DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY - AUSTRALIA

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INQUIRY INTO BUSINESS COMMITMENT TO RESEARCH AND DEVELOPMENT IN AUSTRALIA

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Executive Summary

During the past decade, Australia's rural R&D corporations (RDCs) have made strategic investments in R&D to help rural industries become more competitive, profitable and environmentally sustainable. Adoption of new technology and practices – flowing from successful R&D projects – is considered a major factor in increasing productivity and competitiveness of rural industries.

In the two decades from 1979 to 1999, there have been productivity increases across all rural industries. ABARE estimates productivity gains for the farm sector for the past 20 years have averaged 2.2% per annum (*Knopke, 2000, Knopke et al., 2000, Ha and Chapman, 2000*). This compares well with productivity increases in the manufacturing sector of about 1.6% and is particularly noteworthy given the decline in terms of trade for farmers of 1.9% per annum during the same period.

The RDC model is a successful investment management model, unique in the world. It is recognised internationally as best practice and represents a true partnership between government and industry. This partnership is based on the Commonwealth Government's commitment to match dollar-for-dollar industry contributions to a maximum of 0.5% of each industry's gross value of production. Industry's commitment to R&D is made possible through levies and voluntary contributions.

In 2000–01, rural industries invested $173 million, while the Commonwealth Government also invested $173 million by way of matching dollars and appropriation funds. With these monies, and drawing on reserves and other income sources, the RDCs funded more than $364 million of rural-related R&D.

The Government's continuing investment in rural R&D is predicated on the need to deliver benefits to industry and the wider community, and preserve our natural resources, particularly in rural and regional Australia. Government funding allows for rural industries to invest in wider 'public good' R&D that promotes sustainable natural resource use, environmental quality, improved food safety and improvements in occupational health and safety.

The range of RDC projects that have benefited rural industries over the past decade is enormous, including advances in crop and pasture varieties, genetic improvements in animals, technological improvements in equipment, advances in crop management and animal husbandry, more efficient input use, enhanced control of pests and diseases, improved harvesting techniques, better resource management and improved risk management tools.

Introduction

Over the past decade Australia's rural Research and Development Corporations (RDCs) have shaped the direction and outcomes of national research and development covering wool, dairy, fisheries and aquaculture, beef, lamb and mutton, pig production, forest production, grains, sugar, cotton, grapes and wine, more than 40 horticultural industries, natural resources and new and emerging rural industries such as rice, agroforestry, kangaroo meat, venison, emu products, rambutans and longans.

RDCs cover cotton, dairy, fisheries, forest and wood products, grains, grape and wine, horticulture, meat, pork, sugar, and wool. In addition, there are two general RDCs, the Rural Industries Research and Development Corporation and Land & Water Australia, which invest in new and emerging rural industries and broad natural resource management issues respectively.

The RDC model is unique in that it is a partnership between the Commonwealth Government and rural industries to invest in R&D that promotes internationally-competitive and sustainable practices and provides benefits to the wider community.

The RDCs are:

- Australian Pork Limited* (APL)
- Australian Wool Innovation Company* (AWI)
- Cotton Research and Development Corporation (CRDC)
- Dairy Research and Development Corporation (DRDC)
- Fisheries Research and Development Corporation (FRDC)
- Forest and Wood Products Research and Development Corporation (FWPRDC)
- Grains Research and Development Corporation (GRDC)
- Grape and Wine Research and Development Corporation (GWRDC)
- Horticulture Australia Limited* (HAL)
- Land & Water Australia (LWA)
- Meat & Livestock Australia* (MLA)
- Rural Industries Research and Development Corporation (RIRDC)
- Sugar Research and Development Corporation (SRDC)

(* The asterisks indicate the RDCs that have become industry-owned companies).

Collectively, they form the RDC model: one of the longest-standing and most successful government commitments to innovation in any Australian industry. As a consequence of this approach the Australian rural sector uses processes and technologies that are among the most advanced in the world.

Evolution of the RDC model

The Commonwealth Government established statutory authorities in the early 1920s to manage collective marketing schemes for primary industries. However, the first statutory arrangements for R&D were not introduced until 1936. Since then, there have been a number of key changes:

Key changes to rural R&D

1936	The first statutory industry/government research scheme introduced (*Wool Publicity and Research Act 1936*)
1945	Industry levy matched on a one-to-one basis with Commonwealth government funds (*Wool Use Promotion Act 1945*)
1953	*Wool Research Act 1953* established to give wool industry greater control over promotional funds
1957	*Wool Research Act 1953* amended to combine government and industry funds and provide for joint management of funds
1955-1982	Research funds established for wheat, tobacco, fisheries, wine, dairy, meat, honey, eggs, chicken meat, pigs, dried fruits, oilseeds, barley and cotton industries
1985	Restructure of funding system for rural R&D (*Rural Industries Research Act 1985*) to amalgamate rural industry legislation and provide one Act for administration of rural industry R&D funds. The Meat Research Corporation formed with the passage of the *Meat Research Corporation Act 1985*
1987	The Horticultural Research and Development Corporation formed with the passage of the *Horticultural Research and Development Corporation Act 1987*
1989	Introduction of the *Primary Industries and Energy Research and Development Act 1989*
1997	Creation of Meat & Livestock Australia under Corporations Law
2001	Creation of Australian Wool Innovation Pty Ltd, Horticulture Australia Limited and Australian Pork Limited under Corporations Law

The Government introduced the *Primary Industries and Energy Research and Development Act 1989* (PIERD Act) to expand the rural R&D effort, improve its efficiency and effectiveness by investing in priority areas and enhance industry competitiveness through more effective uptake of research. This represented a fundamental turning point in accountability to industry and government.

In the late 1990s industry and global market changes, and a desire by some rural industries for more flexibility in operations and greater autonomy in spending statutory levies, combined to create a climate for reviewing R&D structural arrangements.

MLA was created in 1997 following a recommendation by the Meat and Livestock Industry Reform Task Force that the Australian Meat and Livestock Corporation and Meat Research Corporation be abolished and industry be given more responsibility and control over its marketing and R&D.

MLA is a Corporations Law company that receives government and industry funding to provide marketing and R&D services to its industries. Accountability to

government is provided through a Deed of Agreement that includes annual and strategic plans and annual reports. MLA paved the way for new institutional arrangements for the wool (AWI), horticulture (HA) and pig industries (APL), all of which were incorporated this year.

The importance of innovation to the Australian economy, industries and community cannot be overstated. As highlighted in a number of recent reviews, there is little doubt innovation policy will form a vital part of broader government policy in future.

Innovation allows industries to improve their competitiveness, profitability and sustainability through:

- embracing and capitalising on advances in science, engineering and technology; and
- responding to new market opportunities.

Innovation for Australia's rural industries – including agriculture, fisheries and forestry – is supported by research and development (R&D) investment throughout the supply chain, with the Commonwealth Government's rural R&D Corporation (RDC) model being a vital component. This model complements the role of other rural research providers such as the CSIRO, Cooperative Research Centres (CRCs), State and Territory agencies and universities, as well as that of the Australian Research Council (ARC), which mainly funds basic research across broad disciplines.

Policy Rationale for the RDCs

The Government's matching contribution for rural R&D enables the RDCs to invest in R&D that not only results in industry-based productivity increases, but also delivers essential public good outcomes. These public good outcomes include regional development, improvements in food safety, environmental benefits, medical advances and new consumer products.

The Research, Innovation and Competitiveness Statement (Kerin and Cook, 1989), which formed the policy basis for the RDC model, articulated the key reasons for government involvement in rural R&D:

- to overcome the market failure associated with the lack of incentives and difficulty in organising the many rural producers to fund and pursue R&D and then capture the benefits of successful research projects; and
- to fulfil the need to fund R&D that addresses national needs and priorities and delivers public goods and benefits, such as those related to improved natural resource management and general management of the nation's food supply.

The flow on benefits to the wider community from R&D in this sector is also important. The Industries Assistance Commission (IAC) estimated at least 50% of benefits from rural R&D were captured by industry with the remaining benefits being distributed across other industries and the general community (*Industries Assistance Commission Report, 1976*). In its 1995 inquiry, the Industry Commission agreed with a joint RDC submission showing that RDCs pursued more basic/strategic R&D (38% of total R&D effort) than private sector business enterprises (6% of total R&D effort)

(*Industry Commission, 1995*).

The Government contribution recognises the significant value of investing public funds in R&D issues with:

- unique Australian characteristics, such as geography, climate and bioresources;
- a comparative advantage in terms of previous research, existing capacity or a body of existing knowledge;
- benefits that can be captured in Australia; and
- an under-investment of private industry research funding.

It also recognises:

- agriculture, fisheries and forestry production in the Australian environment has unique characteristics, which increases the reliance on domestic R&D;
- there are proven returns on investment and spin-off benefits (such as value-adding and benefits to the community) generated by rural R&D;
- the atomistic nature of the rural sector would mean there would be an under-investment in research if left to the private sector alone;
- investment in primary industries is often investment in environmental issues and not just for industry benefit; and
- Australian rural industries contribute around 20% of the total value of Australian exports (or almost $28 billion in 1999-2000 – an increase of over $6 billion in real terms compared with 10 years ago).

Key features of the RDC model

One of the original reasons for establishing the RDCs was to encourage industry investment and involvement in agricultural research. As such a fundamental feature of the RDC model is that it is effectively a partnership between the Commonwealth Government and rural industries to pursue rural R&D.

The key features of the Model are:

- Corporations are governed by independent skills-based boards charged with taking a strategic approach to rural R&D;
- a national and integrated approach to R&D priority-setting;
- strong industry involvement throughout the R&D process;
- a strong focus on outcomes; and
- accountability to industry and government.

A fundamental feature of RDC planning, activities and reporting is its emphasis on the ‘quadruple bottom line’ as spelt out in the objectives of the PIERD Act. These objectives require RDCs to fund and administer R&D relating to primary industries with a view to:

a) increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries;
b) achieving the sustainable use and sustainable management of natural resources;

c) making more effective use of the resources and skills of the community in general and the scientific community in particular; and
d) improving accountability for expenditure upon research and development activites in relation to primary industries.

The RDC operating environment facilitates an investment approach to R&D funding, with a focus on outcomes that deliver benefits to industry and the community. They also work in a coordinated way and fund joint R&D programs to tackle cross-industry issues such as salinity and soil acidification, pasture productivity, alternative farming systems, agroforestry, integrated pest management (IPM) and water quality (including algal bloom management).

Reporting to government and industry

All RDCs are required by law to produce annual reports and they must provide these to the Government and their industries through their representative organisation. All RDCs are required to attend the annual conference of their representative organisations, where the report is considered and RDCs report on progress.

The annual reports give a transparent account of the achievement of legislative objectives and corporate plans, including successes and shortcomings. Outputs and outcomes are measured against performance indicators indicating how well each RDC achieved.

It has been the practice of the responsible Minister to write to the RDCs to communicate the Government's priorities for rural R&D. These priorities are in many cases complementary to the priorities for rural industries. The Government expects these priorities to be reflected in the plans of the RDCs and reported in their annual report. Current priorities are sustainable natural resource management; whole of industry approach; biotechnology; increases in trade and market access; clean and green image; food safety; and improving our human resources. RDCs integrate these with industry priorities in corporate plans.

RDCs also recognise they need to continually improve their accountability to Government and industry. They have been working on a systematic approach, based on the quadruple bottom line concept, to reporting collective RDC performance to Government. This involves establishing common performance indicators, providing evidence of best management practice and achieving continuous improvement in delivering outcomes to industry and government stakeholders.

Government investment encourages industry investment

At the core of the RDC model is the matching funding arrangement wherein the Government matches industry's R&D contributions on a dollar-for-dollar basis up to 0.5% of the industry's gross value of production (GVP). The great bulk of the industry contributions are collected via a statutory levy or charge that is usually imposed at the first point of sale.

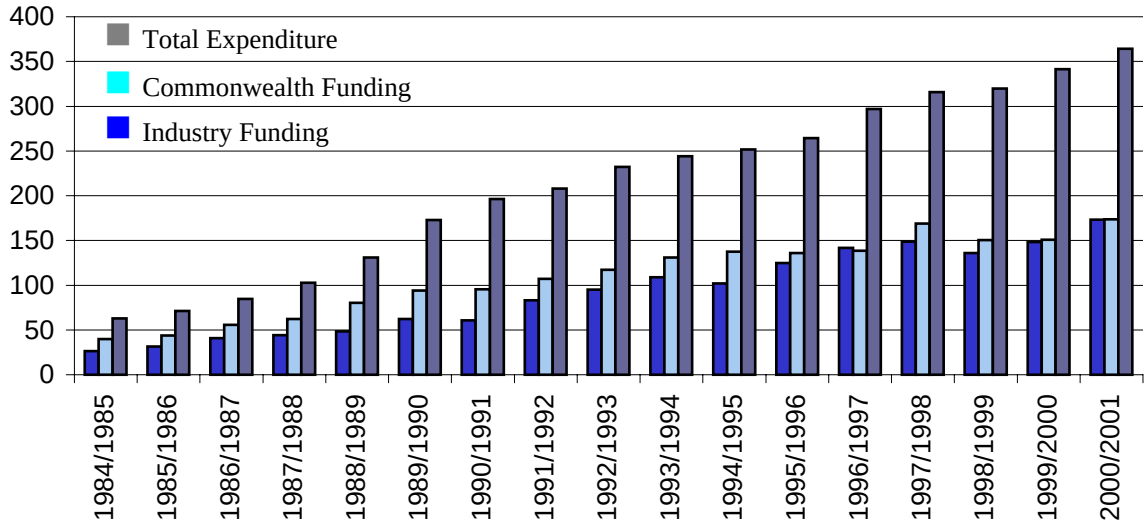
Producers have been willing to pay the statutory levy and in some instances have paid beyond the limit of the Commonwealth's matching payments. For example, the

grains industry has a statutory R&D levy of 1% on the farm-gate value of grain and while the Government only matches half of this (0.5% of GVP) grain growers are prepared to pay the additional (unmatched) levy because of the benefits that have accrued over the years (see below). Each year the industry has the opportunity to review the levy rate, but has consistently declined to reduce it.

Government support provides a solid foundation for rural industries to maintain or increase their level of R&D funding as they grow and develop. In fact, from this perspective alone the RDC model has been extremely successful. As an example, between 1985-86 and 1998-99 the dairy industry increased its contribution to R&D from 0.06% of GVP to 0.45% of GVP.

Overall, rural R&D income and expenditure have increased steadily since 1984-85. Between 1984-85 and 2000-01, the overall expenditure on rural R&D through the RDCs has increased from $63 million to $364 million. There has been an increase in government and industry contributions over this period, as shown in Figure 1.

Figure 1: RDC income and expenditure 1984-85 to 2000-01



Source: RDC Annual Reports 1984-1985 to 2000-2001

Industry adoption rates have been high

RDCs facilitate the uptake of R&D outcomes through their close links with industry.

- In a recent survey the Grains RDC (GRDC) found 54% of graingrowers had changed farming practices or crops as a result of GRDC-supported research outputs during the past two years.
- A study on technology adoption in the grape industry by the Grape and Wine RDC (GWRDC) showed 80% of growers were well informed on viticulture research and 68% had made positive changes to grape growing techniques over a two to three year period.

- MLA has achieved benefits for the beef industry of $8.6 million to date from its $2 million investment in the National Livestock Identification Scheme.
- The Forest and Wood Products RDC (FWPRDC) has funded research leading to the development of a high valued end-use for timber marked with gum veins, insect markings and knots, with this product showing high adoption rates by industry.
- DRDC invests research funds into five dairy manufacturing research centres that have instigated significant innovations, hastened the speed of adoption of new technology and provided returns to Australia of more than $55 million over the period 1993-1998.

RDCs: a key player in R&D investment

The RDCs' unique structure and mandate allows them to identify industry needs and R&D issues, invest in strategic R&D and pursue specified outcomes defined by industry and government priorities.

They complement the role of rural research providers such as the CSIRO, Cooperative Research Centres (CRCs), State and Territory agencies and universities, as well as that of the Australian Research Council (ARC), which mainly funds basic research across broad disciplines.

The CSIRO is Australia's largest Government research agency, undertaking basic-through-to-applied R&D with a focus on strategic user-oriented research. Approximately 15% of the RDCs investment is directly with the CSIRO and up to a further 15% indirectly, with CSIRO and RDCs being joint participants in CRCs.

CRCs bring together researchers from universities, CSIRO, other government research agencies (including the RDCs) and private industry to maximise the benefits of research through enhanced cooperative links between researchers and research users in the public and private sector. As at July 2001, there were 64 established CRCs: 12 relating to agriculture and rural-based manufacturing and 15 to environmental research. RDCs are involved in 15 CRCs and in a number of cases there is more than one RDC involved with a CRC.

State governments spend around $250 million per annum on rural R&D. Institutional arrangements, priorities and funding for rural R&D in each state have recently been reviewed and, in some cases, restructured. State government research often focuses on solutions for local or regional production problems and includes extension of relevant information to producers. It is often undertaken in collaboration with other research agencies and universities, with many projects conducted with joint funding from the RDCs.

The RDCs are often able to leverage investment from these bodies and from the private sector into industry and government R&D priorities for primary industries. Examples of this is the grains industry, via the GRDC, include:

- Grain*gene* – includes investment from AWB Limited and CSIRO;
- SunPrime – includes investment from GrainCorp and the University of Sydney; and

- CSIRO Stored Grain Research Laboratory – includes significant investments made by Australia's bulk handling companies.

The RDC model established under the PIERD Act differs significantly from the model of the early 1980s, when rural industry R&D was largely driven by the priorities of research agencies. Now, industry and government needs and priorities dominate the research agenda, and researchers must commit to projects with well-defined objectives, project payments contingent on meeting agreed milestones, and final payment on final report delivery. Timely reviews of projects by industry ensures focus on delivery of outcomes. Close links with industry facilitates the uptake of R&D outputs.

The Benefits

Adoption of new technology and practices – flowing from successful R&D projects – is considered a major factor in increasing productivity and competitiveness of rural industries.

