
Cotton Research and
Development Corporation

Grains Research and
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Fisheries Research and
Development Corporation

Rural Industries Research and
Development Corporation

Sugar Research and
Development Corporation

Grape and Wine Research and
Development Corporation

IMPACT OF INVESTMENT IN RESEARCH AND DEVELOPMENT BY THE RURAL RESEARCH AND DEVELOPMENT CORPORATIONS



Year 2 results

Council of Rural Research and Development
Corporations Chairs

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Executive Summary

Australian agriculture is innovative and consistently out-performs most other sectors of the Australian economy in total factor productivity growth, with domestic rural R&D a major driver of this performance.

The RDC model is an effective working alliance between government, industry and research partners

This investment in rural research and development is driven by the unique model of co-investment between government and industry through the Rural Research and Development Corporations (RDCs). The RDC model, based on industry and government collaboration, is an effective working alliance between government, industry and research partners. It is a unique example of government–industry partnership benefiting both the industry and the wider community.

The RDCs are major funders of R&D in Australian agriculture, investing \$441¹ million in R&D in 2008-09, which covered a range of priority areas including productivity, climate change and natural resource management. This amount includes \$244 million of industry investment and \$207 million in Government matching contributions.

Averaged over the past 20 years, for every \$1.00 that the Australian Government has contributed, industry has contributed \$1.50. This serves to leverage the total investment and provides greater benefits for Australia than from either party investing alone, creating ownership by industry and a partnership between industry and government. This substantial investment accounts for around 30² per cent of the R&D expenditure in the agricultural, fisheries and forestry industries undertaken in Australia, with the strategic activities of the RDCs influencing a large proportion of other research and development.

The structure of the RDC model and the extensive collaboration between the organisations involved, promotes effective research, development, innovation and extension of research findings in areas that are priorities for both industry and government, such as productivity growth, climate change and natural resource management. The ability to tackle projects jointly increases efficiency and can result in more effective communication and uptake of the outcomes of R&D. This contributes directly to the growth in productivity in Australian agriculture.

This report provides the results of the second year of an ongoing evaluation of the impacts, effectiveness and returns on investment by Australian rural research and development corporations. It builds on the 2008 report, showing once again, a high return on investment from the random sample of programs assessed across the RDCs.

The evaluation program undertaken by the RDCs is the largest and broadest of this type of analysis of rural R&D in Australia. The program will continue to be refined as standards and tools are developed to assist the RDCs. This evaluation program is likely to be useful for other forms of investment in

¹ Expenditure varies from year to year and total R&D expenditure does not necessarily equal the totals of industry and Government contributions due to carry forward balances of industry funds.

² Core, P. (2010) A retrospective on rural R&D in Australia. Department of Agriculture Fisheries and Forestry, Canberra, January 2010, page v.

research and development both in Australia and overseas, where assessment of innovation programs and projects is desirable.

Context and purpose

The Council of Rural Research and Development Corporations Chairs (CRRDCC) is a non incorporated body comprising the Chairs of 16³ RDCs and provides the peak forum for evaluation of the collective impact of the RDCs and for collaboration on major projects of national significance. The 16 RDCs are listed at Appendix A.

This evaluation process demonstrates the strong collaboration between RDCs, rural industry, government and research partners and shows significant benefits are generated in areas targeted by the National Research and Rural Research and Development Priorities.

In December 2008, the CRRDCC released the first year of results of this ongoing evaluation of the investment return. The 2008 report showed that over a 25 year timeframe, for every \$1.00 invested there was an average return of \$11.00, in 2007 dollars.

This is the second report to be delivered by the RDCs and shows results consistent with that of the first year, underlining the high value investment in rural research and development provides to Australian businesses and the community.

This report will:

- assist in communicating the range and value of activities undertaken by the RDCs to their stakeholders in a credible and verifiable way within a consistent framework;
- assist in developing common standards and tools for use across the RDCs and, more broadly, in other areas of research and development and innovation; and
- assist the RDCs in strategic and resource allocation decisions.

