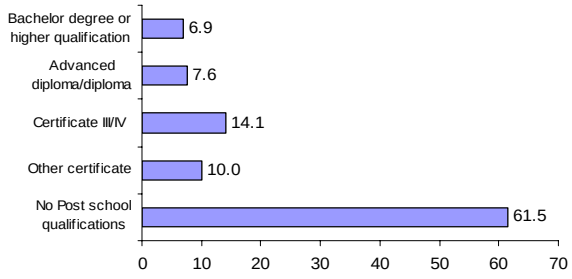
Education, skills and labour supply

The Australian Government takes a national leadership role in education and training, particularly through the Vocational Education and Training (VET) System. The States and Territories have primary responsibility for the management and delivery of education and training in schools and through VET, while the Australian Government is responsible for funding and policy-making in the higher education sector.

Skills overview of agriculture workers

A large proportion (60%) of workers in the rural, forestry and fishing industries do not have post-school qualifications, this compares with a 42% average for all industries. Formal qualifications are generally thought to be less important than on-the-job experience in this industry sector, and there is a high proportion of mature-age workers, 45 years or older, with many continuing to work beyond 65 years of age.

Agriculture, Forestry and Fishing
Educational Profile, May 2004 (%)



from DEWR Australian Jobs 2005

Although the drought has subdued employment growth in the industry, 9,000 new jobs are expected in the next 5 years. The Agri-Food Industry Skills Council (AFISC) observes in its Industry Skills Council (ISC) Report that the industry is facing a critical lack of people nationally.[1] The report notes that skills development in this industry "is only meaningful if people are first attracted to live, seek employment and career development within a regionally

[1] Agri-food Industry Skills Council, Draft Industry Skills Report, May 2005, page 5

based industry".[2] Attracting suitable people requires a partnership between government, industry and communities.[3]

In common with several other industries, agri-food has an image problem amongst young people. The Council identifies a need to change the attitudes of young people, parents and careers advisers.[4] This was also picked up by the National Skills Shortages Strategy Rural Industry Task Force and a number of responses were developed including the ONtrack website, www.ruralskills.com.au/Ontrack/menu.htm, and associated careers materials.

The AFISC report indicates that there is a need for farm hands, people with business management skills, leadership skills, skilled machine operators and unskilled labour in the rural sector.

At the higher skilled end, DEST statistics show that interest in agriculture in higher education institutions remains steady with the total number of students studying agriculture courses at Australian universities over the recent period 2001 to 2004 not changing significantly, from 8718 to 8208. Commencing students in these totals are steady or increasing slightly from 3014 to 3172. A recent trend in these figures is the move away from rural campuses - students studying agriculture courses in rural institutions falling from 8400 in 2002 to 6731 in 2004.

Government initiatives

There are a number of new Government measures which have recently been introduced and which are likely to have a direct benefit for training of agriculture workers:

- $350 million over five years to establish the Australian Technical Colleges (ATCs). In September 2004, the Australian Government announced its election commitment to establish 24 ATCs as part of the Government's broader strategy to address skills needs in the trades in regional and metropolitan areas. The first of the Colleges will begin accepting students in 2006, with all 24 operational by 2008. Three-quarters of the 24 regions earmarked for a College are in rural areas;

- $22.9 million over four years to establish the Institute for Trade Skills Excellence to be established in the second half of 2005. The Institute will promote the quality of trade skills training. It will be industry-led through the involvement of peak industry bodies; the Australian Chamber of Commerce and Industry, the Business Council of Australia, Australian Industry Group and the National Farmers' Federation;

- Formation of the Agri-food Industry Skills Council (AFISC), one of ten newly created skills councils, by amalgamation of five former Industry Training Advisory Boards. AFISC is responsible for Rural Industry Training Packages developed to meet the skills needs of the agri-food industry, ensuring they are updated to reflect the changing needs of industry. The Training Packages comprise of integrated sets of nationally endorsed competency standards, assessment guidelines and qualifications for specific industries, industry sectors or enterprises. Training Packages have gradually replaced courses, although courses can still be developed and accredited where no Training Package qualification exists. As of 1 July 2005, funding for national Training Package development is provided by DEST;

[2] ibid, page 8
[3] ibid, page 9
[4] ibid, page 9

- The Australian Network of Industry Careers Advisers (ANICA) initiative building on the existing network of Local Community Partnerships (LCPs), which from 2006 will be extended to achieve national coverage and ensure access to all rural and remote areas in Australia, delivers a strong focus on ensuring career and transition support services are in place and are accessible by young people in rural Australia. In partnership with industry and professional career advisers, LCPs will assist students to understand study and work options through career information, advice, support and planning.