The range of RDC projects that have benefited rural industries over the past decade is enormous, including advances in crop and pasture varieties, genetic improvements in animals, technological improvements in equipment, advances in crop management and animal husbandry, more efficient input use, enhanced control of pests and diseases, improved harvesting techniques, better resource management and improved risk management tools.

In the area of productivity:

- An investment by the Cotton RDC of $12 million in plant breeding, particularly in CSIRO, contributed to a move away from a dominance of US-bred cotton varieties to more than 80% of Australian cotton area being planted to CSIRO varieties during the 1990s.
- The Australian Wool Innovation Company has developed a new control method to reduce blowfly problems in sheep – a problem that costs the sheep industry more than $160 million per annum.
- RIRDC-funded research has facilitated reductions in rice industry water use of more than 30% over the past 10 years, while yields per megalitre have increased by more than 60%.

In addition to productivity improvements, the RDCs have had an important role in research into improving access to overseas markets and developing new products or modifying existing products to improve their value. Examples of RDC investment in these areas include:

- Virtually all RDCs, including the Dairy RDC, Sugar RDC, CRDC, RIRDC, Meat & Livestock Australia and the former Horticultural RDC, have funded trade research to provide a factual basis for lobbying overseas governments to reform trade barriers and reduce subsidies to their industries.

- RIRDC has funded research leading to the development of the world's first regulatory approved therapeutic honey, Medihoney, which has the potential to treat bacterial infections that are becoming resistant to conventional antibiotics.

- SRDC has funded the development of a new brand of raw sugar, Queensland High Pol, which enables Australia to compete directly with high pol sugar from Brazil.

In relation to sustainable use and management of natural resources RDCs invest around $100 million per annum in projects providing environmental benefits.

The following case studies demonstrate some of the significant benefits achieved in these areas.

RDCs have improved the understanding and management of natural resources

- Land & Water Australia has contributed to a significant improvement in the understanding and management of natural resources through investment in the National Land and Water Resources Audit, the Redesigning Agriculture for Australian Landscapes Program and the Social and Institutional Research Program.

- GRDC has funded R&D to overcome many problems associated with environmentally beneficial minimum tillage systems, assisting in an increase in direct drilling from 25% of crop area in 1995-96 to 36% in 1998-99.

- MLA has invested about $10 million in a Sustainable Grazing System program for livestock, including PROGRAZE® workshops that have resulted in 41% of participants moving to a more sustainable grazing approach.

- GWRDC has funded the development of partial rootzone drying technology that halves water consumption by grapevines, without affecting grape quality or yield, substantially easing the pressure on rivers and irrigation systems.

- Investment by FRDC in the Western Rock Lobster fishery in WA has contributed to its certification by the Marine Stewardship Council as a sustainable, well-managed fishery – a world first.

RDCs have assisted in the rehabilitation of degraded resources

- Land & Water Australia has taken the lead in the better co-ordination of national research effort under the National Dryland Salinity Program which has improved understanding of the causes and remedial actions for dryland salinity.

- Collaboration between RIRDC, Land & Water Australia and FWPRDC in the Joint Venture Agroforestry Program has reduced the risks associated with farm forestry in low to medium rainfall areas and boosted its expansion.

- The National Eutrophication Management Program, managed by Land & Water Australia, has made a major contribution to understanding the processes leading to algal blooms and strategies to prevent and manage them.

- Land & Water Australia has developed a rehabilitation manual incorporating all aspects of stream rehabilitation for application by river managers across Australia.

RDCs have reduced adverse impacts on the environment

- SRDC has invested $2.4 million over 10 years to encourage the adoption of green cane harvesting and crop trash retention resulting in potential benefits to the industry of $60 million and additional environmental benefits of $26 million.

- CRDC has played an important role in the introduction of Integrated Pest Management (IPM) regimes that have significantly reduced the reliance of the industry on environmentally harmful broad-spectrum and residual pesticides.

- The Pig R&D Corporation (PRDC, now Australian Pork Ltd) has demonstrated the benefits of using waste from deep litter-based piggery production systems as a fertiliser replacement for broadacre crops – creating money from what was a waste product and an environmental problem.

- Land & Water Australia manages the Climate Variability in Agriculture Program that has resulted in improved climate planning tools for farmers providing both financial and environmental benefits (37% of farmers now take account of seasonal forecasts in their planning).

RDCs have also provided broader community benefits

Rural research has a track record of delivering community benefits – in terms of direct contributions as well as through the flow on benefits from industry competitiveness and environmental sustainability R&D. The Industries Assistance Commission (IAC) estimated at least 50% of benefits from rural R&D were captured by industry, with the remaining benefits being distributed across other industries and the general community (*Industries Assistance Commission Report, 1976*).

More directly, some of the specific investments by the RDCs in projects of community benefit include:

- **Regional development:** for example, the significant expansion of the cotton and wine industries in Australia over the past 25 years has been supported by the considerable investment in R&D.

- **Investment in human resources:** RDCs directly fund training and development of people in their industries through, for example, support for the Australian Rural Leadership Program, development of farmer groups, travel awards, scholarships and the development of science, engineering and technology researchers.

- **Food safety and health:** Investment in issues associated with food safety and human health have provided benefits to industries and consumers – for example, MLA's $4 million investment in its SAFEMEAT program and Horticulture Australia Ltd's (HA) investment in an on-farm food safety and certification program, *Freshcare*.

- **Occupational Health and Safety (OH&S):** RDCs have helped address the significant OH&S issues associated with farming and the food supply chain – for example, MLA has developed a comprehensive resource kit to help abattoir workers manage transmissible disease risks, PRDC published a safety manual for piggeries, and SRDC analysis of OH&S issues led to the initiation of training courses that reduced injury down-time in cane mills by 40% between 1997 and 2000.

RDCs deliver clear economic benefits

The RDCs regularly commission quantitative and qualitative studies benefit-cost analyses (BCAs) into R&D projects within their portfolios, to quantify the return from each dollar invested. These analyses include consideration of both productivity and market benefits from the research.

The most recent review summarising these results was by Chudleigh and Simpson (2001). Chudleigh and Simpson examined BCAs from a number of the RDCs including:

- DRDC: benefit-cost ratio for portfolio of projects 3.2:1
- Land & Water Australia: benefit-cost ratio for portfolio of projects 20:1
- PRDC: benefit-cost ratio for portfolio of projects 8:1
- SRDC: benefit-cost ratio for portfolio of projects 3:1
- AWI: benefit-cost ratio for portfolio of projects 6:1

Chudleigh and Simpson estimated a weighted average of these ratios showing overall returns of 7.2:1.

If these were extrapolated over the entire amount invested by the RDCs over the decade, then the net benefit would be around $13.8 billion (in 1990-91 dollars). This is supported by other summary results of BCAs collected through the annual AFFA surveys of RDCs (Table 3) as well as by other researchers (for example, *Scobie et al, 1991* and *Mullen and Cox, 1995*).

Table 1: Benefit-cost analyses for rural R&D 1995-96 to 1998-99

Survey Year	Projects	Average BCA[1]	Range
1995-96	31	10	0.8-130
1996-97	11	39	3-169
1997-98	13	35	0.8-164
1998-99	30	13	1-81

1. Unweighted average of projects analysed. Source: AFFA Annual surveys of RDCs.

Examples of some of the analyses that have been done by particular RDCs are discussed below.

A 1999-2000 DRDC study on the economic returns from its R&D investment found the Corporation delivered a return over five years of at least $3.20 for every dollar invested (*DRDC Annual Report, 1999-2000*). The DRDC's top 13 projects collectively delivered $233 million to the Australian dairy industry from 1993-94 to 1997-98, while the total amount invested by the DRDC over the period was $73 million – illustrating that the economic benefits of the DRDC's top 13 projects alone generated three times the value of the total R&D investment.

The SRDC commissions regular independent evaluations of its R&D portfolio performance, most recently in 1998. Based on a random sample of projects over the previous five years, the benefit-cost ratio was 6:1 at a 5% discount rate. This equated to a quantifiable Net Present Value (NPV) of approximately $200 million to the Australian sugar industry and community for an investment of $33 million.

Industry and government-funded R&D, managed by the FRDC, has contributed to the transformation of Australia's Southern Bluefin Tuna industry from a low-value, threatened wild-catch resource into a high-value, more sustainable industry. FRDC worked within the industry, with customers and other research investors to improve the knowledge of the species, husbandry processes, technology and marketing. Southern Bluefin Tuna are now produced from aquaculture (farmed) as well as defined wild-catch fisheries for the Japanese sashimi market – boosting the value of the catch from less than $10 million in 1991-92 (when the tuna was mainly used for canning) to more than $250 million in 1999-2000 (ABARE, 2000). The benefit-cost ratio of research into Southern Bluefin Tuna aquaculture has been estimated at 41:1 and the close involvement of industry with the project has ensured 100% adoption of research recommendations.

Productivity growth in the rural sector

Declining terms of trade for the rural sector – where prices of farm products have not kept pace with rising prices of farm inputs – of 1.9% per annum over the past 20 years have provided a strong incentive to improve productivity. Productivity growth reflects the gains from adopting new technologies and better farming methods and is vital to continued profitability on farms and overall economic growth.

Ongoing productivity gains through R&D investment will be important for international competitiveness and in determining the split of resources invested in crop and livestock industries (*Knopke, 2000*). Knopke discusses the factors contributing to the strong productivity performance in broadacre cropping farms, which include better farm management, advances in plant breeding, improved crop rotations with better pest and weed control, development of new herbicides, more efficient fertiliser use, larger scale farming and advances in tractor and machinery design.

ABARE studies of broadacre and dairy productivity confirm high levels of productivity growth in the farm sector of around 2.2% per annum over the period 1997-98 to 1998-99. This compares well with productivity increases in the manufacturing sector of about 1.6% per annum. Despite the overall high rate of productivity growth for the farm sector, there were some significant differences in productivity between industries, regions and farms (*Knopke et al., 2000*; *Ha and Chapman, 2000*), as shown in Table 2.

Table 2: Terms of trade and productivity growth[a]

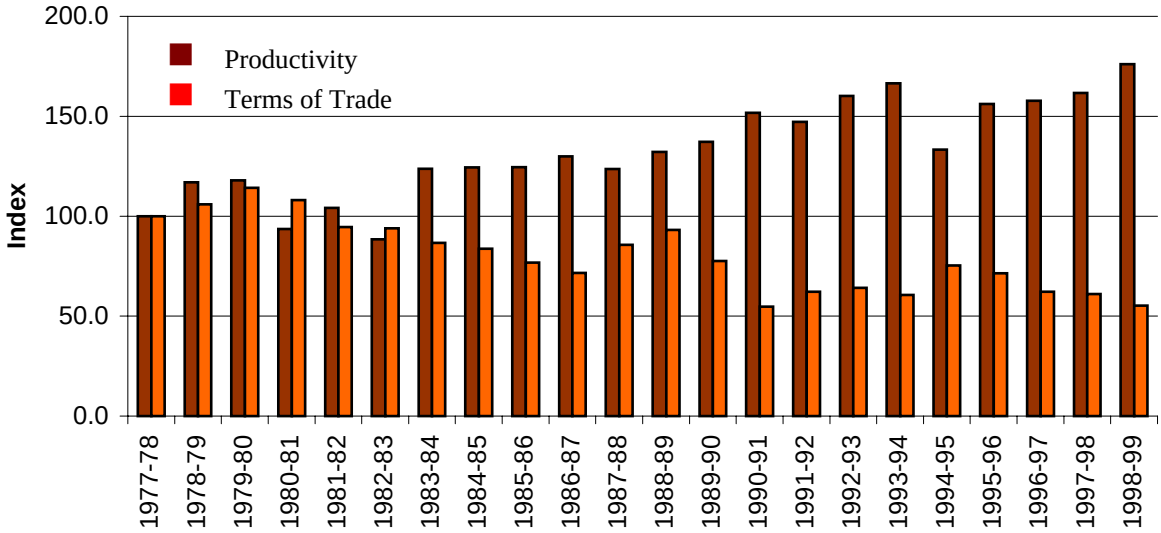
Annual rates of change 1977-78 to 1998-99

	Output Growth %	Input Growth %	Productivity %	Terms of Trade %
Total farm sector	**2.7**	**0.5**	**2.2**	**-1.9**
Crop farms				
Wheat and other crops	4.8	1.3	3.6	-3.1
Mixed crops livestock	3.6	1.0	2.6	-2.9
All crop farms	4.5	1.3	3.2	-3.1
Livestock specialist				
Sheep	1.2	0.6	0.6	-2.4
Beef	2.4	0.3	2.1	-2.1
Sheep-beef	0.4	-0.9	1.4	-2.2
All broadacre farms	**3.3**	**0.7**	**2.6**	**-2.9**
All dairy farms[b]	**4.4**	**2.6**	**1.8**	**-1.1**

a. Productivity growth is measured as total factor productivity which takes into account all inputs and outputs associated with the operating unit as well as technological changes.
b. Dairy data are for the 22 years, 1978-79 to 1999-2000.

The highest rate of growth has been in the wheat and other crops industries (3.6% per annum) while, in contrast, the sheep industry has grown by 0.6% per annum, which has not been sufficient to offset the declining terms of trade for this industry. Terms of trade and productivity indexes over time are shown in Figure 2.

Figure 2: Productivity growth and terms of trade on crop farms



The productivity estimates by Knopke are broadly consistent with those produced by others for the agricultural sector (as summarised in *Chudleigh and Simpson, 2001*).

While R&D outcomes are clearly likely to contribute to productivity growth it is difficult to measure the exact contribution. Initial results from RIRDC-backed research from the Centre for International Economics (CIE) show more than half of all productivity gains in agriculture are directly attributable to knowledge. This is supported by information from the US, where every 1% increase in publicly-funded R&D increases productivity by 0.38% and that an extra year of farm operator education improves productivity by 0.32% (*Woods, 2000*). Some examples of recent research which will improve the productivity of the rural sector are outlined below.

Over the past decade CRDC has contributed approximately $12 million to plant breeding, particularly in CSIRO. Prior to 1980 the cotton industry was completely dependent on US-bred varieties. During the 1980s, the release of locally bred CSIRO varieties gained momentum and by the mid 1990s CSIRO varieties dominated the market (more than 80% of cotton area). The advantage of locally produced varieties is that they are more likely to be suited to the Australian environment than cultivars produced for conditions in other countries. The percentage of CSIRO cultivars planted by Australian cotton growers is a measure of acceptance and uptake of this area of CRDC research. The investment in the Australian breeding program has also produced a revenue stream for the Corporation through a royalty sharing agreement with the CSIRO. The income from royalties supplements the Corporation's other revenue and is reinvested into the research program.

AWI has funded research resulting in the development of a new compound that has the potential to reduce the damaging effects of the sheep blowfly. The sheep blowfly is estimated to cost the Australian Merino sheep and wool industries more than $160 million a year to control and treat its effects. In a program backed by AWI in collaboration with CSIRO Livestock and Virbac Australia Pty Ltd, researchers are evaluating an alternative method of controlling and reducing the financial costs

associated with breech strike in sheep. The project has drawn on recent developments in human dermatology and cancer therapy to develop a non-toxic, natural compound applied to the sheep that appears to permanently inactivate a proportion (up to 100%) of wool follicles. This research stands to significantly benefit woolgrowers and the industry financially, as current control measures (such as jetting, mulesing, crutching and shearing) are costly, labour intensive and, in some cases, potentially harmful to the environment (jetting) or raise animal welfare issues (mulesing).

RIRDC-funded research supports one of the most efficient rice industries in the world. The Australian rice industry produces 1.7 million tonnes p.a. (85% for export), operates without production or export subsidies and is particularly important to regional Australia, with around 2,500 family-operated farm businesses in NSW and Victoria. Through implementation of R&D outputs – such as laser landforming, electro-magnetic surveying and soil textural analyses and planting new shorter-season varieties – rice industry water use per hectare has declined by more than 30% over the past 10 years, while yields per megalitre have increased by more than 60%.

A HA study reviewed the impact of HRDC and Australian Apple and Pear Growers Association Inc (AAPGA) investment in pest, weed and disease management and crop regulation R&D between 1991 and 1999. It included an evaluation of the impact of practices such as integrated pest management (IPM), now practiced by an estimated 80% of apple and pear growers, and chemical thinning. It found that the economic returns from the R&D investment have been significant, with benefit-cost ratios of 1.5:1 and an internal rate of return of 12%. The study reported that the R&D investment had accelerated the development of IPM and crop regulation technologies over the nine years, resulted in significant changes in industry practice and culture and impacted positively on the extent and rate of adoption of IPM practices.

GRDC has developed a low-cost, on-farm meter for measuring grain moisture before delivery of grain to receival points – to be on the market in 2002. Grain that contains too much moisture can go mouldy, lose export value and has to be dried, leading to added cost and greenhouse emissions. Checking the moisture content of grain before delivery to receival points can save all this – and so assure Australia's customers of a superior product and farmers of a better return. The meter is an example of a successful local commercial development from Australia's research investment that generates national benefits far greater than the cost of the research.

The challenges ahead

Continued investment in rural R&D is essential to delivering new technologies and products with potential to add value to rural export markets and provide options for sustainable production in the context of Australia's natural environment. The existing industry-government partnership that is fundamental to the RDC model remains relevant as the best means of effectively delivering rural R&D outcomes.

The Government continues to regard the industry-government partnership in RDCs as important to focusing research efforts in the most prospective areas, achieving appropriate levels of funding for R&D, maximising adoption rates and obtaining significant wider community benefits.

Ongoing investment in rural R&D is essential to:

- maintain productivity growth at a level that offsets declining terms of trade;
- ensure Australian rural industries maintain a competitive advantage in a world commodity market characterised by declining real commodity prices;
- deliver new technologies and products with potential to add enormous value to fast-growing rural export markets;
- ensure rural industries sustainably manage the natural resource base on which they depend;
- add value to other Australian industry sectors, from manufacturing, transport and retail to pharmaceuticals and 'nutraceuticals'; and
- provide jobs and economic growth in rural and regional Australia.