Results

The results from this second random sample of programs again show significant and consistent benefits from investment by the RDCs across a range of activities they participate in.

There were 59 individual programs evaluated in 2009, representing \$676 million in RDC investments. These programs covered a range of investments from forestry, meat, fodder crops and soil biology to education in dairy and fisheries resource management. These programs cover applied research, extension, capacity building, and information management. The programs were independently evaluated using a standardised cost benefit analysis methodology that was applied consistently across the RDCs.

For every \$1.00 invested,
\$10.51 is returned after 25
years

The results show a strong return on investment, with a benefit cost ratio of 2.36 after five years and 5.56 after 10 years. The return rises to 10.51 after 25 years. That is, for every \$1.00 invested, \$10.51 is returned after

³ Following the closure of Land and Water Australia in December 2009, 15 RDCs now comprise the CRRDCC

25 years, largely consistent with the results from 2008, which showed that for every \$1.00 invested, \$11.00 was returned.

Importantly, these results show that pay back on the investment dollar is quick, with 60 per cent of projects showing a positive net present value by year five and 77 per cent positive by year 10. This means that there is a low risk of the innovation becoming obsolete, or industry circumstances changing, before the costs of the project can be recouped. Obsolescence in this context means the risk of adoption falling short of expectations as producers switch to newer innovations.

The results also show that there are no negative results in the 10 year and 25 year timeframes, with the high and consistent rates of return at the program level suggesting that there may be under investment in rural R&D, an issue that will be investigated further in the 2010 evaluation report.

Benefits

Not all results are amenable to economic evaluation with current technologies, particularly those in the environmental and social areas. For the R&D projects analysed this year, the calculated returns on investment consisted primarily of economic benefits. The economic benefits came largely from productivity gains, improved market outcomes and improved quality management. While many projects also delivered environmental and social benefits, in most cases they could not be quantified within the scope of the evaluations conducted, and are not included in the returns on investment contained in this report.

Nevertheless, the evaluations describe a broad suite of environmental and social benefits arising from RDC investments. The majority of the reported social and environmental benefits included environmental and health benefits through the reduced use of chemicals, and improvements in food safety. Environmental benefits also included reduced soil erosion, reduction of chemical residues and more efficient water use.

Human resource capacity building, a critical contributor to regional development is also a major social impact of the RDC investments.

As noted above, the majority of the evaluations conducted by the RDCs were not able to quantify the environmental and social benefits in economic terms, therefore the calculated returns on investment understate the full suite of benefits delivered by RDC investments. Consistent measurement of environmental and social benefits is a key goal that the RDCs are actively pursuing. It is intended that a separate report will be published, outlining the results of this work.

1 Introduction

The Council of Rural Research and Development Corporations Chairs (CRRDCC) led the collective measurement of the impact of Rural R&D to demonstrate the returns generated by the RDC model for levy payers and government. The purpose of the collective evaluation is to ensure that future prioritisation of investments by the RDCs is based on a sound, systematic knowledge of the impacts of past investments across the RDC portfolio. This is increasingly important as the RDCs collaborate on a wider range of issues such as climate change, trade, energy and natural resource management.

A consistent approach to evaluation provides information to assess the returns to rural industries and the broader society from the total investment made by the RDCs in research and development on behalf of Australia's agricultural, fisheries and forestry industries. The information will better inform policy makers and RDCs on the contribution that the RDC model is making to productivity in these industries, both within the industries and along the supply chain. This is critical to maintaining the international competitiveness of Australia's rural industries. It will also provide information on the net public benefits being delivered by the RDC model.

The cost benefit analyses (CBA) provide a consistently assembled source of data on a range of factors such as gross benefits, benefit lags, costs and contributions, counterfactual arguments and other data linking environmental and social benefits with program investments.