- $117 million over the period from 2005 to 2008 is allocated to the Country Areas Programme (CAP) to improving learning outcomes for students in geographically isolated areas across Australia. This amount represents an increase of $25 million, or 27%, over the last four year funding period;

- The Assistance for Isolated Children (AIC) Scheme helps the families of primary, secondary and under 16 year old tertiary students who are unable to attend an appropriate government school on a daily basis because of geographic isolation;

- $120 million in 2005-06 to extend entitlement to the Youth Allowance, Austudy and ABSTUDY to New Apprentices to ease the financial burden they face in the initial years of training;

- $0.5 million in 2005-06 to extend entitlement to Living Away From Home Allowance to third year New Apprentices (currently only first and second year New Apprentices are eligible); and

- $26 million to James Cook University for veterinary science and tropical agriculture. The Australian Government is providing $12 million for the infrastructure of a new veterinary science school at the University's Townsville campus, and $13.9 million for the provision of 100 new places (growing to 274 by 2009) to be shared equally between new courses in veterinary science and tropical agriculture. The commitment will provide increased opportunities to students, particularly in rural and regional Australia, and ensure that Australia has veterinarians with expertise in tropical animal diseases and experts in tropical agriculture.

Government initiatives can provide leadership for advancing skills development and learning in rural industries. FarmBis, for example, is part of the Agriculture – Advancing Australia initiative and aims to:

- increase farmer participation in learning activities which will enhance the profitability, sustainability and competitiveness of their business;
- develop greater acceptance of the benefits of continuous learning and skills development, and its relevance to the changing management needs of a competitive farm sector; and
- enhance farmers' capacity to identify and access appropriate learning activities, and over time, influence more flexible delivery of such activities.

FarmBis supports rural industries undergoing economic adjustment by providing training in the areas of financial, marketing and human resource management, including farm performance

benchmarking, leadership development, quality assurance activities, skills audits and specialised management areas, such as risk management.

Research, development, innovation and technology

Funding Research and Development

Responsibility for science is dispersed throughout many Ministerial portfolios of Government reflecting a pluralistic system of science supporting and drawing on activities across the whole of government. The Australian Government provides support for science using different mechanisms catering for such a wide range of scientific activities. Block funding is provided directly to research organisations. Other funding is provided through competitive and peer-reviewed processes.

This pluralistic system ensures that science supports Australia's economic, social and environmental goals in the most effective and efficient way possible—and quickly. Backing Australia's Ability – Building our Future through Science and Innovation was swiftly developed in response to a comprehensive mapping of Australia's science and innovation system and to targeted reviews of specific aspects of this system in 2003. Extensive cross-portfolio involvement in both Backing Australia's Ability packages has facilitated the development of a consistent and coordinated "system" based approach to progressing the national R&D agenda

The recent Budget 2005-06 provided a total support package of $5.5 billion for science and innovation. Of that total, $514 million was identified as directly supporting "agricultural production and technology", mainly programmes in the Agriculture, Fisheries and Forestry portfolio and the Education, Science and Training portfolio through CSIRO and the Cooperative Research Centres (CRC) programme. A large proportion of the total, $2.06 billion, directed at universities is provided as general funding rather than being committed to any particular purpose. Of the $556 million of this general funding allocated to the Australian Research Council (ARC), $13 million can be identified with fields of research primarily about agriculture. ARC funding is also directed to many fields which indirectly contribute to agriculture but are not included in the above figure. CSIRO has made a separate submission to this Inquiry. Detailed information on their activities is available in that submission.

National Research Priorities were announced by the Government in December 2002 as a way of focusing public science funding and research on the areas that will help Australia confront its biggest economic, social and environmental challenges (http://www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/national_research_priorities/). Consequently, all Australian Government departments and agencies conducting or funding research are addressing these priorities. Detail of how the priorities support agriculture research is provided at Attachment A.

The Government has increasingly moved to strengthen institutional funding for research with peer-reviewed and competitive processes, and a greater share of total funding is now allocated on this basis. Funding to the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC) is being doubled. *Backing Australia's Ability* provided an additional $735.4 million for ARC National Competitive Grants over the five years to 2005-06.

There are 15 CRCs that are conducting research directly involving Agriculture. In addition, there are some CRCs in the environment sector which undertake research of significant relevance to agriculture, for example the CRC for Australian Weed Management, the CRC for

Plant-based Management of Dryland Salinity and the Bushfire CRC. See Attachment B for more details.

The CRCs conducting research involving Agriculture have a strong education component that focuses not only on producing graduates with skills relevant to industry needs but also on the transfer of new technologies to individual farmers.