Underlying many of these points is the need for continued strong productivity growth in rural industries. Limited scope exists for such productivity growth without advances through high-tech R&D such as:

- higher-yielding plants and animals;
- plants and animals better suited to low moisture or saline environments;
- improved soil fertility;
- new pest and disease controls;
- better understanding of climate impacts on production; and
- improved supply chain operation and efficiency.

For example, genetic engineering will be important in creating new products to improve the quality of life, human health and safety. Similarly, bioprospecting and bioprocessing have already made possible the discovery and development of synthetic fuels from agricultural products, new drugs and health-promoting food products. Major competitors such as the US, EU and NZ are investing heavily in these technologies and without a similar capability, Australia will rapidly lose its competitive position. The House of Representatives Standing Committee on Primary Industries and Regional Services (2001) recently argued "there is immense potential for Australia to use its biological and ... other strengths ... to compete with the best in the world in an era dominated by biotechnology".

The RDC model remains relevant for the 21st century

An important question for this first decade of the 21st century is whether the RDC model remains the best means of achieving the rural R&D outcomes of maximum benefit to industry and the community. The Commonwealth Government recently endorsed the superiority of the RDC model in its major statement on the future of innovation in Australia, Backing Australia's Ability (Department of Industry, Science and Resources, 2001):

"*A joint Industry-Government investment of $1.5 billion made over the past five years through rural R&D corporations maintains the place of Australia's primary industries as among the best in the world. The Government's continued commitment to this industry-Government partnership will continue to strengthen our rural economy.*"

The model adapts to incorporate new best practice strategies for funding and delivering R&D, depending on industry needs. Recent moves to give industry greater ownership and control through private companies reflect this. Regardless of the form of model adopted by each RDC, a strong focus remains on government and industry priorities in corporate planning. The RDC model provides:

- the mechanism to fund new technologies;
- industry and government priority setting to ensure appropriate invetsment strategies; and
- links across RDCs to collaborate on high-priority areas and create substantial efficiencies.

Collaboration between the RDCs and other research providers and funding bodies to deliver solutions for their industries remains a key feature of the model. CSIRO, State/Territory governments, universities, CRCs and the private sector are important partners. Collaboration consolidates effort, provides a critical mass of funding to develop leading-edge technologies and improves priority setting.

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Statutory RDCs

Cotton Research and Development Corporation

PO Box 282
NARRABRI NSW 2390
Telephone: (02) 6792 4088
Facsimile: (02) 6792 4400
Website: www.crdc.com.au

Chair: Ms Bridget Jackson
Executive Director: Mr Ralph Schulzé

The Cotton Research and Development Corporation (CRDC) aims to create a more sustainable, competitive and profitable cotton industry providing increased economic, environmental and social benefits to rural and regional communities and the nation. It will achieve this by: improving production, processing, storage transport and marketing of cotton; making more effective use of the resources and skills of the community in general and the scientific community in particular; and improving accountability for expenditure upon research and development activities in relation to the cotton industry.

In 2000-01 the Corporation received $6.93 million in industry contributions and $6.77 million from the Commonwealth. Total investment in R&D was $13.9 million.

Dairy Research and Development Corporation

Level 3, 84 William Street
MELBOURNE VIC 3000
Telephone: (03) 9602 5300
Facsimile: (03) 9602 5442
Website: www.drdc.com.au

Chair: Mr Anthony Bates
Chief Executive Officer: Dr Joe Sullivan

The Dairy Research and Development Corporation's (DRDC) mission is to maximise the economic, environmental and social benefits for its stakeholders through targeted investment in R&D to achieve an innovative, globally competitive and sustainable dairy industry. DRDC is a statutory corporation of the Commonwealth Government.

In 2000-01, the total dairy R&D investment of $31.16 million was made up of contributions from the Australian dairy industry ($14.70 million) the Commonwealth ($12.68 million) and other sources ($3.78 million).

Fisheries Research and Development Corporation

PO BOX 222
DEAKIN WEST ACT 2600
Telephone: (02) 6285 0400

Facsimile: (02) 6285 4421
Website: www.frdc.com.au

Chair: Mr Dennis Bryne
Executive Director: Mr Peter Dundas-Smith

The Fisheries Research and Development Corporation's (FRDC) has become widely recognised as the leading Australian agency concerned with planning, funding and managing fisheries R&D. FRDC's mission is to increase economic and social benefits for the fishing industry and the people of Australia, through planned investment in research and development, in an ecologically sustainable framework.

In 2000-01 the FRDC received $3.8 million in industry R&D contributions, with the Commonwealth contributing $14.3 million. Total R&D investment amounted to $20.3 million.

Forest and Wood Products Research and Development Corporation

PO Box 69
World Trade Centre
MELBOURNE VIC 8005
Telephone: (03) 9614 7544
Facsimile: (03) 9614 6822
Website: www.fwprdc.org.au

Chair: Mr Thorold Gunnersen
Executive Director: Dr Glen Kile

The Forest and Wood Products Research and Development Corporation (FWPRDC) vision is to create an internationally competitive and sustainable forest and wood products industry that supports employment and communities throughout Australia.

In 2000-01 the FWPRDC received $3.86 million in industry R&D contributions and $2.67 million from the Commonwealth, with total R&D investment amounting to $4.35 million.

Grains Research and Development Corporation

PO Box E6
KINGSTON ACT 2604
Telephone: (02) 6272 5525
Facsimile: (02) 6271 6430
Website: www.grdc.com.au

Chair: Mr Grant Latta
Managing Director: Professor John Lovett

The Grains Research and Development Corporation (GRDC) is one of the world's leading grains research organisations, responsible for planning, investing and overseeing research and development, delivering improvements in production, sustainability and profitability across the Australian grains industry. The GRDC's vision is for a profitable, internationally competitive and ecologically sustainable grains industry. The GRDC's research portfolio covers 25 leviable crops spanning temperate and tropical cereals, oilseeds and pulses, worth over $7 billion a year in farm production, alone.

In 2000-01 the GRDC received $48.87 million in industry R&D contributions and $34.46 million in Commonwealth contributions. Total R&D investment for 2000-01 was $107.80 million with a total budget of $115.74 million.

Grape and Wine Research and Development Corporation

PO Box 2592
Kent Town Business Centre
KENT TOWN SA 5071
Telephone: (08) 8222 9266
Facsimile: (08) 8222 9267
Website: www.gwrdc.com.au

Chair: Dr John Stocker AO
Executive Director: Mr David Hall

The Grape and Wine Research and Development Corporation (GWRDC) invests in grape and wine research and development on behalf of the Australian wine industry and the Australian community. The GWRDC's mission is to realise for Australia the excellent returns available from strategic investment in wine industry research and development. The GWRDC coordinates, optimises and offers program leadership on a national basis. Its investment approach aims to address industry-wide priorities, whilst ensuring that delivery and adoption occur at a more regional level.

In 2000-01 the GWRDC received $6.2 million in R&D contributions from industry, with $5.1 million being contributed by the Commonwealth. Total R&D investment amounted to $11.3 million.

Land & Water Australia

PO Box 2182
CANBERRA ACT 2601
Telephone: (02) 6257 3379
Facsimile: (02) 6257 3420
Website: www.lwa.gov.au

Chair: Ms Roberta Brazil
Executive Director: Mr Andrew Campbell

Land & Water Australia's mission is to provide national leadership in generating knowledge, informing debate and inspiring innovation and action in natural resource management. The Corporation identifies and invests in R&D that helps maintain the natural resource base vital to Australia, and applies principles of ecologically sustainable development in order to maximise the benefits derived by the community from our land, water and vegetation resources.

In 2000-01 the Corporation's expenditure totalled $22.162million, predominantly from the Commonwealth Government.

Rural Industries Research and Development Corporation

PO Box 4776
KINGSTON ACT 2604
Telephone: (02) 6272 4539
Facsimile: (02) 6272 5877
Website: www.rirdc.gov.au

Chair: Professor Elizabeth Woods
Executive Director: Mr Peter Core

The Rural Industries Research and Development Corporation is about managing and funding priority research and translating results into practical outcomes for industry development. Put simply, our business is about new products and services and new and better ways of producing them. The Corporation achieves this by enhancing innovation in the rural and related sectors; fostering the development of new industries; and by addressing strategic issues facing the rural sector.

In 2000-01, RIRDC received $3.96 million in industry levies, $15.30 million in Commonwealth funding, and had a total R&D expenditure of $24.28 million.

Sugar Research and Development Corporation

PO Box 12050
George St Post Shop
BRISBANE QLD 4003
Telephone: (07) 3210 0495
Facsimile: (07) 3210 0506
Website: www.srdc.gov.au

Chair: Mr Clive Hildebrand
Executive Director: Dr Russell Muchow

The Sugar Research and Development Corporation (SRDC) funds research and development projects aimed at producing outcomes that benefit the international competitiveness, profitability and sustainability of the Australian sugar industry, and the Australian community.

SRDC activities are based around three value systems, which include competitive whole of industry sugar systems, sustainable farming systems, and sustainable processing and distribution systems. These focus on the need to consider the sugar system as a whole and to use multi disciplinary approaches to explore the inter-dependencies between the growing, harvesting, milling and marketing sectors. Furthermore, there is a need to devote attention to resource use and environmental sustainability and to deliver triple bottom line outcomes.

In 2000-01 the SRDC received $4.51 million in industry R&D contributions, $8.14 million in Commonwealth R&D contributions and had a total R&D expenditure of $13.76 million.

Industry-owned Companies

Meat and Livestock Australia

Locked Bag 991
NORTH SYDNEY NSW 2059
Telephone: (02) 9463 9333
Facsimile: (02) 9463 9393
Website: www.mla.com.au

Chair: Mr David Crombie
Managing Director: Mr Richard Brooks

Meat and Livestock Australia (MLA) is an industry owned company that provides marketing and R&D services to the meat and livestock industry. Meat and Livestock Australia's mission is to create opportunities for growth and profit in our industry.

In 2000-01 MLA received $25.14 million from producer levies and private industry sources, $20.76 million from the Commonwealth and expended a total of $41.49 million for investment in R&D for these industries.

Horticulture Australia Limited

Level 1, 50 Carrington St
SYDNEY NSW 2000
Telephone: (02) 8295 2300
Facsimile: (020) 82952399
Website: www.horticulture.com.au

Chair: Dr Jane Wilson
Managing Director: Mr John Webster

The aim of Horticulture Australia Limited (HAL) is to develop Australian horticulture by providing comprehensive and professional R&D and marketing services to over 30 different organisations from the fruit, vegetables and nursery industries. HAL is an industry owned company that the Commonwealth has contracted to deliver marketing and R&D services for the horticulture industry

In 2000-01 the HRDC received $11 million in industry funding, $17 million in Commonwealth funding and had an expenditure of $35 million.

Australian Wool Innovation Pty Ltd

Level 5, 45-47 York St
SYDNEY NSW 2000
Telephone: (02) 9299 9090
Facsimile: (02) 9299 9880
Website: www.wool.com.au

Chair: Ms Maree McCaskill
Managing Director: Mr Col Dorber

Australian Wool Innovation Pty Ltd (AWI) aims to increase the profitability, productivity and sustainability of Australian wool producers through improving wool quality, the efficiency of wool processing and developing new wool products for consumers.

In 2000-01 AWI received $40 million in industry R&D contributions and $9.83 million in Commonwealth contributions, and had a total expenditure of $20.27 million.

Australian Pork Limited

PO Box 148
DEAKIN WEST ACT 2600
Telephone: (02) 6285 2200
Facsimile: (02) 6285 2288
Website: www.apl.au.com

Chair: Dr Paul Higgins
Chief Executive Officer: Mr Brian Ramsay

Australian Pork Limited (APL) is an industry-owned company that provides marketing, R&D and policy services to the pork industry. It has responsibility for providing the Australian pork industry with its R&D and marketing services, as well as undertaking strategic policy development.

In 2000-01 the PRDC received $3.51million in industry R&D contributions and $4.07million in Commonwealth contributions, contributing to a total expenditure of $9.32million.

DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY - AUSTRALIA

SUBMISSION TO THE HOUSE OF REPRESENTATIVES STANDING COMMITTEE ON SCIENCE AND INNOVATION

INQUIRY INTO BUSINESS COMMITMENT TO RESEARCH AND DEVELOPMENT IN AUSTRALIA

September 2002

Executive Summary

During the past decade, Australia's rural R&D corporations (RDCs) have made strategic investments in R&D to help rural industries become more competitive, profitable and environmentally sustainable. Adoption of new technology and practices – flowing from successful R&D projects – is considered a major factor in increasing productivity and competitiveness of rural industries.

In the two decades from 1979 to 1999, there have been productivity increases across all rural industries. ABARE estimates productivity gains for the farm sector for the past 20 years have averaged 2.2% per annum (*Knopke, 2000, Knopke et al., 2000, Ha and Chapman, 2000*). This compares well with productivity increases in the manufacturing sector of about 1.6% and is particularly noteworthy given the decline in terms of trade for farmers of 1.9% per annum during the same period.

The RDC model is a successful investment management model, unique in the world. It is recognised internationally as best practice and represents a true partnership between government and industry. This partnership is based on the Commonwealth Government's commitment to match dollar-for-dollar industry contributions to a maximum of 0.5% of each industry's gross value of production. Industry's commitment to R&D is made possible through levies and voluntary contributions.

In 2000–01, rural industries invested $173 million, while the Commonwealth Government also invested $173 million by way of matching dollars and appropriation funds. With these monies, and drawing on reserves and other income sources, the RDCs funded more than $364 million of rural-related R&D.

The Government's continuing investment in rural R&D is predicated on the need to deliver benefits to industry and the wider community, and preserve our natural resources, particularly in rural and regional Australia. Government funding allows for rural industries to invest in wider 'public good' R&D that promotes sustainable natural resource use, environmental quality, improved food safety and improvements in occupational health and safety.

The range of RDC projects that have benefited rural industries over the past decade is enormous, including advances in crop and pasture varieties, genetic improvements in animals, technological improvements in equipment, advances in crop management and animal husbandry, more efficient input use, enhanced control of pests and diseases, improved harvesting techniques, better resource management and improved risk management tools.

Introduction

Over the past decade Australia's rural Research and Development Corporations (RDCs) have shaped the direction and outcomes of national research and development covering wool, dairy, fisheries and aquaculture, beef, lamb and mutton, pig production, forest production, grains, sugar, cotton, grapes and wine, more than 40 horticultural industries, natural resources and new and emerging rural industries such as rice, agroforestry, kangaroo meat, venison, emu products, rambutans and longans.

RDCs cover cotton, dairy, fisheries, forest and wood products, grains, grape and wine, horticulture, meat, pork, sugar, and wool. In addition, there are two general RDCs, the Rural Industries Research and Development Corporation and Land & Water Australia, which invest in new and emerging rural industries and broad natural resource management issues respectively.

The RDC model is unique in that it is a partnership between the Commonwealth Government and rural industries to invest in R&D that promotes internationally-competitive and sustainable practices and provides benefits to the wider community.

The RDCs are:

- Australian Pork Limited* (APL)
- Australian Wool Innovation Company* (AWI)
- Cotton Research and Development Corporation (CRDC)
- Dairy Research and Development Corporation (DRDC)
- Fisheries Research and Development Corporation (FRDC)
- Forest and Wood Products Research and Development Corporation (FWPRDC)
- Grains Research and Development Corporation (GRDC)
- Grape and Wine Research and Development Corporation (GWRDC)
- Horticulture Australia Limited* (HAL)
- Land & Water Australia (LWA)
- Meat & Livestock Australia* (MLA)
- Rural Industries Research and Development Corporation (RIRDC)
- Sugar Research and Development Corporation (SRDC)

(* The asterisks indicate the RDCs that have become industry-owned companies).

Collectively, they form the RDC model: one of the longest-standing and most successful government commitments to innovation in any Australian industry. As a consequence of this approach the Australian rural sector uses processes and technologies that are among the most advanced in the world.

Evolution of the RDC model

The Commonwealth Government established statutory authorities in the early 1920s to manage collective marketing schemes for primary industries. However, the first statutory arrangements for R&D were not introduced until 1936. Since then, there have been a number of key changes:

Key changes to rural R&D

1936	The first statutory industry/government research scheme introduced (*Wool Publicity and Research Act 1936*)
1945	Industry levy matched on a one-to-one basis with Commonwealth government funds (*Wool Use Promotion Act 1945*)
1953	*Wool Research Act 1953* established to give wool industry greater control over promotional funds
1957	*Wool Research Act 1953* amended to combine government and industry funds and provide for joint management of funds
1955-1982	Research funds established for wheat, tobacco, fisheries, wine, dairy, meat, honey, eggs, chicken meat, pigs, dried fruits, oilseeds, barley and cotton industries
1985	Restructure of funding system for rural R&D (*Rural Industries Research Act 1985*) to amalgamate rural industry legislation and provide one Act for administration of rural industry R&D funds. The Meat Research Corporation formed with the passage of the *Meat Research Corporation Act 1985*
1987	The Horticultural Research and Development Corporation formed with the passage of the *Horticultural Research and Development Corporation Act 1987*
1989	Introduction of the *Primary Industries and Energy Research and Development Act 1989*
1997	Creation of Meat & Livestock Australia under Corporations Law
2001	Creation of Australian Wool Innovation Pty Ltd, Horticulture Australia Limited and Australian Pork Limited under Corporations Law

The Government introduced the *Primary Industries and Energy Research and Development Act 1989* (PIERD Act) to expand the rural R&D effort, improve its efficiency and effectiveness by investing in priority areas and enhance industry competitiveness through more effective uptake of research. This represented a fundamental turning point in accountability to industry and government.

In the late 1990s industry and global market changes, and a desire by some rural industries for more flexibility in operations and greater autonomy in spending statutory levies, combined to create a climate for reviewing R&D structural arrangements.

MLA was created in 1997 following a recommendation by the Meat and Livestock Industry Reform Task Force that the Australian Meat and Livestock Corporation and Meat Research Corporation be abolished and industry be given more responsibility and control over its marketing and R&D.