The evaluation process provides information that allows the RDCs to address the following areas:

- the extent of the spillovers between the RDCs and their levy payers that results in benefits accruing beyond the specific industries associated with each RDC;
- the incidence of benefits along the supply chain and their impact on industry competitiveness;
- the extent of public benefits and their relationship to government formulated rural research priorities;
- the attribution of benefits from collaboration amongst RDCs in carrying out their RD&E; and
- the attribution of benefits from collaboration between RDCs and other investors in research and development including the CRCs, CSIRO, state governments and universities.

It should be noted that there are significant differences between the RDCs and the industries in which they are operating. This means that comparing results of individual RDC's evaluation with the aggregated or average return should be treated with caution. Questions of assessing the lessons from any negative returns cannot be adequately addressed from the aggregated figures. This is a matter for each RDC to address within their own portfolio.

The innovation cycle is complex and prone to produce large irregular returns from some projects or periods of smaller incremental gains across the entire portfolio. Further, extension of the results of RDC investments is likely to vary considerably between RDCs and is driven by such factors as scope of levy mandate, industry prospects, capacity to finance new innovation by individuals and producers, climate variability and trade circumstances.

The evaluation process is ongoing...

This report summarises the results of the second year of the CRRDCC evaluation process. The evaluation process is ongoing and aimed at producing a major report every three years. The results of the 2009 evaluation will be aggregated with the 2008 and 2010 results to be reported on in late 2010.

The 2008 report provided the results of an independent evaluation of 36 highly successful projects and 32 randomly selected projects, to give an indication of average returns across the portfolio. The results showed that over a 25 year timeframe, for every \$1.00 invested there was an average return of \$11.00, in 2007 dollars.

The results of the first year of the evaluations can be found at www.ruralrdc.com.au

2 Methodology

In 2007, the CRRDCC developed an effective evaluation framework, in consultation with ACIL Tasman, for assessing the impact of RDC investments and their compliance with government priorities. The resulting methodology was reviewed by The Treasury, Department of Finance and Deregulation, the Department of Agriculture, Fisheries and Forestry, the Productivity Commission and the Australian Bureau of Agriculture and Resource Economics. The framework enables independent estimates to be provided of the net benefits of RDC investments, including achievements and industry benefits, relative to priorities.

There are three elements in the evaluation process:

1. Analysis of a sufficient number of significant, successful, large scale projects or programs to demonstrate that the entire RDC portfolio is adding value to the Australian economy and producing positive private and public benefits. These projects were undertaken in year one and will be included in the evaluation process in subsequent years, when particular aspects of the portfolio are selected for assessment. No such projects were included in the 2009 evaluation process.
2. Representative random sampling of project clusters from each RDC to build a pool of consistent cost benefit analysis studies (CBAs) that can be used to provide an indication of the range and trends in returns from the total RDCs investments over a three year period. Randomly selected projects will be evaluated each year.
3. An analysis of early stage collaborative R&D projects, which are expected to have major areas of public interest in order to measure the value of work in progress and the private and public opportunities early stage research creates. A large cross sector project on biosecurity was undertaken in the first year of evaluation and several more are planned for next year.

A comprehensive description of the methodology can be found at www.ruralrdc.com.au.

3 Projects

RDCs assembled their entire investment portfolio into a series of sub programs or clusters of projects. Projects were randomly selected and RDCs then commissioned independent consultants to undertake the analysis.

There were 59 project clusters (programs) evaluated in 2009. The programs covered a broad range of RDC investments ranging across forestry, meat, fodder crops, dairy systems, soil biology and fisheries resource management. As well as covering a range of industry related topics, the programs also reflect the various stages across a wide spectrum of the innovation cycle within which the RDCs operate.

These programs cover applied research, extension, capacity building, and information management. While many of these elements are often contained within each program, such as most programs have an extension component, the majority of the 2009 programs focused more on one element than another. For example, the Edgenetwork® offers a range of practical workshops, designed to help producers gain knowledge and skills to improve livestock operations. This education program supports producers forming ‘peer review boards’ to discuss and analyse management practices used on their farms.