CRCs are involved in education and training with schools and TAFEs in their region. Examples include:

- The Rice CRC has been actively involving school children in its Crop Critters project.
- The Molecular Plant Breeding CRC's Education Program, in association with the Australian Centre for Plant Functional Genomics, is currently delivering a series of workshops for high school students called 'Get into Genes'.
- Dairy Australia in conjunction with the CRC for Innovative Dairy Products has funded dairy farmers and industry people to undertake the CSIRO Industry Link Gene Technology Workshop.
- The CRC for Viticulture provides the Viticulture Research to Practice topics delivered under licence by 16 organisations including grape and wine producers, regional associations, universities, TAFEs, viticulturists and agribusiness companies. The 16 organisations are providing the training and information to their clients in the format that best suits their needs. This approach has proven to be extremely successful with more than 740 people attending Viticulture Research to Practice training in 2003/04, compared with a total of 429 attendees for the same topics in the 2002/03.
- The CRC for Sustainable Rice Production works closely with the network of NSW Department of Primary Industries' District Agronomists in raising awareness of CRC progress within the farming community. The main focus for the agronomist team has been the education and training of farmers in the project "Targeting better Near Infrared test sampling through remote sensing". Over the 2 years the number of farmer participants increased from 179 to 549, crop numbers from 450 to 834 and crop area from 14,000 ha to 29,500 ha.
- The Australian Sheep Industry CRC is currently creating and disseminating new resources in sheep meat and wool education based on national competencies for the VET sector.
- The Molecular Plant Breeding CRC has been active with two major workshops/short courses in conjunction with TAFEs - 'From Genome to Phenome' and 'Molecular Markers in Plant Breeding'. The CRC is currently filming an educational DVD on molecular marker techniques with TAFE SA due for release in 2005.

The question of making research and development provision more responsive and relevant to industry is a complex one. This issue is addressed in a variety of ways within the current innovation system. The establishment of R&D Corporations provides a basis for industry groups within the agricultural sector to drive research agendas through fully financed or co-funded research programs. The transactional basis of such arrangements provides a direct impetus to research provision. This is applied in a more general manner by the external earnings arrangements of the publicly funded research agencies in the DEST portfolio (CSIRO, ANSTO and AIMS).

Some programs within the portfolio – the CRC programme and ARC Linkages Programme – have industry involvement as an explicit condition of funding.

Other consultative arrangements provide more general opportunities to influence the strategies of research providers. For instance, the Sector Advisory Committees in CSIRO assist in the planning of research portfolios for each Sector, providing valuable information about the strategic research needs of industry and society and assisting with strategies for the uptake of research results by industry.

The Government is also driving a collaborative agenda in the provision of infrastructure through its National Collaborative Research Infrastructure Strategy. The Framework is based on competitive funding principles and the establishment of processes to link investments in research infrastructure to research strategies and priorities. This approach builds on the process for allocating funding to the Major National Research Facilities targeting benefit to Australian industry with a number supporting Australia's rural industries, for example:

- The International Livestock Resources and Information Centre ($4.5 million) targeting livestock industry organisations
- The Australian Genome Research Facility ($14 million) with benefits for animal and veterinary science, agriculture and microbiology
- The National Wine Industry Research Cluster ($4.5 million) to support Australia's $1.6 billion wine export industry

Technology Adoption

1.1 Is there sufficient understanding of the drivers of adoption and how can this be improved?

While improving, there is generally considered to be insufficient understanding of the causal linkages between the outcomes of research and its uptake by users across the industrial sector. Commercialisation of innovative technology, whether as products, services or processes rarely follows a linear path. Routes of adoption are diverse and complex, and some innovations arise from a familiar pattern only to metamorphose into applications not even remotely considered at their inception.

The rural sector is an excellent example of the diversity of pathways to adoption. As a sector it has particular characteristics that differentiate it from other sectors (eg the biomedical area). It also exhibits a wide range of adoption pathways across the types of agricultural industries and technologies.

While we note the Rural Research and Development Corporations (RDCs) play an important role in adoption, there are also funding programmes and research suppliers in the DEST portfolio which offer commercialisation opportunities and services. These include;

- Cooperative Research Centres programme which supports 72 Cooperative Research Centres of which almost half are engaged in agriculture and related activities and with most having industrial partners that greatly facilitates the adoption process.

- The CSIRO which offers contract research services through its external earnings requirement as well as research supporting activities of national benefit such as research into ground water levels and river health. Contract research in CSIRO has been beneficial in developing a commercially aware culture and responsiveness to client needs and in determining long term strategic research plans in consultation with stakeholders. Consequently CSIRO has developed strong and comprehensive connections with the commissioners and users of their research services and outputs.

Both the CSIRO and CRCs have cooperative relations with the RDCs and the outcomes of research are typically delivered to the sector by disseminating the information directly to the growers or producers at field days, information events or direct communications. This manner of technology dissemination takes place at the 'grass roots,' thus having a direct impact on production with little delay.

Development of an agreed understanding in describing, articulating and developing policies and programs in relation to research commercialisation and collaboration between public sector research and industry could assist in better understanding these linkages including factors driving adoption of technology. A policy framework for explaining and articulating this relationship is outlined in Figure 1 below.