MLA is a Corporations Law company that receives government and industry funding to provide marketing and R&D services to its industries. Accountability to

government is provided through a Deed of Agreement that includes annual and strategic plans and annual reports. MLA paved the way for new institutional arrangements for the wool (AWI), horticulture (HA) and pig industries (APL), all of which were incorporated this year.

The importance of innovation to the Australian economy, industries and community cannot be overstated. As highlighted in a number of recent reviews, there is little doubt innovation policy will form a vital part of broader government policy in future.

Innovation allows industries to improve their competitiveness, profitability and sustainability through:

- embracing and capitalising on advances in science, engineering and technology; and
- responding to new market opportunities.

Innovation for Australia's rural industries – including agriculture, fisheries and forestry – is supported by research and development (R&D) investment throughout the supply chain, with the Commonwealth Government's rural R&D Corporation (RDC) model being a vital component. This model complements the role of other rural research providers such as the CSIRO, Cooperative Research Centres (CRCs), State and Territory agencies and universities, as well as that of the Australian Research Council (ARC), which mainly funds basic research across broad disciplines.

Policy Rationale for the RDCs

The Government's matching contribution for rural R&D enables the RDCs to invest in R&D that not only results in industry-based productivity increases, but also delivers essential public good outcomes. These public good outcomes include regional development, improvements in food safety, environmental benefits, medical advances and new consumer products.

The Research, Innovation and Competitiveness Statement (Kerin and Cook, 1989), which formed the policy basis for the RDC model, articulated the key reasons for government involvement in rural R&D:

- to overcome the market failure associated with the lack of incentives and difficulty in organising the many rural producers to fund and pursue R&D and then capture the benefits of successful research projects; and
- to fulfil the need to fund R&D that addresses national needs and priorities and delivers public goods and benefits, such as those related to improved natural resource management and general management of the nation's food supply.

The flow on benefits to the wider community from R&D in this sector is also important. The Industries Assistance Commission (IAC) estimated at least 50% of benefits from rural R&D were captured by industry with the remaining benefits being distributed across other industries and the general community (*Industries Assistance Commission Report, 1976*). In its 1995 inquiry, the Industry Commission agreed with a joint RDC submission showing that RDCs pursued more basic/strategic R&D (38% of total R&D effort) than private sector business enterprises (6% of total R&D effort)

(*Industry Commission, 1995*).

The Government contribution recognises the significant value of investing public funds in R&D issues with:

- unique Australian characteristics, such as geography, climate and bioresources;
- a comparative advantage in terms of previous research, existing capacity or a body of existing knowledge;
- benefits that can be captured in Australia; and
- an under-investment of private industry research funding.

It also recognises:

- agriculture, fisheries and forestry production in the Australian environment has unique characteristics, which increases the reliance on domestic R&D;
- there are proven returns on investment and spin-off benefits (such as value-adding and benefits to the community) generated by rural R&D;
- the atomistic nature of the rural sector would mean there would be an under-investment in research if left to the private sector alone;
- investment in primary industries is often investment in environmental issues and not just for industry benefit; and
- Australian rural industries contribute around 20% of the total value of Australian exports (or almost $28 billion in 1999-2000 – an increase of over $6 billion in real terms compared with 10 years ago).

Key features of the RDC model

One of the original reasons for establishing the RDCs was to encourage industry investment and involvement in agricultural research. As such a fundamental feature of the RDC model is that it is effectively a partnership between the Commonwealth Government and rural industries to pursue rural R&D.

The key features of the Model are:

- Corporations are governed by independent skills-based boards charged with taking a strategic approach to rural R&D;
- a national and integrated approach to R&D priority-setting;
- strong industry involvement throughout the R&D process;
- a strong focus on outcomes; and
- accountability to industry and government.

A fundamental feature of RDC planning, activities and reporting is its emphasis on the ‘quadruple bottom line’ as spelt out in the objectives of the PIERD Act. These objectives require RDCs to fund and administer R&D relating to primary industries with a view to:

a) increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries;
b) achieving the sustainable use and sustainable management of natural resources;

c) making more effective use of the resources and skills of the community in general and the scientific community in particular; and
d) improving accountability for expenditure upon research and development activites in relation to primary industries.

The RDC operating environment facilitates an investment approach to R&D funding, with a focus on outcomes that deliver benefits to industry and the community. They also work in a coordinated way and fund joint R&D programs to tackle cross-industry issues such as salinity and soil acidification, pasture productivity, alternative farming systems, agroforestry, integrated pest management (IPM) and water quality (including algal bloom management).

Reporting to government and industry

All RDCs are required by law to produce annual reports and they must provide these to the Government and their industries through their representative organisation. All RDCs are required to attend the annual conference of their representative organisations, where the report is considered and RDCs report on progress.

The annual reports give a transparent account of the achievement of legislative objectives and corporate plans, including successes and shortcomings. Outputs and outcomes are measured against performance indicators indicating how well each RDC achieved.

It has been the practice of the responsible Minister to write to the RDCs to communicate the Government's priorities for rural R&D. These priorities are in many cases complementary to the priorities for rural industries. The Government expects these priorities to be reflected in the plans of the RDCs and reported in their annual report. Current priorities are sustainable natural resource management; whole of industry approach; biotechnology; increases in trade and market access; clean and green image; food safety; and improving our human resources. RDCs integrate these with industry priorities in corporate plans.

RDCs also recognise they need to continually improve their accountability to Government and industry. They have been working on a systematic approach, based on the quadruple bottom line concept, to reporting collective RDC performance to Government. This involves establishing common performance indicators, providing evidence of best management practice and achieving continuous improvement in delivering outcomes to industry and government stakeholders.

Government investment encourages industry investment

At the core of the RDC model is the matching funding arrangement wherein the Government matches industry's R&D contributions on a dollar-for-dollar basis up to 0.5% of the industry's gross value of production (GVP). The great bulk of the industry contributions are collected via a statutory levy or charge that is usually imposed at the first point of sale.

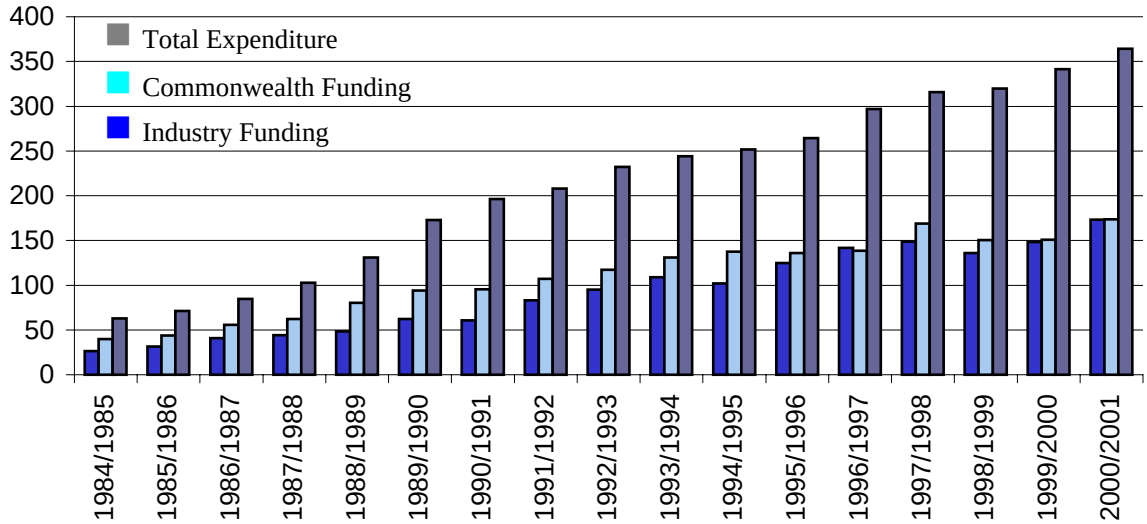
Producers have been willing to pay the statutory levy and in some instances have paid beyond the limit of the Commonwealth's matching payments. For example, the

grains industry has a statutory R&D levy of 1% on the farm-gate value of grain and while the Government only matches half of this (0.5% of GVP) grain growers are prepared to pay the additional (unmatched) levy because of the benefits that have accrued over the years (see below). Each year the industry has the opportunity to review the levy rate, but has consistently declined to reduce it.

Government support provides a solid foundation for rural industries to maintain or increase their level of R&D funding as they grow and develop. In fact, from this perspective alone the RDC model has been extremely successful. As an example, between 1985-86 and 1998-99 the dairy industry increased its contribution to R&D from 0.06% of GVP to 0.45% of GVP.

Overall, rural R&D income and expenditure have increased steadily since 1984-85. Between 1984-85 and 2000-01, the overall expenditure on rural R&D through the RDCs has increased from $63 million to $364 million. There has been an increase in government and industry contributions over this period, as shown in Figure 1.

Figure 1: RDC income and expenditure 1984-85 to 2000-01



Source: RDC Annual Reports 1984-1985 to 2000-2001

Industry adoption rates have been high

RDCs facilitate the uptake of R&D outcomes through their close links with industry.

- In a recent survey the Grains RDC (GRDC) found 54% of graingrowers had changed farming practices or crops as a result of GRDC-supported research outputs during the past two years.
- A study on technology adoption in the grape industry by the Grape and Wine RDC (GWRDC) showed 80% of growers were well informed on viticulture research and 68% had made positive changes to grape growing techniques over a two to three year period.

- MLA has achieved benefits for the beef industry of $8.6 million to date from its $2 million investment in the National Livestock Identification Scheme.
- The Forest and Wood Products RDC (FWPRDC) has funded research leading to the development of a high valued end-use for timber marked with gum veins, insect markings and knots, with this product showing high adoption rates by industry.
- DRDC invests research funds into five dairy manufacturing research centres that have instigated significant innovations, hastened the speed of adoption of new technology and provided returns to Australia of more than $55 million over the period 1993-1998.

RDCs: a key player in R&D investment

The RDCs' unique structure and mandate allows them to identify industry needs and R&D issues, invest in strategic R&D and pursue specified outcomes defined by industry and government priorities.

They complement the role of rural research providers such as the CSIRO, Cooperative Research Centres (CRCs), State and Territory agencies and universities, as well as that of the Australian Research Council (ARC), which mainly funds basic research across broad disciplines.

The CSIRO is Australia's largest Government research agency, undertaking basic-through-to-applied R&D with a focus on strategic user-oriented research. Approximately 15% of the RDCs investment is directly with the CSIRO and up to a further 15% indirectly, with CSIRO and RDCs being joint participants in CRCs.

CRCs bring together researchers from universities, CSIRO, other government research agencies (including the RDCs) and private industry to maximise the benefits of research through enhanced cooperative links between researchers and research users in the public and private sector. As at July 2001, there were 64 established CRCs: 12 relating to agriculture and rural-based manufacturing and 15 to environmental research. RDCs are involved in 15 CRCs and in a number of cases there is more than one RDC involved with a CRC.

State governments spend around $250 million per annum on rural R&D. Institutional arrangements, priorities and funding for rural R&D in each state have recently been reviewed and, in some cases, restructured. State government research often focuses on solutions for local or regional production problems and includes extension of relevant information to producers. It is often undertaken in collaboration with other research agencies and universities, with many projects conducted with joint funding from the RDCs.

The RDCs are often able to leverage investment from these bodies and from the private sector into industry and government R&D priorities for primary industries. Examples of this is the grains industry, via the GRDC, include:

- Grain*gene* – includes investment from AWB Limited and CSIRO;
- SunPrime – includes investment from GrainCorp and the University of Sydney; and

- CSIRO Stored Grain Research Laboratory – includes significant investments made by Australia's bulk handling companies.

The RDC model established under the PIERD Act differs significantly from the model of the early 1980s, when rural industry R&D was largely driven by the priorities of research agencies. Now, industry and government needs and priorities dominate the research agenda, and researchers must commit to projects with well-defined objectives, project payments contingent on meeting agreed milestones, and final payment on final report delivery. Timely reviews of projects by industry ensures focus on delivery of outcomes. Close links with industry facilitates the uptake of R&D outputs.

The Benefits

Adoption of new technology and practices – flowing from successful R&D projects – is considered a major factor in increasing productivity and competitiveness of rural industries.

The range of RDC projects that have benefited rural industries over the past decade is enormous, including advances in crop and pasture varieties, genetic improvements in animals, technological improvements in equipment, advances in crop management and animal husbandry, more efficient input use, enhanced control of pests and diseases, improved harvesting techniques, better resource management and improved risk management tools.

In the area of productivity:

- An investment by the Cotton RDC of $12 million in plant breeding, particularly in CSIRO, contributed to a move away from a dominance of US-bred cotton varieties to more than 80% of Australian cotton area being planted to CSIRO varieties during the 1990s.
- The Australian Wool Innovation Company has developed a new control method to reduce blowfly problems in sheep – a problem that costs the sheep industry more than $160 million per annum.
- RIRDC-funded research has facilitated reductions in rice industry water use of more than 30% over the past 10 years, while yields per megalitre have increased by more than 60%.

In addition to productivity improvements, the RDCs have had an important role in research into improving access to overseas markets and developing new products or modifying existing products to improve their value. Examples of RDC investment in these areas include:

- Virtually all RDCs, including the Dairy RDC, Sugar RDC, CRDC, RIRDC, Meat & Livestock Australia and the former Horticultural RDC, have funded trade research to provide a factual basis for lobbying overseas governments to reform trade barriers and reduce subsidies to their industries.

- RIRDC has funded research leading to the development of the world's first regulatory approved therapeutic honey, Medihoney, which has the potential to treat bacterial infections that are becoming resistant to conventional antibiotics.

- SRDC has funded the development of a new brand of raw sugar, Queensland High Pol, which enables Australia to compete directly with high pol sugar from Brazil.

In relation to sustainable use and management of natural resources RDCs invest around $100 million per annum in projects providing environmental benefits.

The following case studies demonstrate some of the significant benefits achieved in these areas.

RDCs have improved the understanding and management of natural resources

- Land & Water Australia has contributed to a significant improvement in the understanding and management of natural resources through investment in the National Land and Water Resources Audit, the Redesigning Agriculture for Australian Landscapes Program and the Social and Institutional Research Program.

- GRDC has funded R&D to overcome many problems associated with environmentally beneficial minimum tillage systems, assisting in an increase in direct drilling from 25% of crop area in 1995-96 to 36% in 1998-99.

- MLA has invested about $10 million in a Sustainable Grazing System program for livestock, including PROGRAZE® workshops that have resulted in 41% of participants moving to a more sustainable grazing approach.

- GWRDC has funded the development of partial rootzone drying technology that halves water consumption by grapevines, without affecting grape quality or yield, substantially easing the pressure on rivers and irrigation systems.

- Investment by FRDC in the Western Rock Lobster fishery in WA has contributed to its certification by the Marine Stewardship Council as a sustainable, well-managed fishery – a world first.

RDCs have assisted in the rehabilitation of degraded resources

- Land & Water Australia has taken the lead in the better co-ordination of national research effort under the National Dryland Salinity Program which has improved understanding of the causes and remedial actions for dryland salinity.

- Collaboration between RIRDC, Land & Water Australia and FWPRDC in the Joint Venture Agroforestry Program has reduced the risks associated with farm forestry in low to medium rainfall areas and boosted its expansion.

- The National Eutrophication Management Program, managed by Land & Water Australia, has made a major contribution to understanding the processes leading to algal blooms and strategies to prevent and manage them.

- Land & Water Australia has developed a rehabilitation manual incorporating all aspects of stream rehabilitation for application by river managers across Australia.

RDCs have reduced adverse impacts on the environment

- SRDC has invested $2.4 million over 10 years to encourage the adoption of green cane harvesting and crop trash retention resulting in potential benefits to the industry of $60 million and additional environmental benefits of $26 million.

- CRDC has played an important role in the introduction of Integrated Pest Management (IPM) regimes that have significantly reduced the reliance of the industry on environmentally harmful broad-spectrum and residual pesticides.

- The Pig R&D Corporation (PRDC, now Australian Pork Ltd) has demonstrated the benefits of using waste from deep litter-based piggery production systems as a fertiliser replacement for broadacre crops – creating money from what was a waste product and an environmental problem.

- Land & Water Australia manages the Climate Variability in Agriculture Program that has resulted in improved climate planning tools for farmers providing both financial and environmental benefits (37% of farmers now take account of seasonal forecasts in their planning).

RDCs have also provided broader community benefits

Rural research has a track record of delivering community benefits – in terms of direct contributions as well as through the flow on benefits from industry competitiveness and environmental sustainability R&D. The Industries Assistance Commission (IAC) estimated at least 50% of benefits from rural R&D were captured by industry, with the remaining benefits being distributed across other industries and the general community (*Industries Assistance Commission Report, 1976*).

More directly, some of the specific investments by the RDCs in projects of community benefit include:

- **Regional development:** for example, the significant expansion of the cotton and wine industries in Australia over the past 25 years has been supported by the considerable investment in R&D.

- **Investment in human resources:** RDCs directly fund training and development of people in their industries through, for example, support for the Australian Rural Leadership Program, development of farmer groups, travel awards, scholarships and the development of science, engineering and technology researchers.

- **Food safety and health:** Investment in issues associated with food safety and human health have provided benefits to industries and consumers – for example, MLA's $4 million investment in its SAFEMEAT program and Horticulture Australia Ltd's (HA) investment in an on-farm food safety and certification program, *Freshcare*.

- **Occupational Health and Safety (OH&S):** RDCs have helped address the significant OH&S issues associated with farming and the food supply chain – for example, MLA has developed a comprehensive resource kit to help abattoir workers manage transmissible disease risks, PRDC published a safety manual for piggeries, and SRDC analysis of OH&S issues led to the initiation of training courses that reduced injury down-time in cane mills by 40% between 1997 and 2000.

RDCs deliver clear economic benefits

The RDCs regularly commission quantitative and qualitative studies benefit-cost analyses (BCAs) into R&D projects within their portfolios, to quantify the return from each dollar invested. These analyses include consideration of both productivity and market benefits from the research.