Another example of the emphasis in some of these programs on various stages of the innovation cycle is the GRDC soil biology programs, which, in collaboration with industry partners, developed new biological seed inoculants to improve plant performance. This program focused on the development and commercialisation of new inoculants by applying basic research on soil biology and inoculants already in wide spread use for legumes.

A full list of all of the programs selected for the 2009 evaluation report can be found at Appendix B.

4 Benefits of the RDC investments

4.1 Economic benefits

The total net present value (NPV) of all programs evaluated in 2009 was estimated at \$1.9 billion over a 25 year period. Economic benefits included productivity gains, improved market outcomes, and improved quality systems.

4.1.1 Productivity gains

A large proportion of programs identified reduced costs to industry, including lower operating and capital costs, as a significant benefit from RDC investment in projects. Other improvements to industry profits were identified as coming from increased sale volumes (as consumer demand and consumption increases in response to improved quality) and improved efficiency resulting in lower costs proportional to output.

Productivity gains were expected, in some instances, from improved supply chain efficiency arising from improvements in managerial systems and practices, as well as the availability of increasingly accurate information. Additional efficiency gains occurred as a result of increased crop yields and/or reduced yield losses. An example of the multiple economic, environmental and social gains that are often produced by RDC projects is presented in Box 1 below. In this project HAL invested in a cluster of avocado plant protection projects over a 7 year period. The project produced multiple benefits for the avocado industry, other horticultural industries and regional communities.

Box 1 HAL Investment in Avocado Projects – Plant Protection

Horticulture Australia Limited (HAL) has supported plant protection programs in the Avocado industry over the past seven years. These programs are concerned with protecting avocado crops from pests and diseases such as sunblotch viroid, bugs/beetles and fungal diseases.

Between 2002 and 2011, investment in the plant protection cluster by HAL, industry and other sources is estimated at over \$4.6 million. The net present value of benefits for this cluster of investments was estimated at over \$20 million over 25 years, producing a total investment benefit cost ratio of over 4.8. The benefits of the investment are outlined as including:

Economic benefits

- Increased avocado yield and quality
- Production cost savings
- Enhanced access to export markets
- Domestic market bio-security
- Improved/new technologies for other industries
- Increased yield

Environmental and social benefits

- Reduced use of chemicals on farms enhancing farmer lifestyle
- Less chemical residues in soils, public waterways etc
- Less chemical residues in Australian avocados
- Regional growth opportunities

Source: Economic Analysis of HAL Investment in Avocado Projects in Plant Protection Cluster.

4.1.2 Improved market outcomes

A number of programs reported benefits from improvements in industry communication and knowledge, including better and more accurate reporting, better understanding of the impact of events on price movements and more informed consumers. Improved knowledge in the industry allows farmers and the supply chain to more accurately plan, particularly in relation to supply management. Improved knowledge of products also allows consumers to make more informed decisions regarding purchases.

4.1.3 Quality system improvements

A number of programs identified quality improvements as a benefit arising from R&D investments. Improvements in technology, disease control or other investments in improving food quality lead to a better image for products and reduced rejection of products due to quality concerns. Such quality improvements can potentially result in increased consumption and sales.

In addition to quality improvements, benefits are also expected from the development of new products and product markets into the future. The development of these new products will allow for expansion in existing markets as well as for new sales opportunities in the development of new markets.

As quality is improved, benefits are passed on to consumers through increased consumer value and satisfaction. The development of new products and improved quality has also been outlined as a means of capturing potential gains in export markets. An example of quality system R&D investments is contained in Box 2 below, where RIRDC made multiple investments in improving oaten hay quality. Australia has been exporting containerised oaten hay to the discerning Japanese horse industry for a number of years. Growing this market relies on constant attention to improving hay quality.