Figure 1: A policy framework for industry–research linkages

Effective linkages between Australia's research and industry sectors require:

1. Innovative, entrepreneurial and internationally competitive industries and firms that thrive on new ideas and research

   > Policy focus 1: Industry demand

2. A sound, sustainable and vibrant research sector that

   - is strong in applied as well as basic research
   - covers the range of disciplines and skills needed to deal with complex problems

   > Policy focus 2: Research capacity

3. Applied research that is aligned with the needs of industry via mechanisms that effectively identify and communicate

   - industry's needs
   - the research sector's capacities

   > Policy focus 3: Industry–research collaboration & communication

4. Effective mechanisms and appropriate incentives for translating research outputs into successful products, services and processes, including through:

   - knowledge diffusion (such as publication, education, information dissemination)
   - knowledge production (such as patenting, licensing, company formation)
   - knowledge relationships (such as consultancies and contracts, joint ventures)

   > Policy focus 4: Knowledge transfer mechanisms & incentives

This way of framing the policy issues emphasises the need for industry to be strong and active as an investor in research and development, and in deploying the results (policy focus 1). Complementing this 'demand side' is the need for a strong research sector that has capacities across the range of disciplines and types of research (policy focus 2). In the 'space' between

these two interdependent sectors lie the areas for policy action for research commercialisation (broadly defined), including both the broad questions of alignment, collaboration and communication (policy focus 3), and the specific pathways for translating research into products, services and process (policy focus 4).

Research undertaken in publicly funded research agencies (PFRAs) provides commercial benefits both directly and indirectly. The direct path—through the commercialisation of specific intellectual property (IP) in the form of patented inventions, processes and ideas or research outcomes arising from commercial arrangements with end users - is seen as generating demonstrable benefits to industry and the wider community, and providing a source of income for research institutions including for reinvestment in further research.

The indirect commercial benefits of publicly funded research are also very important. Australia's innovating businesses draw on ideas and experience emerging from universities and PFRAs though a wide variety of means. These include recruiting high quality researchers and scientists trained in universities, drawing on new research findings published in learned journals and elsewhere, and participating in industry conferences, seminars, workshops and the like.

Research suggests that in many individual instances both the direct and indirect modes can come into play. Researchers, businesses, entrepreneurs and investors collaborate to identify, protect and exploit IP, but they will also often use research consultancies and contracts to develop and test ideas that have been identified or are embryonic and not quite ready for protecting. Alternatively, ideas and commercial opportunities will develop through publishing and reading research papers, conducting meetings, conferences and workshops, or developing longer term partnerships and collaborations.

A recent DEST commissioned study[5] identified four 'models of knowledge transfer' to describe the different processes and interactions of participants in commercialising research innovation. The main attributes of these models and the way in which they impact on measures of commercial outcomes are shown in Figure 2 below.

Figure 2: Models of the different processes of research commercialisation

- ***Knowledge production model***—sees transfer as the sale of 'knowledge products' embedded in intellectual property (IP) and other explicit or codified formats, and manifested in sale and or licensing of intellectual property rights to new businesses (spin-outs) or existing businesses which may be in the public or private sector
- ***Knowledge diffusion model***—approaches transfer from the perspective of encouraging broad industry adoption of the results of research; it emphasises communication and adoption of research results.
- ***Knowledge relationship model***—sees transfer as the provision of services to businesses based on a broadly defined intellectual property platform, including trade secrets, know-how and other forms of tacit knowledge; it emphasises collaboration, partnership and joint ventures.
- ***Knowledge engagement model—***sees transfer as a by-product of a convergence of interests between science and society and in particular, the interests of higher education, industry, and government.

[5]The Emerging Business of Knowledge Transfer, Howard Partners 2005, www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/commercialisation/knowledge.htm.

These models are to some degree ideal representations and that 'real world' examples of research commercialisation will often have elements from two or more of the models. The knowledge diffusion model is considered to be the most relevant to the Australian agriculture and food sector.

A recent Coordinating Committee on Science and Technology Working Group report[6] concluded that current metrics for commercialisation of publicly funded research need to be extended to reflect a broader understanding of the commercial and economic benefits of research commercialisation.

Maximising the commercial potential of research outcomes is strongly linked to application of factors including skills and business knowledge and intellectual property and patents.

Skills and business knowledge

Skills including commercial management, entrepreneurship, adequate knowledge of IP development and IP legal management are essential to the commercial success of knowledge transfer. These are needed to identify and take a technological innovation and turn it into a commercially viable proposition. Awareness too, for both industry and researchers, to understand the other's environment and culture, to have the capacity to be able to work and understand the constraints of each other's field is an important skill.

Intellectual property and patents

The sequestration and protection of IP through the patenting and plant breeders rights system is essential to the research commercialisation process. Sometimes unrealistic expectations by researchers as to the value and equity share of potential IP of an innovation can have the effect of dissuading potential investors and hinder the progression of commercialisation. Researchers/universities need a greater understanding of the commercialisation process and risk that investors have to manage. Likewise investors also need a better understanding that researchers need realistic reward for their innovation.

The RIRDC *Commercialisation of Intellectual Property Principles*[7] notes there are many ways in which RIRDC sponsored research can be adopted, recognising that commercialisation is only one means by which research outputs may be managed and that uptake and adoption may be maximised though means other than commercialisation. In that context one of the principles states that research must be managed on the basis that it may generate valuable IP and that appropriate arrangements need to be made to ensure that the research is placed in a format so that it is capable of being protected.