The most recent review summarising these results was by Chudleigh and Simpson (2001). Chudleigh and Simpson examined BCAs from a number of the RDCs including:

- DRDC: benefit-cost ratio for portfolio of projects 3.2:1
- Land & Water Australia: benefit-cost ratio for portfolio of projects 20:1
- PRDC: benefit-cost ratio for portfolio of projects 8:1
- SRDC: benefit-cost ratio for portfolio of projects 3:1
- AWI: benefit-cost ratio for portfolio of projects 6:1

Chudleigh and Simpson estimated a weighted average of these ratios showing overall returns of 7.2:1.

If these were extrapolated over the entire amount invested by the RDCs over the decade, then the net benefit would be around $13.8 billion (in 1990-91 dollars). This is supported by other summary results of BCAs collected through the annual AFFA surveys of RDCs (Table 3) as well as by other researchers (for example, *Scobie et al, 1991* and *Mullen and Cox, 1995*).

Table 1: Benefit-cost analyses for rural R&D 1995-96 to 1998-99

Survey Year	Projects	Average BCA[1]	Range
1995-96	31	10	0.8-130
1996-97	11	39	3-169
1997-98	13	35	0.8-164
1998-99	30	13	1-81

1. Unweighted average of projects analysed. Source: AFFA Annual surveys of RDCs.

Examples of some of the analyses that have been done by particular RDCs are discussed below.

A 1999-2000 DRDC study on the economic returns from its R&D investment found the Corporation delivered a return over five years of at least $3.20 for every dollar invested (*DRDC Annual Report, 1999-2000*). The DRDC's top 13 projects collectively delivered $233 million to the Australian dairy industry from 1993-94 to 1997-98, while the total amount invested by the DRDC over the period was $73 million – illustrating that the economic benefits of the DRDC's top 13 projects alone generated three times the value of the total R&D investment.

The SRDC commissions regular independent evaluations of its R&D portfolio performance, most recently in 1998. Based on a random sample of projects over the previous five years, the benefit-cost ratio was 6:1 at a 5% discount rate. This equated to a quantifiable Net Present Value (NPV) of approximately $200 million to the Australian sugar industry and community for an investment of $33 million.

Industry and government-funded R&D, managed by the FRDC, has contributed to the transformation of Australia's Southern Bluefin Tuna industry from a low-value, threatened wild-catch resource into a high-value, more sustainable industry. FRDC worked within the industry, with customers and other research investors to improve the knowledge of the species, husbandry processes, technology and marketing. Southern Bluefin Tuna are now produced from aquaculture (farmed) as well as defined wild-catch fisheries for the Japanese sashimi market – boosting the value of the catch from less than $10 million in 1991-92 (when the tuna was mainly used for canning) to more than $250 million in 1999-2000 (ABARE, 2000). The benefit-cost ratio of research into Southern Bluefin Tuna aquaculture has been estimated at 41:1 and the close involvement of industry with the project has ensured 100% adoption of research recommendations.

Productivity growth in the rural sector

Declining terms of trade for the rural sector – where prices of farm products have not kept pace with rising prices of farm inputs – of 1.9% per annum over the past 20 years have provided a strong incentive to improve productivity. Productivity growth reflects the gains from adopting new technologies and better farming methods and is vital to continued profitability on farms and overall economic growth.

Ongoing productivity gains through R&D investment will be important for international competitiveness and in determining the split of resources invested in crop and livestock industries (*Knopke, 2000*). Knopke discusses the factors contributing to the strong productivity performance in broadacre cropping farms, which include better farm management, advances in plant breeding, improved crop rotations with better pest and weed control, development of new herbicides, more efficient fertiliser use, larger scale farming and advances in tractor and machinery design.

ABARE studies of broadacre and dairy productivity confirm high levels of productivity growth in the farm sector of around 2.2% per annum over the period 1997-98 to 1998-99. This compares well with productivity increases in the manufacturing sector of about 1.6% per annum. Despite the overall high rate of productivity growth for the farm sector, there were some significant differences in productivity between industries, regions and farms (*Knopke et al., 2000*; *Ha and Chapman, 2000*), as shown in Table 2.

Table 2: Terms of trade and productivity growth[a]

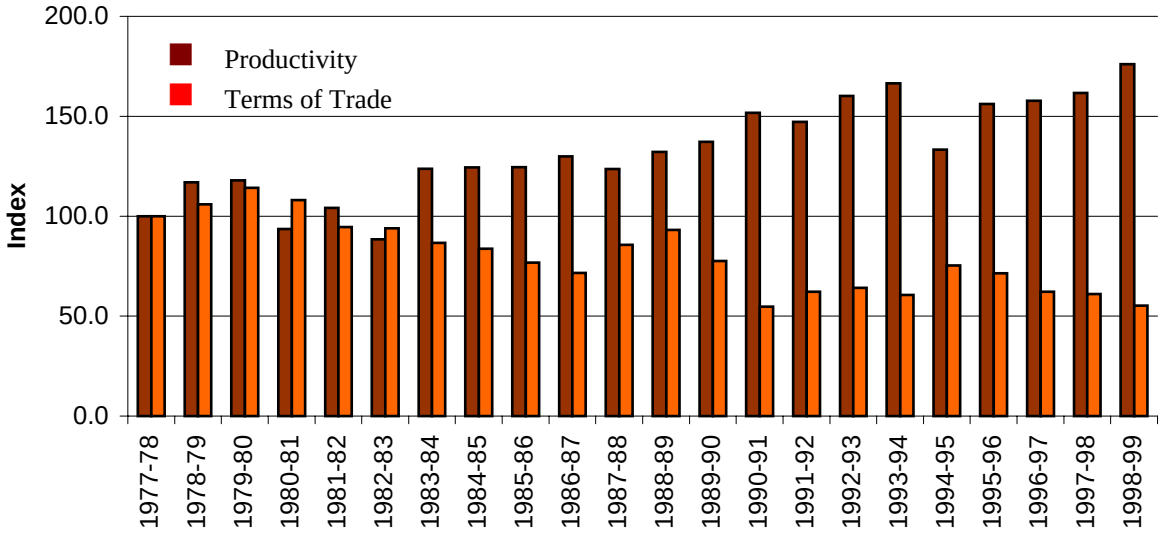
Annual rates of change 1977-78 to 1998-99

	Output Growth %	Input Growth %	Productivity %	Terms of Trade %
Total farm sector	**2.7**	**0.5**	**2.2**	**-1.9**
Crop farms				
Wheat and other crops	4.8	1.3	3.6	-3.1
Mixed crops livestock	3.6	1.0	2.6	-2.9
All crop farms	4.5	1.3	3.2	-3.1
Livestock specialist				
Sheep	1.2	0.6	0.6	-2.4
Beef	2.4	0.3	2.1	-2.1
Sheep-beef	0.4	-0.9	1.4	-2.2
All broadacre farms	**3.3**	**0.7**	**2.6**	**-2.9**
All dairy farms[b]	**4.4**	**2.6**	**1.8**	**-1.1**

a. Productivity growth is measured as total factor productivity which takes into account all inputs and outputs associated with the operating unit as well as technological changes.
b. Dairy data are for the 22 years, 1978-79 to 1999-2000.

The highest rate of growth has been in the wheat and other crops industries (3.6% per annum) while, in contrast, the sheep industry has grown by 0.6% per annum, which has not been sufficient to offset the declining terms of trade for this industry. Terms of trade and productivity indexes over time are shown in Figure 2.

Figure 2: Productivity growth and terms of trade on crop farms



The productivity estimates by Knopke are broadly consistent with those produced by others for the agricultural sector (as summarised in *Chudleigh and Simpson, 2001*).

While R&D outcomes are clearly likely to contribute to productivity growth it is difficult to measure the exact contribution. Initial results from RIRDC-backed research from the Centre for International Economics (CIE) show more than half of all productivity gains in agriculture are directly attributable to knowledge. This is supported by information from the US, where every 1% increase in publicly-funded R&D increases productivity by 0.38% and that an extra year of farm operator education improves productivity by 0.32% (*Woods, 2000*). Some examples of recent research which will improve the productivity of the rural sector are outlined below.

Over the past decade CRDC has contributed approximately $12 million to plant breeding, particularly in CSIRO. Prior to 1980 the cotton industry was completely dependent on US-bred varieties. During the 1980s, the release of locally bred CSIRO varieties gained momentum and by the mid 1990s CSIRO varieties dominated the market (more than 80% of cotton area). The advantage of locally produced varieties is that they are more likely to be suited to the Australian environment than cultivars produced for conditions in other countries. The percentage of CSIRO cultivars planted by Australian cotton growers is a measure of acceptance and uptake of this area of CRDC research. The investment in the Australian breeding program has also produced a revenue stream for the Corporation through a royalty sharing agreement with the CSIRO. The income from royalties supplements the Corporation's other revenue and is reinvested into the research program.

AWI has funded research resulting in the development of a new compound that has the potential to reduce the damaging effects of the sheep blowfly. The sheep blowfly is estimated to cost the Australian Merino sheep and wool industries more than $160 million a year to control and treat its effects. In a program backed by AWI in collaboration with CSIRO Livestock and Virbac Australia Pty Ltd, researchers are evaluating an alternative method of controlling and reducing the financial costs

associated with breech strike in sheep. The project has drawn on recent developments in human dermatology and cancer therapy to develop a non-toxic, natural compound applied to the sheep that appears to permanently inactivate a proportion (up to 100%) of wool follicles. This research stands to significantly benefit woolgrowers and the industry financially, as current control measures (such as jetting, mulesing, crutching and shearing) are costly, labour intensive and, in some cases, potentially harmful to the environment (jetting) or raise animal welfare issues (mulesing).

RIRDC-funded research supports one of the most efficient rice industries in the world. The Australian rice industry produces 1.7 million tonnes p.a. (85% for export), operates without production or export subsidies and is particularly important to regional Australia, with around 2,500 family-operated farm businesses in NSW and Victoria. Through implementation of R&D outputs – such as laser landforming, electro-magnetic surveying and soil textural analyses and planting new shorter-season varieties – rice industry water use per hectare has declined by more than 30% over the past 10 years, while yields per megalitre have increased by more than 60%.

A HA study reviewed the impact of HRDC and Australian Apple and Pear Growers Association Inc (AAPGA) investment in pest, weed and disease management and crop regulation R&D between 1991 and 1999. It included an evaluation of the impact of practices such as integrated pest management (IPM), now practiced by an estimated 80% of apple and pear growers, and chemical thinning. It found that the economic returns from the R&D investment have been significant, with benefit-cost ratios of 1.5:1 and an internal rate of return of 12%. The study reported that the R&D investment had accelerated the development of IPM and crop regulation technologies over the nine years, resulted in significant changes in industry practice and culture and impacted positively on the extent and rate of adoption of IPM practices.

GRDC has developed a low-cost, on-farm meter for measuring grain moisture before delivery of grain to receival points – to be on the market in 2002. Grain that contains too much moisture can go mouldy, lose export value and has to be dried, leading to added cost and greenhouse emissions. Checking the moisture content of grain before delivery to receival points can save all this – and so assure Australia's customers of a superior product and farmers of a better return. The meter is an example of a successful local commercial development from Australia's research investment that generates national benefits far greater than the cost of the research.

The challenges ahead

Continued investment in rural R&D is essential to delivering new technologies and products with potential to add value to rural export markets and provide options for sustainable production in the context of Australia's natural environment. The existing industry-government partnership that is fundamental to the RDC model remains relevant as the best means of effectively delivering rural R&D outcomes.

The Government continues to regard the industry-government partnership in RDCs as important to focusing research efforts in the most prospective areas, achieving appropriate levels of funding for R&D, maximising adoption rates and obtaining significant wider community benefits.

Ongoing investment in rural R&D is essential to:

- maintain productivity growth at a level that offsets declining terms of trade;
- ensure Australian rural industries maintain a competitive advantage in a world commodity market characterised by declining real commodity prices;
- deliver new technologies and products with potential to add enormous value to fast-growing rural export markets;
- ensure rural industries sustainably manage the natural resource base on which they depend;
- add value to other Australian industry sectors, from manufacturing, transport and retail to pharmaceuticals and 'nutraceuticals'; and
- provide jobs and economic growth in rural and regional Australia.

Underlying many of these points is the need for continued strong productivity growth in rural industries. Limited scope exists for such productivity growth without advances through high-tech R&D such as:

- higher-yielding plants and animals;
- plants and animals better suited to low moisture or saline environments;
- improved soil fertility;
- new pest and disease controls;
- better understanding of climate impacts on production; and
- improved supply chain operation and efficiency.

For example, genetic engineering will be important in creating new products to improve the quality of life, human health and safety. Similarly, bioprospecting and bioprocessing have already made possible the discovery and development of synthetic fuels from agricultural products, new drugs and health-promoting food products. Major competitors such as the US, EU and NZ are investing heavily in these technologies and without a similar capability, Australia will rapidly lose its competitive position. The House of Representatives Standing Committee on Primary Industries and Regional Services (2001) recently argued "there is immense potential for Australia to use its biological and ... other strengths ... to compete with the best in the world in an era dominated by biotechnology".

The RDC model remains relevant for the 21st century

An important question for this first decade of the 21st century is whether the RDC model remains the best means of achieving the rural R&D outcomes of maximum benefit to industry and the community. The Commonwealth Government recently endorsed the superiority of the RDC model in its major statement on the future of innovation in Australia, Backing Australia's Ability (Department of Industry, Science and Resources, 2001):

"*A joint Industry-Government investment of $1.5 billion made over the past five years through rural R&D corporations maintains the place of Australia's primary industries as among the best in the world. The Government's continued commitment to this industry-Government partnership will continue to strengthen our rural economy.*"

The model adapts to incorporate new best practice strategies for funding and delivering R&D, depending on industry needs. Recent moves to give industry greater ownership and control through private companies reflect this. Regardless of the form of model adopted by each RDC, a strong focus remains on government and industry priorities in corporate planning. The RDC model provides:

- the mechanism to fund new technologies;
- industry and government priority setting to ensure appropriate invetsment strategies; and
- links across RDCs to collaborate on high-priority areas and create substantial efficiencies.

Collaboration between the RDCs and other research providers and funding bodies to deliver solutions for their industries remains a key feature of the model. CSIRO, State/Territory governments, universities, CRCs and the private sector are important partners. Collaboration consolidates effort, provides a critical mass of funding to develop leading-edge technologies and improves priority setting.

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Statutory RDCs

Cotton Research and Development Corporation

PO Box 282
NARRABRI NSW 2390
Telephone: (02) 6792 4088
Facsimile: (02) 6792 4400
Website: www.crdc.com.au

Chair: Ms Bridget Jackson
Executive Director: Mr Ralph Schulzé

The Cotton Research and Development Corporation (CRDC) aims to create a more sustainable, competitive and profitable cotton industry providing increased economic, environmental and social benefits to rural and regional communities and the nation. It will achieve this by: improving production, processing, storage transport and marketing of cotton; making more effective use of the resources and skills of the community in general and the scientific community in particular; and improving accountability for expenditure upon research and development activities in relation to the cotton industry.

In 2000-01 the Corporation received $6.93 million in industry contributions and $6.77 million from the Commonwealth. Total investment in R&D was $13.9 million.

Dairy Research and Development Corporation

Level 3, 84 William Street
MELBOURNE VIC 3000
Telephone: (03) 9602 5300
Facsimile: (03) 9602 5442
Website: www.drdc.com.au

Chair: Mr Anthony Bates
Chief Executive Officer: Dr Joe Sullivan

The Dairy Research and Development Corporation's (DRDC) mission is to maximise the economic, environmental and social benefits for its stakeholders through targeted investment in R&D to achieve an innovative, globally competitive and sustainable dairy industry. DRDC is a statutory corporation of the Commonwealth Government.

In 2000-01, the total dairy R&D investment of $31.16 million was made up of contributions from the Australian dairy industry ($14.70 million) the Commonwealth ($12.68 million) and other sources ($3.78 million).

Fisheries Research and Development Corporation

PO BOX 222
DEAKIN WEST ACT 2600
Telephone: (02) 6285 0400

Facsimile: (02) 6285 4421
Website: www.frdc.com.au

Chair: Mr Dennis Bryne
Executive Director: Mr Peter Dundas-Smith

The Fisheries Research and Development Corporation's (FRDC) has become widely recognised as the leading Australian agency concerned with planning, funding and managing fisheries R&D. FRDC's mission is to increase economic and social benefits for the fishing industry and the people of Australia, through planned investment in research and development, in an ecologically sustainable framework.

In 2000-01 the FRDC received $3.8 million in industry R&D contributions, with the Commonwealth contributing $14.3 million. Total R&D investment amounted to $20.3 million.

Forest and Wood Products Research and Development Corporation

PO Box 69
World Trade Centre
MELBOURNE VIC 8005
Telephone: (03) 9614 7544
Facsimile: (03) 9614 6822
Website: www.fwprdc.org.au

Chair: Mr Thorold Gunnersen
Executive Director: Dr Glen Kile

The Forest and Wood Products Research and Development Corporation (FWPRDC) vision is to create an internationally competitive and sustainable forest and wood products industry that supports employment and communities throughout Australia.

In 2000-01 the FWPRDC received $3.86 million in industry R&D contributions and $2.67 million from the Commonwealth, with total R&D investment amounting to $4.35 million.

Grains Research and Development Corporation

PO Box E6
KINGSTON ACT 2604
Telephone: (02) 6272 5525
Facsimile: (02) 6271 6430
Website: www.grdc.com.au

Chair: Mr Grant Latta
Managing Director: Professor John Lovett

The Grains Research and Development Corporation (GRDC) is one of the world's leading grains research organisations, responsible for planning, investing and overseeing research and development, delivering improvements in production, sustainability and profitability across the Australian grains industry. The GRDC's vision is for a profitable, internationally competitive and ecologically sustainable grains industry. The GRDC's research portfolio covers 25 leviable crops spanning temperate and tropical cereals, oilseeds and pulses, worth over $7 billion a year in farm production, alone.

In 2000-01 the GRDC received $48.87 million in industry R&D contributions and $34.46 million in Commonwealth contributions. Total R&D investment for 2000-01 was $107.80 million with a total budget of $115.74 million.

Grape and Wine Research and Development Corporation

PO Box 2592
Kent Town Business Centre
KENT TOWN SA 5071
Telephone: (08) 8222 9266
Facsimile: (08) 8222 9267
Website: www.gwrdc.com.au

Chair: Dr John Stocker AO
Executive Director: Mr David Hall

The Grape and Wine Research and Development Corporation (GWRDC) invests in grape and wine research and development on behalf of the Australian wine industry and the Australian community. The GWRDC's mission is to realise for Australia the excellent returns available from strategic investment in wine industry research and development. The GWRDC coordinates, optimises and offers program leadership on a national basis. Its investment approach aims to address industry-wide priorities, whilst ensuring that delivery and adoption occur at a more regional level.

In 2000-01 the GWRDC received $6.2 million in R&D contributions from industry, with $5.1 million being contributed by the Commonwealth. Total R&D investment amounted to $11.3 million.

Land & Water Australia

PO Box 2182
CANBERRA ACT 2601
Telephone: (02) 6257 3379
Facsimile: (02) 6257 3420
Website: www.lwa.gov.au

Chair: Ms Roberta Brazil
Executive Director: Mr Andrew Campbell

Land & Water Australia's mission is to provide national leadership in generating knowledge, informing debate and inspiring innovation and action in natural resource management. The Corporation identifies and invests in R&D that helps maintain the natural resource base vital to Australia, and applies principles of ecologically sustainable development in order to maximise the benefits derived by the community from our land, water and vegetation resources.

In 2000-01 the Corporation's expenditure totalled $22.162million, predominantly from the Commonwealth Government.

Rural Industries Research and Development Corporation

PO Box 4776
KINGSTON ACT 2604
Telephone: (02) 6272 4539
Facsimile: (02) 6272 5877
Website: www.rirdc.gov.au

Chair: Professor Elizabeth Woods
Executive Director: Mr Peter Core

The Rural Industries Research and Development Corporation is about managing and funding priority research and translating results into practical outcomes for industry development. Put simply, our business is about new products and services and new and better ways of producing them. The Corporation achieves this by enhancing innovation in the rural and related sectors; fostering the development of new industries; and by addressing strategic issues facing the rural sector.

In 2000-01, RIRDC received $3.96 million in industry levies, $15.30 million in Commonwealth funding, and had a total R&D expenditure of $24.28 million.

Sugar Research and Development Corporation

PO Box 12050
George St Post Shop
BRISBANE QLD 4003
Telephone: (07) 3210 0495
Facsimile: (07) 3210 0506
Website: www.srdc.gov.au

Chair: Mr Clive Hildebrand
Executive Director: Dr Russell Muchow

The Sugar Research and Development Corporation (SRDC) funds research and development projects aimed at producing outcomes that benefit the international competitiveness, profitability and sustainability of the Australian sugar industry, and the Australian community.

SRDC activities are based around three value systems, which include competitive whole of industry sugar systems, sustainable farming systems, and sustainable processing and distribution systems. These focus on the need to consider the sugar system as a whole and to use multi disciplinary approaches to explore the inter-dependencies between the growing, harvesting, milling and marketing sectors. Furthermore, there is a need to devote attention to resource use and environmental sustainability and to deliver triple bottom line outcomes.

In 2000-01 the SRDC received $4.51 million in industry R&D contributions, $8.14 million in Commonwealth R&D contributions and had a total R&D expenditure of $13.76 million.

Industry-owned Companies

Meat and Livestock Australia

Locked Bag 991
NORTH SYDNEY NSW 2059
Telephone: (02) 9463 9333
Facsimile: (02) 9463 9393
Website: www.mla.com.au

Chair: Mr David Crombie
Managing Director: Mr Richard Brooks

Meat and Livestock Australia (MLA) is an industry owned company that provides marketing and R&D services to the meat and livestock industry. Meat and Livestock Australia's mission is to create opportunities for growth and profit in our industry.

In 2000-01 MLA received $25.14 million from producer levies and private industry sources, $20.76 million from the Commonwealth and expended a total of $41.49 million for investment in R&D for these industries.

Horticulture Australia Limited

Level 1, 50 Carrington St
SYDNEY NSW 2000
Telephone: (02) 8295 2300
Facsimile: (020) 82952399
Website: www.horticulture.com.au

Chair: Dr Jane Wilson
Managing Director: Mr John Webster

The aim of Horticulture Australia Limited (HAL) is to develop Australian horticulture by providing comprehensive and professional R&D and marketing services to over 30 different organisations from the fruit, vegetables and nursery industries. HAL is an industry owned company that the Commonwealth has contracted to deliver marketing and R&D services for the horticulture industry

In 2000-01 the HRDC received $11 million in industry funding, $17 million in Commonwealth funding and had an expenditure of $35 million.

Australian Wool Innovation Pty Ltd

Level 5, 45-47 York St
SYDNEY NSW 2000
Telephone: (02) 9299 9090
Facsimile: (02) 9299 9880
Website: www.wool.com.au

Chair: Ms Maree McCaskill
Managing Director: Mr Col Dorber

Australian Wool Innovation Pty Ltd (AWI) aims to increase the profitability, productivity and sustainability of Australian wool producers through improving wool quality, the efficiency of wool processing and developing new wool products for consumers.

In 2000-01 AWI received $40 million in industry R&D contributions and $9.83 million in Commonwealth contributions, and had a total expenditure of $20.27 million.

Australian Pork Limited

PO Box 148
DEAKIN WEST ACT 2600
Telephone: (02) 6285 2200
Facsimile: (02) 6285 2288
Website: www.apl.au.com

Chair: Dr Paul Higgins
Chief Executive Officer: Mr Brian Ramsay

Australian Pork Limited (APL) is an industry-owned company that provides marketing, R&D and policy services to the pork industry. It has responsibility for providing the Australian pork industry with its R&D and marketing services, as well as undertaking strategic policy development.

In 2000-01 the PRDC received $3.51million in industry R&D contributions and $4.07million in Commonwealth contributions, contributing to a total expenditure of $9.32million.

DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY - AUSTRALIA

SUBMISSION TO THE HOUSE OF REPRESENTATIVES STANDING COMMITTEE ON SCIENCE AND INNOVATION

INQUIRY INTO BUSINESS COMMITMENT TO RESEARCH AND DEVELOPMENT IN AUSTRALIA

September 2002

Executive Summary

During the past decade, Australia's rural R&D corporations (RDCs) have made strategic investments in R&D to help rural industries become more competitive, profitable and environmentally sustainable. Adoption of new technology and practices – flowing from successful R&D projects – is considered a major factor in increasing productivity and competitiveness of rural industries.

In the two decades from 1979 to 1999, there have been productivity increases across all rural industries. ABARE estimates productivity gains for the farm sector for the past 20 years have averaged 2.2% per annum (*Knopke, 2000, Knopke et al., 2000, Ha and Chapman, 2000*). This compares well with productivity increases in the manufacturing sector of about 1.6% and is particularly noteworthy given the decline in terms of trade for farmers of 1.9% per annum during the same period.

The RDC model is a successful investment management model, unique in the world. It is recognised internationally as best practice and represents a true partnership between government and industry. This partnership is based on the Commonwealth Government's commitment to match dollar-for-dollar industry contributions to a maximum of 0.5% of each industry's gross value of production. Industry's commitment to R&D is made possible through levies and voluntary contributions.

In 2000–01, rural industries invested $173 million, while the Commonwealth Government also invested $173 million by way of matching dollars and appropriation funds. With these monies, and drawing on reserves and other income sources, the RDCs funded more than $364 million of rural-related R&D.

The Government's continuing investment in rural R&D is predicated on the need to deliver benefits to industry and the wider community, and preserve our natural resources, particularly in rural and regional Australia. Government funding allows for rural industries to invest in wider 'public good' R&D that promotes sustainable natural resource use, environmental quality, improved food safety and improvements in occupational health and safety.

The range of RDC projects that have benefited rural industries over the past decade is enormous, including advances in crop and pasture varieties, genetic improvements in animals, technological improvements in equipment, advances in crop management and animal husbandry, more efficient input use, enhanced control of pests and diseases, improved harvesting techniques, better resource management and improved risk management tools.

Introduction

Over the past decade Australia's rural Research and Development Corporations (RDCs) have shaped the direction and outcomes of national research and development covering wool, dairy, fisheries and aquaculture, beef, lamb and mutton, pig production, forest production, grains, sugar, cotton, grapes and wine, more than 40 horticultural industries, natural resources and new and emerging rural industries such as rice, agroforestry, kangaroo meat, venison, emu products, rambutans and longans.

RDCs cover cotton, dairy, fisheries, forest and wood products, grains, grape and wine, horticulture, meat, pork, sugar, and wool. In addition, there are two general RDCs, the Rural Industries Research and Development Corporation and Land & Water Australia, which invest in new and emerging rural industries and broad natural resource management issues respectively.

The RDC model is unique in that it is a partnership between the Commonwealth Government and rural industries to invest in R&D that promotes internationally-competitive and sustainable practices and provides benefits to the wider community.

The RDCs are:

- Australian Pork Limited* (APL)
- Australian Wool Innovation Company* (AWI)
- Cotton Research and Development Corporation (CRDC)
- Dairy Research and Development Corporation (DRDC)
- Fisheries Research and Development Corporation (FRDC)
- Forest and Wood Products Research and Development Corporation (FWPRDC)
- Grains Research and Development Corporation (GRDC)
- Grape and Wine Research and Development Corporation (GWRDC)
- Horticulture Australia Limited* (HAL)
- Land & Water Australia (LWA)
- Meat & Livestock Australia* (MLA)
- Rural Industries Research and Development Corporation (RIRDC)
- Sugar Research and Development Corporation (SRDC)

(* The asterisks indicate the RDCs that have become industry-owned companies).

Collectively, they form the RDC model: one of the longest-standing and most successful government commitments to innovation in any Australian industry. As a consequence of this approach the Australian rural sector uses processes and technologies that are among the most advanced in the world.

Evolution of the RDC model

The Commonwealth Government established statutory authorities in the early 1920s to manage collective marketing schemes for primary industries. However, the first statutory arrangements for R&D were not introduced until 1936. Since then, there have been a number of key changes:

Key changes to rural R&D

1936	The first statutory industry/government research scheme introduced (*Wool Publicity and Research Act 1936*)
1945	Industry levy matched on a one-to-one basis with Commonwealth government funds (*Wool Use Promotion Act 1945*)
1953	*Wool Research Act 1953* established to give wool industry greater control over promotional funds
1957	*Wool Research Act 1953* amended to combine government and industry funds and provide for joint management of funds
1955-1982	Research funds established for wheat, tobacco, fisheries, wine, dairy, meat, honey, eggs, chicken meat, pigs, dried fruits, oilseeds, barley and cotton industries
1985	Restructure of funding system for rural R&D (*Rural Industries Research Act 1985*) to amalgamate rural industry legislation and provide one Act for administration of rural industry R&D funds. The Meat Research Corporation formed with the passage of the *Meat Research Corporation Act 1985*
1987	The Horticultural Research and Development Corporation formed with the passage of the *Horticultural Research and Development Corporation Act 1987*
1989	Introduction of the *Primary Industries and Energy Research and Development Act 1989*
1997	Creation of Meat & Livestock Australia under Corporations Law
2001	Creation of Australian Wool Innovation Pty Ltd, Horticulture Australia Limited and Australian Pork Limited under Corporations Law

The Government introduced the *Primary Industries and Energy Research and Development Act 1989* (PIERD Act) to expand the rural R&D effort, improve its efficiency and effectiveness by investing in priority areas and enhance industry competitiveness through more effective uptake of research. This represented a fundamental turning point in accountability to industry and government.

In the late 1990s industry and global market changes, and a desire by some rural industries for more flexibility in operations and greater autonomy in spending statutory levies, combined to create a climate for reviewing R&D structural arrangements.

MLA was created in 1997 following a recommendation by the Meat and Livestock Industry Reform Task Force that the Australian Meat and Livestock Corporation and Meat Research Corporation be abolished and industry be given more responsibility and control over its marketing and R&D.

MLA is a Corporations Law company that receives government and industry funding to provide marketing and R&D services to its industries. Accountability to

government is provided through a Deed of Agreement that includes annual and strategic plans and annual reports. MLA paved the way for new institutional arrangements for the wool (AWI), horticulture (HA) and pig industries (APL), all of which were incorporated this year.

The importance of innovation to the Australian economy, industries and community cannot be overstated. As highlighted in a number of recent reviews, there is little doubt innovation policy will form a vital part of broader government policy in future.

Innovation allows industries to improve their competitiveness, profitability and sustainability through:

- embracing and capitalising on advances in science, engineering and technology; and
- responding to new market opportunities.

Innovation for Australia's rural industries – including agriculture, fisheries and forestry – is supported by research and development (R&D) investment throughout the supply chain, with the Commonwealth Government's rural R&D Corporation (RDC) model being a vital component. This model complements the role of other rural research providers such as the CSIRO, Cooperative Research Centres (CRCs), State and Territory agencies and universities, as well as that of the Australian Research Council (ARC), which mainly funds basic research across broad disciplines.

Policy Rationale for the RDCs

The Government's matching contribution for rural R&D enables the RDCs to invest in R&D that not only results in industry-based productivity increases, but also delivers essential public good outcomes. These public good outcomes include regional development, improvements in food safety, environmental benefits, medical advances and new consumer products.

The Research, Innovation and Competitiveness Statement (Kerin and Cook, 1989), which formed the policy basis for the RDC model, articulated the key reasons for government involvement in rural R&D:

- to overcome the market failure associated with the lack of incentives and difficulty in organising the many rural producers to fund and pursue R&D and then capture the benefits of successful research projects; and
- to fulfil the need to fund R&D that addresses national needs and priorities and delivers public goods and benefits, such as those related to improved natural resource management and general management of the nation's food supply.

The flow on benefits to the wider community from R&D in this sector is also important. The Industries Assistance Commission (IAC) estimated at least 50% of benefits from rural R&D were captured by industry with the remaining benefits being distributed across other industries and the general community (*Industries Assistance Commission Report, 1976*). In its 1995 inquiry, the Industry Commission agreed with a joint RDC submission showing that RDCs pursued more basic/strategic R&D (38% of total R&D effort) than private sector business enterprises (6% of total R&D effort)

(*Industry Commission, 1995*).

The Government contribution recognises the significant value of investing public funds in R&D issues with:

- unique Australian characteristics, such as geography, climate and bioresources;
- a comparative advantage in terms of previous research, existing capacity or a body of existing knowledge;
- benefits that can be captured in Australia; and
- an under-investment of private industry research funding.

It also recognises:

- agriculture, fisheries and forestry production in the Australian environment has unique characteristics, which increases the reliance on domestic R&D;
- there are proven returns on investment and spin-off benefits (such as value-adding and benefits to the community) generated by rural R&D;
- the atomistic nature of the rural sector would mean there would be an under-investment in research if left to the private sector alone;
- investment in primary industries is often investment in environmental issues and not just for industry benefit; and
- Australian rural industries contribute around 20% of the total value of Australian exports (or almost $28 billion in 1999-2000 – an increase of over $6 billion in real terms compared with 10 years ago).

Key features of the RDC model

One of the original reasons for establishing the RDCs was to encourage industry investment and involvement in agricultural research. As such a fundamental feature of the RDC model is that it is effectively a partnership between the Commonwealth Government and rural industries to pursue rural R&D.

The key features of the Model are:

- Corporations are governed by independent skills-based boards charged with taking a strategic approach to rural R&D;
- a national and integrated approach to R&D priority-setting;
- strong industry involvement throughout the R&D process;
- a strong focus on outcomes; and
- accountability to industry and government.

A fundamental feature of RDC planning, activities and reporting is its emphasis on the ‘quadruple bottom line’ as spelt out in the objectives of the PIERD Act. These objectives require RDCs to fund and administer R&D relating to primary industries with a view to:

a) increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries;
b) achieving the sustainable use and sustainable management of natural resources;

c) making more effective use of the resources and skills of the community in general and the scientific community in particular; and
d) improving accountability for expenditure upon research and development activites in relation to primary industries.

The RDC operating environment facilitates an investment approach to R&D funding, with a focus on outcomes that deliver benefits to industry and the community. They also work in a coordinated way and fund joint R&D programs to tackle cross-industry issues such as salinity and soil acidification, pasture productivity, alternative farming systems, agroforestry, integrated pest management (IPM) and water quality (including algal bloom management).

Reporting to government and industry

All RDCs are required by law to produce annual reports and they must provide these to the Government and their industries through their representative organisation. All RDCs are required to attend the annual conference of their representative organisations, where the report is considered and RDCs report on progress.

The annual reports give a transparent account of the achievement of legislative objectives and corporate plans, including successes and shortcomings. Outputs and outcomes are measured against performance indicators indicating how well each RDC achieved.

It has been the practice of the responsible Minister to write to the RDCs to communicate the Government's priorities for rural R&D. These priorities are in many cases complementary to the priorities for rural industries. The Government expects these priorities to be reflected in the plans of the RDCs and reported in their annual report. Current priorities are sustainable natural resource management; whole of industry approach; biotechnology; increases in trade and market access; clean and green image; food safety; and improving our human resources. RDCs integrate these with industry priorities in corporate plans.

RDCs also recognise they need to continually improve their accountability to Government and industry. They have been working on a systematic approach, based on the quadruple bottom line concept, to reporting collective RDC performance to Government. This involves establishing common performance indicators, providing evidence of best management practice and achieving continuous improvement in delivering outcomes to industry and government stakeholders.

Government investment encourages industry investment

At the core of the RDC model is the matching funding arrangement wherein the Government matches industry's R&D contributions on a dollar-for-dollar basis up to 0.5% of the industry's gross value of production (GVP). The great bulk of the industry contributions are collected via a statutory levy or charge that is usually imposed at the first point of sale.