1.2 How important is technology adoption to the variation in productivity growth between and within agricultural industries.

We are not in a position to assess in detail the relative importance of technology adoption to the variation in inter and intra productivity growth within the sector as we are not sufficiently aware

[6] Metrics for Research Commercialisation, www.dest.gov.au/NR/rdonlyres/E3170A75-79D5-4737-955E-BE41714948E8/5637/FinalMoCReport15April2005.pdf
[7] ref www.rirdc.gov.au/researchpriorities/commpolicy.html

of the specific factors affecting the economic growth of these industries. As such we would suggest the AFFA portfolio would be best placed to make this assessment. An econometric analysis of RIRDC Outcomes reports could assist in this regard.

However, the Howard report referred to earlier highlights there are a range of diverse, often non-linear pathways, via which publicly funded research provides commercial and economic benefits, and the relevance /success of these will largely depend on the industry sector, technology and research discipline involved.

2. What are the tradeoffs in determining an optimal balance between the privatisation of the benefits from research and maximising its uptake by making results freely available?

Publicly funded research institutions engaged in research partnerships are guided by the *National Principles of Intellectual Property Management for Publicly Funded Research*[8]. These Principles seek to assist research institutions to ensure they have access to best practices for the identification, protection and management of IP where a commercial outcome is appropriate. Their dissemination in 2001 was a significant advance in terms of the guidance available to institutions and researchers looking to manage their IP. It is timely, however, to review the National Principles to determine whether and how they might be updated to reflect the growing sophistication and complexity in the research interface with industry and the wider community.

A review of the National Principles is to be undertaken seeking to ensure both industry and researchers have clarity regarding expectations related to the development and execution of IP. It is envisaged that an updated and improved set of principles and guidance will provide greater certainty for future research collaboration and commercialisation of publicly funded research and maximise the effectiveness of public investment in research. In the context of this review it will be important to enure there is consistency between the intent/operation of these revised principles and guiding policy in the agriculture and food sector such as the RIRDC *Commercialisation of Intellectual Property Principles.*

More generally, however, the Government has made it clear that it wants to secure a return from the taxpayer funds it invests in science and has put in place arrangements to facilitate these outcomes. To help in assessing the value of this investment, following the initial Backing Australia's Ability package, the Government's annual Innovation Report was introduced to report on the impact of the package and highlight outcomes from its annual $5 billion expenditure on science and innovation. The external earnings requirements imposed in the Education, Science and Training portfolio publicly funded research agencies in part reflect this objective. As mentioned previously, DEST considers that in many cases establishing a transactional basis for R&D interactions will facilitate good outcomes over time. While there may be a case for making some results freely available, this is seen as being most clearly applicable to areas such as environmental research. Where a clear proprietal or other commercial advantage is derived from research outcomes, DEST considers that this should be open to negotiation between the parties.

[8] ref www.nhmrc.gov.au/funding/policy/ipmanage.htm.

Attachment A

National Research Priorities supporting agriculture

The National Research Priorities are thematic and are underpinned by 'priority goals'. The following three of the four national research priorities support agriculture objectives:

- An Environmentally Sustainable Australia;
- Frontier Technologies for Building and Transforming Australian Industries; and
- Safeguarding Australia.

Priority goals underpinning agriculture objectives of these national research priorities include:

An Environmentally Sustainable Australia
1 Water – a critical resource
Sustainable ways of improving water productivity, using less water in agriculture and other industries, providing increased protection of rivers and groundwater and the re-use of urban and industrial waste waters.

2 Transforming existing industries
New technologies for resource-based industries to deliver substantial increases in national wealth while minimising environmental impacts on land and sea.

3 Overcoming soil loss, salinity and acidity
Identifying causes and solutions to land degradation using a multidisciplinary approach to restore land surfaces.

5 Sustainable use of Australia's biodiversity
Managing and protecting Australia's terrestrial and marine biodiversity both for its own value and to develop long term use of ecosystem goods and services ranging from fisheries to ecotourism.

7 Responding to climate change and variability
Increasing our understanding of the impact of climate change and variability at the regional level across Australia, and addressing the consequences of these factors on the environment and on communities.

Frontier Technologies for Building and Transforming Australian Industries
1 Breakthrough science
Better understanding of the fundamental processes that will advance knowledge and facilitate the development of technological innovations.

2 Frontier technologies
Enhanced capacity in frontier technologies to power world-class industries of the future and build on Australia's strengths in research and innovation (examples include nanotechnology, biotechnology, ICT, photonics, genomics/phenomics, and complex systems).

4 Smart information use
Improved data management for existing and new business applications and creative applications for digital technologies (examples include e-finance, interactive systems, multi-platform media, creative industries, digital media creative design, content generation and imaging).

5 Promoting an innovation culture and economy
Maximising Australia's creative and technological capability by understanding the factors conducive to innovation and its acceptance.

Safeguarding Australia
3 Protecting Australia from invasive diseases and pests
Counteract the impact of invasive species through the application of new technologies and by integrating approaches across agencies and jurisdictions.