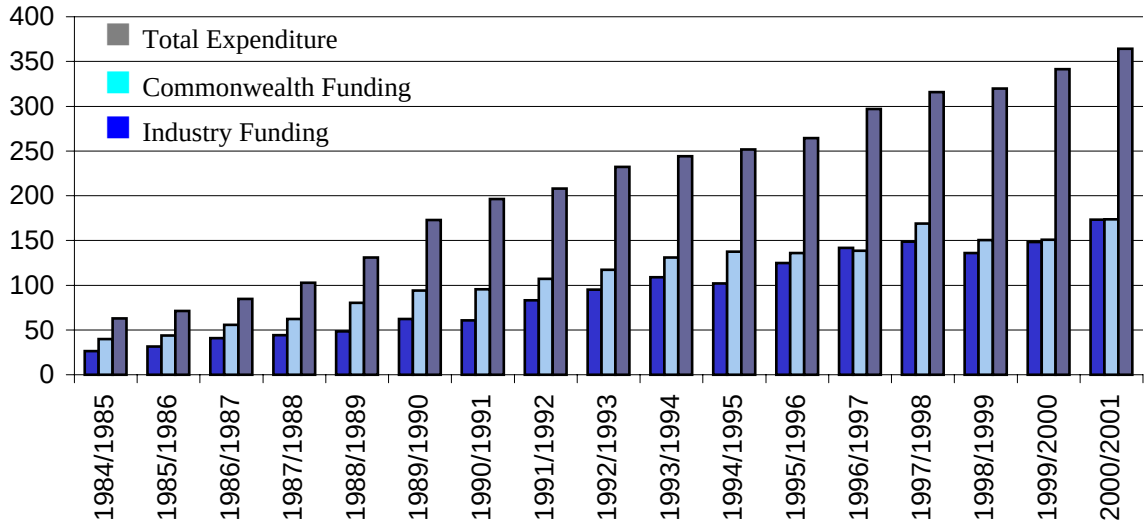
Producers have been willing to pay the statutory levy and in some instances have paid beyond the limit of the Commonwealth's matching payments. For example, the

grains industry has a statutory R&D levy of 1% on the farm-gate value of grain and while the Government only matches half of this (0.5% of GVP) grain growers are prepared to pay the additional (unmatched) levy because of the benefits that have accrued over the years (see below). Each year the industry has the opportunity to review the levy rate, but has consistently declined to reduce it.

Government support provides a solid foundation for rural industries to maintain or increase their level of R&D funding as they grow and develop. In fact, from this perspective alone the RDC model has been extremely successful. As an example, between 1985-86 and 1998-99 the dairy industry increased its contribution to R&D from 0.06% of GVP to 0.45% of GVP.

Overall, rural R&D income and expenditure have increased steadily since 1984-85. Between 1984-85 and 2000-01, the overall expenditure on rural R&D through the RDCs has increased from $63 million to $364 million. There has been an increase in government and industry contributions over this period, as shown in Figure 1.

Figure 1: RDC income and expenditure 1984-85 to 2000-01



Source: RDC Annual Reports 1984-1985 to 2000-2001

Industry adoption rates have been high

RDCs facilitate the uptake of R&D outcomes through their close links with industry.

- In a recent survey the Grains RDC (GRDC) found 54% of graingrowers had changed farming practices or crops as a result of GRDC-supported research outputs during the past two years.
- A study on technology adoption in the grape industry by the Grape and Wine RDC (GWRDC) showed 80% of growers were well informed on viticulture research and 68% had made positive changes to grape growing techniques over a two to three year period.

- MLA has achieved benefits for the beef industry of $8.6 million to date from its $2 million investment in the National Livestock Identification Scheme.
- The Forest and Wood Products RDC (FWPRDC) has funded research leading to the development of a high valued end-use for timber marked with gum veins, insect markings and knots, with this product showing high adoption rates by industry.
- DRDC invests research funds into five dairy manufacturing research centres that have instigated significant innovations, hastened the speed of adoption of new technology and provided returns to Australia of more than $55 million over the period 1993-1998.

RDCs: a key player in R&D investment

The RDCs' unique structure and mandate allows them to identify industry needs and R&D issues, invest in strategic R&D and pursue specified outcomes defined by industry and government priorities.

They complement the role of rural research providers such as the CSIRO, Cooperative Research Centres (CRCs), State and Territory agencies and universities, as well as that of the Australian Research Council (ARC), which mainly funds basic research across broad disciplines.

The CSIRO is Australia's largest Government research agency, undertaking basic-through-to-applied R&D with a focus on strategic user-oriented research. Approximately 15% of the RDCs investment is directly with the CSIRO and up to a further 15% indirectly, with CSIRO and RDCs being joint participants in CRCs.

CRCs bring together researchers from universities, CSIRO, other government research agencies (including the RDCs) and private industry to maximise the benefits of research through enhanced cooperative links between researchers and research users in the public and private sector. As at July 2001, there were 64 established CRCs: 12 relating to agriculture and rural-based manufacturing and 15 to environmental research. RDCs are involved in 15 CRCs and in a number of cases there is more than one RDC involved with a CRC.

State governments spend around $250 million per annum on rural R&D. Institutional arrangements, priorities and funding for rural R&D in each state have recently been reviewed and, in some cases, restructured. State government research often focuses on solutions for local or regional production problems and includes extension of relevant information to producers. It is often undertaken in collaboration with other research agencies and universities, with many projects conducted with joint funding from the RDCs.

The RDCs are often able to leverage investment from these bodies and from the private sector into industry and government R&D priorities for primary industries. Examples of this is the grains industry, via the GRDC, include:

- Grain*gene* – includes investment from AWB Limited and CSIRO;
- SunPrime – includes investment from GrainCorp and the University of Sydney; and

- CSIRO Stored Grain Research Laboratory – includes significant investments made by Australia's bulk handling companies.

The RDC model established under the PIERD Act differs significantly from the model of the early 1980s, when rural industry R&D was largely driven by the priorities of research agencies. Now, industry and government needs and priorities dominate the research agenda, and researchers must commit to projects with well-defined objectives, project payments contingent on meeting agreed milestones, and final payment on final report delivery. Timely reviews of projects by industry ensures focus on delivery of outcomes. Close links with industry facilitates the uptake of R&D outputs.

The Benefits

Adoption of new technology and practices – flowing from successful R&D projects – is considered a major factor in increasing productivity and competitiveness of rural industries.

The range of RDC projects that have benefited rural industries over the past decade is enormous, including advances in crop and pasture varieties, genetic improvements in animals, technological improvements in equipment, advances in crop management and animal husbandry, more efficient input use, enhanced control of pests and diseases, improved harvesting techniques, better resource management and improved risk management tools.

In the area of productivity:

- An investment by the Cotton RDC of $12 million in plant breeding, particularly in CSIRO, contributed to a move away from a dominance of US-bred cotton varieties to more than 80% of Australian cotton area being planted to CSIRO varieties during the 1990s.
- The Australian Wool Innovation Company has developed a new control method to reduce blowfly problems in sheep – a problem that costs the sheep industry more than $160 million per annum.
- RIRDC-funded research has facilitated reductions in rice industry water use of more than 30% over the past 10 years, while yields per megalitre have increased by more than 60%.

In addition to productivity improvements, the RDCs have had an important role in research into improving access to overseas markets and developing new products or modifying existing products to improve their value. Examples of RDC investment in these areas include:

- Virtually all RDCs, including the Dairy RDC, Sugar RDC, CRDC, RIRDC, Meat & Livestock Australia and the former Horticultural RDC, have funded trade research to provide a factual basis for lobbying overseas governments to reform trade barriers and reduce subsidies to their industries.

- RIRDC has funded research leading to the development of the world's first regulatory approved therapeutic honey, Medihoney, which has the potential to treat bacterial infections that are becoming resistant to conventional antibiotics.

- SRDC has funded the development of a new brand of raw sugar, Queensland High Pol, which enables Australia to compete directly with high pol sugar from Brazil.

In relation to sustainable use and management of natural resources RDCs invest around $100 million per annum in projects providing environmental benefits.

The following case studies demonstrate some of the significant benefits achieved in these areas.

RDCs have improved the understanding and management of natural resources

- Land & Water Australia has contributed to a significant improvement in the understanding and management of natural resources through investment in the National Land and Water Resources Audit, the Redesigning Agriculture for Australian Landscapes Program and the Social and Institutional Research Program.

- GRDC has funded R&D to overcome many problems associated with environmentally beneficial minimum tillage systems, assisting in an increase in direct drilling from 25% of crop area in 1995-96 to 36% in 1998-99.

- MLA has invested about $10 million in a Sustainable Grazing System program for livestock, including PROGRAZE® workshops that have resulted in 41% of participants moving to a more sustainable grazing approach.

- GWRDC has funded the development of partial rootzone drying technology that halves water consumption by grapevines, without affecting grape quality or yield, substantially easing the pressure on rivers and irrigation systems.

- Investment by FRDC in the Western Rock Lobster fishery in WA has contributed to its certification by the Marine Stewardship Council as a sustainable, well-managed fishery – a world first.

RDCs have assisted in the rehabilitation of degraded resources

- Land & Water Australia has taken the lead in the better co-ordination of national research effort under the National Dryland Salinity Program which has improved understanding of the causes and remedial actions for dryland salinity.

- Collaboration between RIRDC, Land & Water Australia and FWPRDC in the Joint Venture Agroforestry Program has reduced the risks associated with farm forestry in low to medium rainfall areas and boosted its expansion.

- The National Eutrophication Management Program, managed by Land & Water Australia, has made a major contribution to understanding the processes leading to algal blooms and strategies to prevent and manage them.

- Land & Water Australia has developed a rehabilitation manual incorporating all aspects of stream rehabilitation for application by river managers across Australia.

RDCs have reduced adverse impacts on the environment

- SRDC has invested $2.4 million over 10 years to encourage the adoption of green cane harvesting and crop trash retention resulting in potential benefits to the industry of $60 million and additional environmental benefits of $26 million.

- CRDC has played an important role in the introduction of Integrated Pest Management (IPM) regimes that have significantly reduced the reliance of the industry on environmentally harmful broad-spectrum and residual pesticides.

- The Pig R&D Corporation (PRDC, now Australian Pork Ltd) has demonstrated the benefits of using waste from deep litter-based piggery production systems as a fertiliser replacement for broadacre crops – creating money from what was a waste product and an environmental problem.

- Land & Water Australia manages the Climate Variability in Agriculture Program that has resulted in improved climate planning tools for farmers providing both financial and environmental benefits (37% of farmers now take account of seasonal forecasts in their planning).

RDCs have also provided broader community benefits

Rural research has a track record of delivering community benefits – in terms of direct contributions as well as through the flow on benefits from industry competitiveness and environmental sustainability R&D. The Industries Assistance Commission (IAC) estimated at least 50% of benefits from rural R&D were captured by industry, with the remaining benefits being distributed across other industries and the general community (*Industries Assistance Commission Report, 1976*).

More directly, some of the specific investments by the RDCs in projects of community benefit include:

- **Regional development:** for example, the significant expansion of the cotton and wine industries in Australia over the past 25 years has been supported by the considerable investment in R&D.

- **Investment in human resources:** RDCs directly fund training and development of people in their industries through, for example, support for the Australian Rural Leadership Program, development of farmer groups, travel awards, scholarships and the development of science, engineering and technology researchers.

- **Food safety and health:** Investment in issues associated with food safety and human health have provided benefits to industries and consumers – for example, MLA's $4 million investment in its SAFEMEAT program and Horticulture Australia Ltd's (HA) investment in an on-farm food safety and certification program, *Freshcare*.

- **Occupational Health and Safety (OH&S):** RDCs have helped address the significant OH&S issues associated with farming and the food supply chain – for example, MLA has developed a comprehensive resource kit to help abattoir workers manage transmissible disease risks, PRDC published a safety manual for piggeries, and SRDC analysis of OH&S issues led to the initiation of training courses that reduced injury down-time in cane mills by 40% between 1997 and 2000.

RDCs deliver clear economic benefits

The RDCs regularly commission quantitative and qualitative studies benefit-cost analyses (BCAs) into R&D projects within their portfolios, to quantify the return from each dollar invested. These analyses include consideration of both productivity and market benefits from the research.

The most recent review summarising these results was by Chudleigh and Simpson (2001). Chudleigh and Simpson examined BCAs from a number of the RDCs including:

- DRDC: benefit-cost ratio for portfolio of projects 3.2:1
- Land & Water Australia: benefit-cost ratio for portfolio of projects 20:1
- PRDC: benefit-cost ratio for portfolio of projects 8:1
- SRDC: benefit-cost ratio for portfolio of projects 3:1
- AWI: benefit-cost ratio for portfolio of projects 6:1

Chudleigh and Simpson estimated a weighted average of these ratios showing overall returns of 7.2:1.

If these were extrapolated over the entire amount invested by the RDCs over the decade, then the net benefit would be around $13.8 billion (in 1990-91 dollars). This is supported by other summary results of BCAs collected through the annual AFFA surveys of RDCs (Table 3) as well as by other researchers (for example, *Scobie et al, 1991* and *Mullen and Cox, 1995*).

Table 1: Benefit-cost analyses for rural R&D 1995-96 to 1998-99

Survey Year	Projects	Average BCA[1]	Range
1995-96	31	10	0.8-130
1996-97	11	39	3-169
1997-98	13	35	0.8-164
1998-99	30	13	1-81

1. Unweighted average of projects analysed. Source: AFFA Annual surveys of RDCs.

Examples of some of the analyses that have been done by particular RDCs are discussed below.

A 1999-2000 DRDC study on the economic returns from its R&D investment found the Corporation delivered a return over five years of at least $3.20 for every dollar invested (*DRDC Annual Report, 1999-2000*). The DRDC's top 13 projects collectively delivered $233 million to the Australian dairy industry from 1993-94 to 1997-98, while the total amount invested by the DRDC over the period was $73 million – illustrating that the economic benefits of the DRDC's top 13 projects alone generated three times the value of the total R&D investment.

The SRDC commissions regular independent evaluations of its R&D portfolio performance, most recently in 1998. Based on a random sample of projects over the previous five years, the benefit-cost ratio was 6:1 at a 5% discount rate. This equated to a quantifiable Net Present Value (NPV) of approximately $200 million to the Australian sugar industry and community for an investment of $33 million.

Industry and government-funded R&D, managed by the FRDC, has contributed to the transformation of Australia's Southern Bluefin Tuna industry from a low-value, threatened wild-catch resource into a high-value, more sustainable industry. FRDC worked within the industry, with customers and other research investors to improve the knowledge of the species, husbandry processes, technology and marketing. Southern Bluefin Tuna are now produced from aquaculture (farmed) as well as defined wild-catch fisheries for the Japanese sashimi market – boosting the value of the catch from less than $10 million in 1991-92 (when the tuna was mainly used for canning) to more than $250 million in 1999-2000 (ABARE, 2000). The benefit-cost ratio of research into Southern Bluefin Tuna aquaculture has been estimated at 41:1 and the close involvement of industry with the project has ensured 100% adoption of research recommendations.

Productivity growth in the rural sector

Declining terms of trade for the rural sector – where prices of farm products have not kept pace with rising prices of farm inputs – of 1.9% per annum over the past 20 years have provided a strong incentive to improve productivity. Productivity growth reflects the gains from adopting new technologies and better farming methods and is vital to continued profitability on farms and overall economic growth.

Ongoing productivity gains through R&D investment will be important for international competitiveness and in determining the split of resources invested in crop and livestock industries (*Knopke, 2000*). Knopke discusses the factors contributing to the strong productivity performance in broadacre cropping farms, which include better farm management, advances in plant breeding, improved crop rotations with better pest and weed control, development of new herbicides, more efficient fertiliser use, larger scale farming and advances in tractor and machinery design.

ABARE studies of broadacre and dairy productivity confirm high levels of productivity growth in the farm sector of around 2.2% per annum over the period 1997-98 to 1998-99. This compares well with productivity increases in the manufacturing sector of about 1.6% per annum. Despite the overall high rate of productivity growth for the farm sector, there were some significant differences in productivity between industries, regions and farms (*Knopke et al., 2000*; *Ha and Chapman, 2000*), as shown in Table 2.

Table 2: Terms of trade and productivity growth[a]

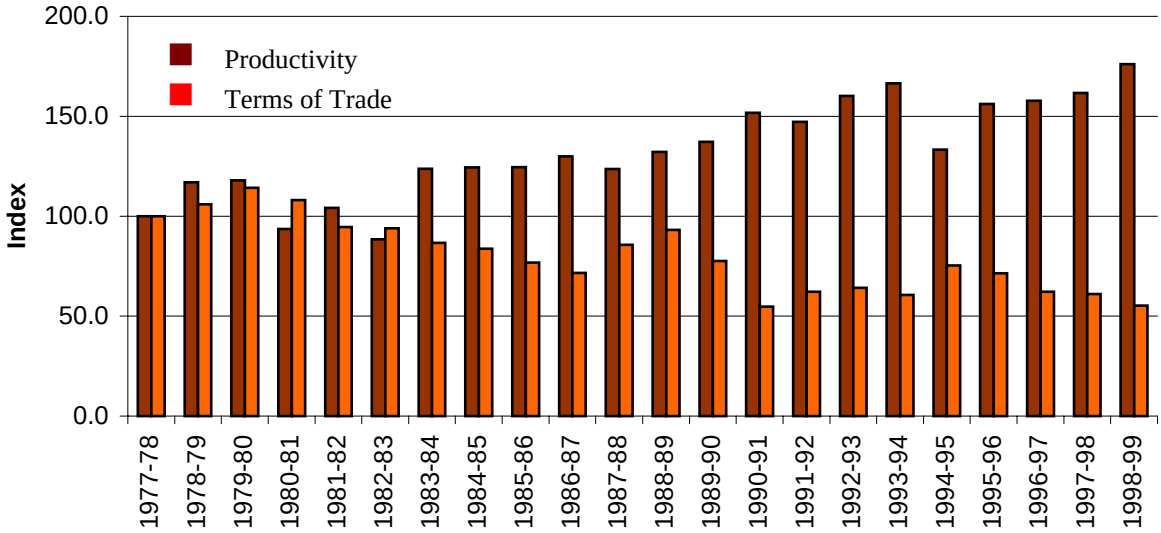
Annual rates of change 1977-78 to 1998-99

	Output Growth %	Input Growth %	Productivity %	Terms of Trade %
Total farm sector	**2.7**	**0.5**	**2.2**	**-1.9**
Crop farms				
Wheat and other crops	4.8	1.3	3.6	-3.1
Mixed crops livestock	3.6	1.0	2.6	-2.9
All crop farms	4.5	1.3	3.2	-3.1
Livestock specialist				
Sheep	1.2	0.6	0.6	-2.4
Beef	2.4	0.3	2.1	-2.1
Sheep-beef	0.4	-0.9	1.4	-2.2
All broadacre farms	**3.3**	**0.7**	**2.6**	**-2.9**
All dairy farms[b]	**4.4**	**2.6**	**1.8**	**-1.1**

a. Productivity growth is measured as total factor productivity which takes into account all inputs and outputs associated with the operating unit as well as technological changes.
b. Dairy data are for the 22 years, 1978-79 to 1999-2000.