A National Research Priority (NRP) Standing Committee was established in February 2005. Amongst other things, this Committee will assess agency progress in implementation of the NRPs and report to the government on that progress.

The Standing Committee will be chaired by the Chief Scientist, is expected to meet initially at the end of March 2005, and is to provide feedback to NRP-reporting agencies about their:

- revised NRP implementation plans; and
- NRP-Implementation Progress Reports for 2004; and also to
- decide on a future reporting arrangement.

Attachment B

Cooperative Research Centres Involved In Agriculture (as at June 2005)

Name of CRC	Research focus	Date established	CRC Programme funding	Total resources	Number of Postgraduate students
CRC for Australian Biosecurity: Emerging Infectious Disease	To enhance the national capacity to respond to emerging infectious diseases by developing new capabilities to detect, monitor, asses, predict and respond to emerging infectious disease threats which impact on national and regional biosecurity. This will be achieved through integrated programs in research, education and utilisation. Specific areas of research expertise will include: • Technologies to enhance disease detection • Ecology of emerging infectious diseases • Advanced surveillance systems	1st July 2003	$17.5m	$61.7m	27
Australian Cotton CRC	To enhance the development and growth of the Australian cotton industry through the application of collaborative research, education, and sustainable farming systems which are environmentally responsible, enhance reliability of production and increase market competitiveness. To be achieved by: • Undertaking research on farming systems suitable for potential new cropping regions in northern Australia. • Developing innovative technologies for crop management, which provide biological solutions to pest and disease management. • Undertaking research on sustainable farming systems which optimise the use of natural resources and minimise environmental impact. • Developing and commercialising new approaches for processing of cotton yarn and fabric. • Providing a coordinated, national extension service for cotton as well as outstanding educational opportunities for new research	1st July 1999	$13.4m	$91.5m	37
Australian Sheep Industry CRC	This CRC is designed to have an immediate and ongoing impact on profitability of the sheep industry. The aim of the CRC is to improve profitability throughout the sheep industry by optimising returns for both wool and sheep meat. To achieve this, the Centre has established four programs of research and education as follows: • Strategic research including sub-programs in innovative genetic technologies, wool science, meat science, parasitology and strategic nutrition to provide the technical basis for precision sheep production of the future with less dependence on chemical use and greater control over product quality. • Precision sheep production focusing on individual animal management involving electronic data capture and automatic drafting systems. • Implementing innovation via extension, communication and determination of key profit drivers in production systems optimising returns from wool and sheep meat. • Education and training will aim to re-vitalise interest in the sheep industry through updated resource material, flexible delivery of industry-relevant courses and a scholarship program that completes with other industries. The CRC will provide integrated programs of education and training throughout the industry including producers, university, vocational training.	1st July 2001	$19.8m	$88.8m	34
CRC for the Australian Poultry Industries	The aim of the CRC is to enhance the competitiveness of the Australian egg and chicken meat industries and supporting industries through the application of strategic programs delivering cost-effective and socially responsible production of safe, quality products for domestic consumption and emerging export markets. The major objectives are:	1 July 2003	$23.1m	$78.6m	24

Name of CRC	Research focus	Date established	CRC Programme funding	Total resources	Number of Postgraduate students
	• Sustainable production of chicken meat without reliance on antibiotics; • Development and commercialisation of new health products and improved diagnostics; • A poultry industry with established bird health and welfare standards; and • Improved education and skills of industry staff.				
CRC for Cattle and Beef Quality	The CRC is focused on: • The consistent eating quality of beef. This is being addressed by innovative genetic, nutritional and management technologies, applicable to grass- and grain-finished production systems. The focus is on beef tenderness, juiciness and flavour using beef processing technologies to add a significant value to Australian beef carcases. Improved standards of food safety and reduced stress in beef cattle will flow from new microbiological surveillance techniques. • The ability of beef producers in regional production environments to meet the beef quality specifications of Australia's new beef grading system based on eating quality. These studies employ the latest gene marker technology to identify cattle with the genes for each meat quality specification, allowing Australia to capture the benefits from the worldwide expansion in genomics knowledge through strategic application of gene markers and functional genomics to genetically improve beef quality of Australian Cattle herds. Growth path biology and decision support packages for industry follow from this research. The Centre's education and training programs are delivering new beef technologies at vocational, undergraduate, postgraduate and industry levels.	1 July 1999	$16.0m	$89.0m	30
CRC for Innovative Dairy Products	The CRC for Innovative Dairy Products undertakes research aimed at the development of innovative products using genomic technologies to maintain Australia's globally competitive position. High value commercial outcomes are the focus of the research: • ·DNA tests that assist selection for desired milk-quality traits • ·Health-enhancing milk products • ·Milk components enhanced for product yield • ·New bio-actives for the health, food and pharmaceutical industries • ·Cloned lines of genetically elite bulls and cows These will be underpinned by a commitment to Intellectual Property development, capture, sales and commercialisation.	1 July 2001	$17.0m	$89.6m	15
CRC for Innovative Grain Food Products	To increase the value and competitiveness of the Australian Grains Industry by delivering unique, higher value functional products. To deliver functional grain products targeting health, taste and convenience so that all stakeholders across the value chain benefit.	1 July 2003	$24.0m	$93.9m	22
CRC for Sugar Industry Innovation through Biotechnology	This CRC will contribute to a sustainable and profitable export-based sugarcane industry, by combining Australia's world-class strengths in molecular biology and chemical engineering with industry skills and infrastructure. It will: • Provide a sustainable competitive edge through value-added sugarcane: superior, IP-protected varieties, with reliable high yields of sugar and high-value biomaterials, from environmentally sustainable farming systems. • Develop novel processes for extraction of renewable biomaterials, and value-adding in new downstream industries. • Provide graduates with world-class skills, and seed new strategic	1 July 2003	$28.0m	$80.0m	11

Name of CRC	Research focus	Date established	CRC Programme funding	Total resources	Number of Postgraduate students
	partnerships, through which Australia's rural communities can share strongly in the benefits of biotechnology.				
CRC for Sustainable Aquaculture of Finfish	The aim of the CRC is to provide critical technologies for rapid and sustainable growth of finfish aquaculture in Australia. The CRC will achieve this by: • Better understanding of tuna physiology to underpin developments in husbandry. • Improved product quality and value adding • Developing formulated feeds for high fish productivity and low wastage. • Enabling efficient fingerling production for new finfish industries. • Reducing the risks and impacts of major fish diseases. • Understanding the environmental interactions of sea-cage farming, to ensure the sustainability and efficiency of the industry.	1 July 2001	$16.5m	$71.9m	37
CRC for Sustainable Production Forestry	The Centre has three research programs: (i) Genetic Improvement, (ii) Sustainable Management, and (iii) Resource Protection. • The Genetic Improvement program provides research to support breeding and deployment programs producing genetically improved seed and colonial stock for plantation forestry, while providing fundamental research to ensure the sustainable management of genetic resources. • The Sustainable Management program develops silvicultural practices that maintain or improve the factors necessary for production over successive crop cycles. These developments are based on an understanding of tree growth that, with the use of process-based models, will improve the predictions of wood yield. • The Resource Protection program develops management techniques to minimise the effects of factors (such as insect attach, vertebrate browsing and fungal pathogens) which may damage the forest and reduce its productivity. The research of the Centre is concentrating on five important species of plantation forestry in Australia, namely Eucalyptus nitens and E. globulus in temperate regions and Pinus elliottii, P.caribea and Araucaria cunnighamii in tropical areas.	1 July 1997	$16.0m	$65.2m	63
CRC for Sustainable Rice Production (winding up by June 2005)	The focus of the Centre is to increase the economic contribution of the rice industry to the regional and national economy through increased production efficiency, increased revenue from new value-added products and increase exports, and improvements in the management of soil and water resources. The Centre has focused on the more strategic research and education issues facing the industry through programs dealing with Natural Resources Management, Sustainable Production Systems, Plant Improvement, Product and Process Development, Education, Training and Technology Transfer. These programs aimed to develop tools to increase natural resource use efficiencies while simultaneously increasing the rural income of rice 110 growing districts. An improved understanding, of the changes occurring in soils used to grow rice, and in the ability of the rice plant to respond to change, was developed, along with cost-effective techniques to measure and monitor soils, crops and the environment. Better adapted and more productive rice genotypes were produced with particular emphasis on shorter growth duration, better cold tolerance, better adaptation to saline conditions, and grain quality characteristics to improve the competitiveness of the industry. In terms of product and process development, the Centre added further value to the Australian rice crop by improving paddy quality and the efficiency and quality control in rice processing systems. It also developed new rice-based	1 July 1997	$15.2m	$52.7m	17