The highest rate of growth has been in the wheat and other crops industries (3.6% per annum) while, in contrast, the sheep industry has grown by 0.6% per annum, which has not been sufficient to offset the declining terms of trade for this industry. Terms of trade and productivity indexes over time are shown in Figure 2.

Figure 2: Productivity growth and terms of trade on crop farms



The productivity estimates by Knopke are broadly consistent with those produced by others for the agricultural sector (as summarised in *Chudleigh and Simpson, 2001*).

While R&D outcomes are clearly likely to contribute to productivity growth it is difficult to measure the exact contribution. Initial results from RIRDC-backed research from the Centre for International Economics (CIE) show more than half of all productivity gains in agriculture are directly attributable to knowledge. This is supported by information from the US, where every 1% increase in publicly-funded R&D increases productivity by 0.38% and that an extra year of farm operator education improves productivity by 0.32% (*Woods, 2000*). Some examples of recent research which will improve the productivity of the rural sector are outlined below.

Over the past decade CRDC has contributed approximately $12 million to plant breeding, particularly in CSIRO. Prior to 1980 the cotton industry was completely dependent on US-bred varieties. During the 1980s, the release of locally bred CSIRO varieties gained momentum and by the mid 1990s CSIRO varieties dominated the market (more than 80% of cotton area). The advantage of locally produced varieties is that they are more likely to be suited to the Australian environment than cultivars produced for conditions in other countries. The percentage of CSIRO cultivars planted by Australian cotton growers is a measure of acceptance and uptake of this area of CRDC research. The investment in the Australian breeding program has also produced a revenue stream for the Corporation through a royalty sharing agreement with the CSIRO. The income from royalties supplements the Corporation's other revenue and is reinvested into the research program.

AWI has funded research resulting in the development of a new compound that has the potential to reduce the damaging effects of the sheep blowfly. The sheep blowfly is estimated to cost the Australian Merino sheep and wool industries more than $160 million a year to control and treat its effects. In a program backed by AWI in collaboration with CSIRO Livestock and Virbac Australia Pty Ltd, researchers are evaluating an alternative method of controlling and reducing the financial costs

associated with breech strike in sheep. The project has drawn on recent developments in human dermatology and cancer therapy to develop a non-toxic, natural compound applied to the sheep that appears to permanently inactivate a proportion (up to 100%) of wool follicles. This research stands to significantly benefit woolgrowers and the industry financially, as current control measures (such as jetting, mulesing, crutching and shearing) are costly, labour intensive and, in some cases, potentially harmful to the environment (jetting) or raise animal welfare issues (mulesing).

RIRDC-funded research supports one of the most efficient rice industries in the world. The Australian rice industry produces 1.7 million tonnes p.a. (85% for export), operates without production or export subsidies and is particularly important to regional Australia, with around 2,500 family-operated farm businesses in NSW and Victoria. Through implementation of R&D outputs – such as laser landforming, electro-magnetic surveying and soil textural analyses and planting new shorter-season varieties – rice industry water use per hectare has declined by more than 30% over the past 10 years, while yields per megalitre have increased by more than 60%.

A HA study reviewed the impact of HRDC and Australian Apple and Pear Growers Association Inc (AAPGA) investment in pest, weed and disease management and crop regulation R&D between 1991 and 1999. It included an evaluation of the impact of practices such as integrated pest management (IPM), now practiced by an estimated 80% of apple and pear growers, and chemical thinning. It found that the economic returns from the R&D investment have been significant, with benefit-cost ratios of 1.5:1 and an internal rate of return of 12%. The study reported that the R&D investment had accelerated the development of IPM and crop regulation technologies over the nine years, resulted in significant changes in industry practice and culture and impacted positively on the extent and rate of adoption of IPM practices.

GRDC has developed a low-cost, on-farm meter for measuring grain moisture before delivery of grain to receival points – to be on the market in 2002. Grain that contains too much moisture can go mouldy, lose export value and has to be dried, leading to added cost and greenhouse emissions. Checking the moisture content of grain before delivery to receival points can save all this – and so assure Australia's customers of a superior product and farmers of a better return. The meter is an example of a successful local commercial development from Australia's research investment that generates national benefits far greater than the cost of the research.

The challenges ahead

Continued investment in rural R&D is essential to delivering new technologies and products with potential to add value to rural export markets and provide options for sustainable production in the context of Australia's natural environment. The existing industry-government partnership that is fundamental to the RDC model remains relevant as the best means of effectively delivering rural R&D outcomes.

The Government continues to regard the industry-government partnership in RDCs as important to focusing research efforts in the most prospective areas, achieving appropriate levels of funding for R&D, maximising adoption rates and obtaining significant wider community benefits.

Ongoing investment in rural R&D is essential to:

- maintain productivity growth at a level that offsets declining terms of trade;
- ensure Australian rural industries maintain a competitive advantage in a world commodity market characterised by declining real commodity prices;
- deliver new technologies and products with potential to add enormous value to fast-growing rural export markets;
- ensure rural industries sustainably manage the natural resource base on which they depend;
- add value to other Australian industry sectors, from manufacturing, transport and retail to pharmaceuticals and 'nutraceuticals'; and
- provide jobs and economic growth in rural and regional Australia.

Underlying many of these points is the need for continued strong productivity growth in rural industries. Limited scope exists for such productivity growth without advances through high-tech R&D such as:

- higher-yielding plants and animals;
- plants and animals better suited to low moisture or saline environments;
- improved soil fertility;
- new pest and disease controls;
- better understanding of climate impacts on production; and
- improved supply chain operation and efficiency.

For example, genetic engineering will be important in creating new products to improve the quality of life, human health and safety. Similarly, bioprospecting and bioprocessing have already made possible the discovery and development of synthetic fuels from agricultural products, new drugs and health-promoting food products. Major competitors such as the US, EU and NZ are investing heavily in these technologies and without a similar capability, Australia will rapidly lose its competitive position. The House of Representatives Standing Committee on Primary Industries and Regional Services (2001) recently argued "there is immense potential for Australia to use its biological and ... other strengths ... to compete with the best in the world in an era dominated by biotechnology".

The RDC model remains relevant for the 21st century

An important question for this first decade of the 21st century is whether the RDC model remains the best means of achieving the rural R&D outcomes of maximum benefit to industry and the community. The Commonwealth Government recently endorsed the superiority of the RDC model in its major statement on the future of innovation in Australia, Backing Australia's Ability (Department of Industry, Science and Resources, 2001):

"*A joint Industry-Government investment of $1.5 billion made over the past five years through rural R&D corporations maintains the place of Australia's primary industries as among the best in the world. The Government's continued commitment to this industry-Government partnership will continue to strengthen our rural economy.*"

The model adapts to incorporate new best practice strategies for funding and delivering R&D, depending on industry needs. Recent moves to give industry greater ownership and control through private companies reflect this. Regardless of the form of model adopted by each RDC, a strong focus remains on government and industry priorities in corporate planning. The RDC model provides:

- the mechanism to fund new technologies;
- industry and government priority setting to ensure appropriate invetsment strategies; and
- links across RDCs to collaborate on high-priority areas and create substantial efficiencies.

Collaboration between the RDCs and other research providers and funding bodies to deliver solutions for their industries remains a key feature of the model. CSIRO, State/Territory governments, universities, CRCs and the private sector are important partners. Collaboration consolidates effort, provides a critical mass of funding to develop leading-edge technologies and improves priority setting.

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Statutory RDCs

Cotton Research and Development Corporation

PO Box 282
NARRABRI NSW 2390
Telephone: (02) 6792 4088
Facsimile: (02) 6792 4400
Website: www.crdc.com.au

Chair: Ms Bridget Jackson
Executive Director: Mr Ralph Schulzé

The Cotton Research and Development Corporation (CRDC) aims to create a more sustainable, competitive and profitable cotton industry providing increased economic, environmental and social benefits to rural and regional communities and the nation. It will achieve this by: improving production, processing, storage transport and marketing of cotton; making more effective use of the resources and skills of the community in general and the scientific community in particular; and improving accountability for expenditure upon research and development activities in relation to the cotton industry.

In 2000-01 the Corporation received $6.93 million in industry contributions and $6.77 million from the Commonwealth. Total investment in R&D was $13.9 million.

Dairy Research and Development Corporation

Level 3, 84 William Street
MELBOURNE VIC 3000
Telephone: (03) 9602 5300
Facsimile: (03) 9602 5442
Website: www.drdc.com.au

Chair: Mr Anthony Bates
Chief Executive Officer: Dr Joe Sullivan

The Dairy Research and Development Corporation's (DRDC) mission is to maximise the economic, environmental and social benefits for its stakeholders through targeted investment in R&D to achieve an innovative, globally competitive and sustainable dairy industry. DRDC is a statutory corporation of the Commonwealth Government.

In 2000-01, the total dairy R&D investment of $31.16 million was made up of contributions from the Australian dairy industry ($14.70 million) the Commonwealth ($12.68 million) and other sources ($3.78 million).

Fisheries Research and Development Corporation

PO BOX 222
DEAKIN WEST ACT 2600
Telephone: (02) 6285 0400

Facsimile: (02) 6285 4421
Website: www.frdc.com.au

Chair: Mr Dennis Bryne
Executive Director: Mr Peter Dundas-Smith

The Fisheries Research and Development Corporation's (FRDC) has become widely recognised as the leading Australian agency concerned with planning, funding and managing fisheries R&D. FRDC's mission is to increase economic and social benefits for the fishing industry and the people of Australia, through planned investment in research and development, in an ecologically sustainable framework.

In 2000-01 the FRDC received $3.8 million in industry R&D contributions, with the Commonwealth contributing $14.3 million. Total R&D investment amounted to $20.3 million.

Forest and Wood Products Research and Development Corporation

PO Box 69
World Trade Centre
MELBOURNE VIC 8005
Telephone: (03) 9614 7544
Facsimile: (03) 9614 6822
Website: www.fwprdc.org.au

Chair: Mr Thorold Gunnersen
Executive Director: Dr Glen Kile

The Forest and Wood Products Research and Development Corporation (FWPRDC) vision is to create an internationally competitive and sustainable forest and wood products industry that supports employment and communities throughout Australia.

In 2000-01 the FWPRDC received $3.86 million in industry R&D contributions and $2.67 million from the Commonwealth, with total R&D investment amounting to $4.35 million.

Grains Research and Development Corporation

PO Box E6
KINGSTON ACT 2604
Telephone: (02) 6272 5525
Facsimile: (02) 6271 6430
Website: www.grdc.com.au

Chair: Mr Grant Latta
Managing Director: Professor John Lovett

The Grains Research and Development Corporation (GRDC) is one of the world's leading grains research organisations, responsible for planning, investing and overseeing research and development, delivering improvements in production, sustainability and profitability across the Australian grains industry. The GRDC's vision is for a profitable, internationally competitive and ecologically sustainable grains industry. The GRDC's research portfolio covers 25 leviable crops spanning temperate and tropical cereals, oilseeds and pulses, worth over $7 billion a year in farm production, alone.

In 2000-01 the GRDC received $48.87 million in industry R&D contributions and $34.46 million in Commonwealth contributions. Total R&D investment for 2000-01 was $107.80 million with a total budget of $115.74 million.

Grape and Wine Research and Development Corporation

PO Box 2592
Kent Town Business Centre
KENT TOWN SA 5071
Telephone: (08) 8222 9266
Facsimile: (08) 8222 9267
Website: www.gwrdc.com.au

Chair: Dr John Stocker AO
Executive Director: Mr David Hall

The Grape and Wine Research and Development Corporation (GWRDC) invests in grape and wine research and development on behalf of the Australian wine industry and the Australian community. The GWRDC's mission is to realise for Australia the excellent returns available from strategic investment in wine industry research and development. The GWRDC coordinates, optimises and offers program leadership on a national basis. Its investment approach aims to address industry-wide priorities, whilst ensuring that delivery and adoption occur at a more regional level.

In 2000-01 the GWRDC received $6.2 million in R&D contributions from industry, with $5.1 million being contributed by the Commonwealth. Total R&D investment amounted to $11.3 million.

Land & Water Australia

PO Box 2182
CANBERRA ACT 2601
Telephone: (02) 6257 3379
Facsimile: (02) 6257 3420
Website: www.lwa.gov.au

Chair: Ms Roberta Brazil
Executive Director: Mr Andrew Campbell

Land & Water Australia's mission is to provide national leadership in generating knowledge, informing debate and inspiring innovation and action in natural resource management. The Corporation identifies and invests in R&D that helps maintain the natural resource base vital to Australia, and applies principles of ecologically sustainable development in order to maximise the benefits derived by the community from our land, water and vegetation resources.

In 2000-01 the Corporation's expenditure totalled $22.162million, predominantly from the Commonwealth Government.

Rural Industries Research and Development Corporation

PO Box 4776
KINGSTON ACT 2604
Telephone: (02) 6272 4539
Facsimile: (02) 6272 5877
Website: www.rirdc.gov.au

Chair: Professor Elizabeth Woods
Executive Director: Mr Peter Core

The Rural Industries Research and Development Corporation is about managing and funding priority research and translating results into practical outcomes for industry development. Put simply, our business is about new products and services and new and better ways of producing them. The Corporation achieves this by enhancing innovation in the rural and related sectors; fostering the development of new industries; and by addressing strategic issues facing the rural sector.

In 2000-01, RIRDC received $3.96 million in industry levies, $15.30 million in Commonwealth funding, and had a total R&D expenditure of $24.28 million.

Sugar Research and Development Corporation

PO Box 12050
George St Post Shop
BRISBANE QLD 4003
Telephone: (07) 3210 0495
Facsimile: (07) 3210 0506
Website: www.srdc.gov.au

Chair: Mr Clive Hildebrand
Executive Director: Dr Russell Muchow

The Sugar Research and Development Corporation (SRDC) funds research and development projects aimed at producing outcomes that benefit the international competitiveness, profitability and sustainability of the Australian sugar industry, and the Australian community.

SRDC activities are based around three value systems, which include competitive whole of industry sugar systems, sustainable farming systems, and sustainable processing and distribution systems. These focus on the need to consider the sugar system as a whole and to use multi disciplinary approaches to explore the inter-dependencies between the growing, harvesting, milling and marketing sectors. Furthermore, there is a need to devote attention to resource use and environmental sustainability and to deliver triple bottom line outcomes.

In 2000-01 the SRDC received $4.51 million in industry R&D contributions, $8.14 million in Commonwealth R&D contributions and had a total R&D expenditure of $13.76 million.

Industry-owned Companies

Meat and Livestock Australia

Locked Bag 991
NORTH SYDNEY NSW 2059
Telephone: (02) 9463 9333
Facsimile: (02) 9463 9393
Website: www.mla.com.au

Chair: Mr David Crombie
Managing Director: Mr Richard Brooks

Meat and Livestock Australia (MLA) is an industry owned company that provides marketing and R&D services to the meat and livestock industry. Meat and Livestock Australia's mission is to create opportunities for growth and profit in our industry.

In 2000-01 MLA received $25.14 million from producer levies and private industry sources, $20.76 million from the Commonwealth and expended a total of $41.49 million for investment in R&D for these industries.

Horticulture Australia Limited

Level 1, 50 Carrington St
SYDNEY NSW 2000
Telephone: (02) 8295 2300
Facsimile: (020) 82952399
Website: www.horticulture.com.au

Chair: Dr Jane Wilson
Managing Director: Mr John Webster

The aim of Horticulture Australia Limited (HAL) is to develop Australian horticulture by providing comprehensive and professional R&D and marketing services to over 30 different organisations from the fruit, vegetables and nursery industries. HAL is an industry owned company that the Commonwealth has contracted to deliver marketing and R&D services for the horticulture industry

In 2000-01 the HRDC received $11 million in industry funding, $17 million in Commonwealth funding and had an expenditure of $35 million.

Australian Wool Innovation Pty Ltd

Level 5, 45-47 York St
SYDNEY NSW 2000
Telephone: (02) 9299 9090
Facsimile: (02) 9299 9880
Website: www.wool.com.au

Chair: Ms Maree McCaskill
Managing Director: Mr Col Dorber

Australian Wool Innovation Pty Ltd (AWI) aims to increase the profitability, productivity and sustainability of Australian wool producers through improving wool quality, the efficiency of wool processing and developing new wool products for consumers.

In 2000-01 AWI received $40 million in industry R&D contributions and $9.83 million in Commonwealth contributions, and had a total expenditure of $20.27 million.

Australian Pork Limited

PO Box 148
DEAKIN WEST ACT 2600
Telephone: (02) 6285 2200
Facsimile: (02) 6285 2288
Website: www.apl.au.com

Chair: Dr Paul Higgins
Chief Executive Officer: Mr Brian Ramsay

Australian Pork Limited (APL) is an industry-owned company that provides marketing, R&D and policy services to the pork industry. It has responsibility for providing the Australian pork industry with its R&D and marketing services, as well as undertaking strategic policy development.

In 2000-01 the PRDC received $3.51million in industry R&D contributions and $4.07million in Commonwealth contributions, contributing to a total expenditure of $9.32million.