Name of CRC	Research focus	Date established	CRC Programme funding	Total resources	Number of Postgraduate students
	products and novel applications utilising rice and rice by- products. The Centre also enhanced the skill and education profile of the rice industry from "paddock to palate" through the provision of technology transfer, training, education and research opportunities.				
CRC for Tropical Plant Protection	The Centre conducts Plant Protection strategic research for northern Australia, with a major focus on disease and pest prevention through improved diagnostics, and on the increased use of disease and pest restraint plant cultivars. There is emphasis on developing and delivering strategies to minimise incursions from exotic disease and pests through pre-emptive management strategies directed towards early detection, and through breeding for resistance to major exotic diseases and pests.	1 July 1999	$13.9m	$74.2m	48
CRC for Value Added Wheat	This CRC applies new science such as proteomics, Genolpasty, molecular genetics, engineered antibody technologies and capillary electrophoresis, to increase knowledge of wheat quality. This and other research offers the opportunity to capitalise on the current deregulation of the wheat industry and the transition of wheat breeding from the public to the private sector. The CRC is creating wheat germ plasm with novel and beneficial properties, and processing improvements to provide a consistent wheat supply, end-use flexibility, greater product profitability and nutritional benefits. The science also provides new methods for early stage quality testing. Other outputs include novel on-the spot quality diagnostics, new decision support systems and new processes. The CRC is ensuring technology uptake and consumer education, and provision of qualified experts for the industry through an active education and technology transfer program. The benefits of this integrated research will be better quality characterisation at all stages through the supply chain, leading to smarter uses of existing varieties and grades, new products and lower production costs. The new, differentiated wheat industry will target specialised markets via various market streams, shifting wheat from 'commodity' status to areas of research expertise.	1st July 2001	$17.2m	$73.4m	30
CRC for Viticulture	The Centre aims to accelerate quality viticulture management from 'vine to palate', ensuring the economic and environmental sustainability of Australia's grape growing industries through nationally-integrated strategic research, proactive technology diffusion and eduction which: • develops and promotes innovative viticultural practices on key grape qualities; • develops and promotes environmentally and economically sustainable vineyard management systems; • develops and promotes the capacity to improve genetically modified grapevines for quality production and sustainable	1 July 1999	$18.0m	$76.8m	32
Molecular Plant Breeding CRC	The CRC research program will provide enabling intellectual property, new molecular technologies, tools and software to increase the efficiency and speed of plant breeding. The ultimate outcome for industry will be more robust germplasm and varieties - sooner. The education program will deliver trained plant breeders and researchers to meet customer needs. The primary focus of the CRC research is on cereals (wheat and barley) and pastures (grasses and clovers). Specifically, MPB research is focussed upon developing and delivering: • gene systems and transgenic technologies • new generation breeding strategies, tools and molecular marker technologies • tools, germplasm and cultivars to industry	1 July 2003	$25.0m	$139.0m	35
CRC for Australian Weed Management	Weeds are amongst the most serious threats facing Australia's primary production and biodiversity, with costs estimated at more than $1.2 billion per year for grain cropping and probably at least twice that for the rest of agriculture. The CRC for Australian Weed Management is working to reduce the risks facing the environment, agricultural and rural sectors across all of Australia from current weeds and an increasing	1 July 2001	$20.3m	$82.2m	32

Name of CRC	Research focus	Date established	CRC Programme funding	Total resources	Number of Postgraduate students
	number of weed incursions from overseas. The Centre's approach is to address weed problems in three general ways. First, to reduce the influx of new weeds from abroad and to more effectively manage new incursions already in Australia, and to do so without unduly affecting access to new species of beneficial plants for Australian agriculture and horticulture. Second, by novel irrigation of agronomy, weed-competitive crop cultivars, agricultural engineering, biocontrol, and smart herbicide use, to reduce the costs of weeds to primary industry while improving the sustainability of agriculture. Third, through the use of multi-disciplinary approaches, including biological control, grazing, fires, herbicides, and vegetation management, protect the integrity of Australia's landscapes and natural ecosystems. This CRC is developing a weed management framework for the next generation of land manager, which will extend far beyond the life of the CRC.				
CRC for Plant-based Management of Dryland Salinity	The focus of the CRC is the management of dryland salinity through the use of profitable, perennial plant-based farming systems. Its objectives are to: • Develop farming systems that mimic natural ecosystems; • Select suitable woody and herbaceous perennials; • Develop, test and demonstrate farming systems that reduce ground water recharge; • Rehabilitate and use salt-affected land • Develop policy options based on understanding the socio-economic constraints to the adoption of new farming systems; • Conduct education and technology transfer programs that enable users to apply the CRC's outputs; and • Protect and enhance biodiversity values in salinising landscapes.	1 July 2001	$27.0m	$170.4m	50
Bushfire CRC	The research program of the Bushfire CRC focuses on five inter-related areas of research and related activities: • Safe Prevention, Preparation and Suppression - To develop technologies to increase the understanding of the behaviour of, and the ability to manage, bushfires in order to reduce the risk to fire fighters and the community. • Management of Fire in the Landscape - Will develop tools for the effective, safe and ecologically sound planning and use of prescribed fire and fire regimes. • Community Self-Sufficiency for Fire Safety - To co-ordinate research in Australia to increase the self-sufficiency of communities in managing the risk from bushfires. It will provide the evidence base for the design of such initiatives and an agreed approach for comprehensive evaluation of their effectiveness. • Protection of People and Property - The objectives of the program are to reduce the loss of buildings and the injuries to occupants, to increase the safety and well being of fire fighters and to increase the availability and retention of essential volunteers. • E: Education, Training and Communication - The program will develop the next cohort of qualified fire researchers, improve the use of Australian intellectual and research resources and maintain Australia at the forefront of international bushfire research. The framework for the research of the Bushfire CRC were developed by end user organisations with interest in, or responsibilities for bushfires (namely, fire and emergency service and resource management agencies, other Australian Government and state departments and municipal authorities), in consultation with researchers and their institutions.	1 July 2003	$24.8m	$99.5m	30