Box 2 RIRDC Investment in the Fodder Crops R&D Program

The Fodder Crops R&D Program is aimed at facilitating the development of a sustainable and profitable Australian fodder industry. An economic analysis of three investments within the program was undertaken – mandatory export market standards, best practise super conditioning and quality lucerne hay production. In total \$0.46 million was invested in the three projects and it was found that the benefits were predominately economic, with a total estimated value of \$6.19 million. These benefits from the three projects included:

Economic benefits

- Reduction in expected costs of trade disruptions for hay and straw
- Maintenance of quality image for hay and straw
- Increased adoption of super conditioning for export hay and domestic market
- Improved hay quality
- Improved machinery performance
- Potential for improved hay quality may lead to an increase in exports and an increase in market share in overseas markets
- Increased yield
- Increased water use efficiency

Environmental and social benefits

- Lowered risk of environmental damage from pesticides
- Potential for an earlier impact on greenhouse gas reduction
- Reduced risk of chemical contaminants in meat and milk

- Increased probability of industry expansion (including regional employment and added value impacts)
- More efficient water use
- Reduced drainage water, recharge to water-tables, and nutrient exports off-farm.
- Reduced workload and improved lifestyles for irrigators

Source: RIRDC (2009), *Economic Evaluation of Investment in the Fodder Crops R&D program*.

4.2 Environmental and social benefits

The environmental and social benefits arising from RDC investments in programs were less frequently quantified than the economic benefits. Most commonly, these benefits included health benefits through the reduced use of chemicals and improvements in food safety as well as benefits from improved coordination and cooperation within industries.

Environmental benefits were mainly due to the reduced use of chemicals and pesticides. Lessened use of harmful pesticides will reduce the negative impact of these products on the surrounding environment, for example, as chemical residues are reduced in soil and streams. The reduction of harmful chemicals is linked to health improvements through less harmful residues in food and reduced exposure to such chemicals by employees and local residents. In addition to reduced chemical residue, the reduction of pests and disease and quality improvements will result in increased food safety, improved food security and a reduction in food borne illness.

Program specific environmental benefits and outcomes were also identified. Examples include reduced soil erosion in agro-forestry projects, improved animal welfare from the humane destruction of chicken carcasses, as well as several projects which identified the benefits of water savings and more efficient water use.

Social benefits from improved social networks and strategic alliances were found to exist in a number of programs. Improvements in industry and community involvement and communication, as well as increased industry coordination and cooperation will result in improved industry capacity and growth in industry knowledge. Such capacity building creates spillover benefits, particularly in the form of productivity and technology improvements, as new knowledge is passed through the economy.

Regional growth opportunities, through improved business and increased regional employment were also outlined as additional social benefits from investments in programs.

Further work is being undertaken on the social and environmental impacts arising from RDC investments and will be included in a separate report.

4.2.1 Summary of environmental benefits

Below is a summary of the environmental benefits identified in the programs evaluated in 2009:

- **DA**
 - Reduced nutrient runoff and reduced water use from systems style approaches to managing farms.
- **CRDC**
 - The water use efficiency on farms project identified savings of 1ML per Ha, subsequently it identified a probable reduction in herbicide use and greenhouse gas emissions.
- **FRDC**
 - Reductions in water contamination and chemicals for disease management.
- **GRDC**
 - Increased adoption of sustainable agricultural practices and subsequent reductions in the use of fungicide.
 - More sustainable agriculture from reduced reliance on manufactured and mined fertilisers.
 - Reduced risk of toxic contamination from chemicals in the farm environment.
 - Reduced use of protectant chemicals in grain storage environments.
 - Increased plant resistance can lead to less chemical/fertiliser usage on oilseed/other farms and potentially lead to reduced export of chemicals and nutrients to public waterways.
- **GWRDC**
 - Reduced water use through improvements in the management of vine physiology.
- **HAL (Potato and Nursery programs)**
 - Accelerated phase out of chemicals, increasing yields and reducing water consumption.
- **RIRDC (Agroforestry, Chicken Meat and Fodder Crop programs)**
 - Benefits achieved from these clusters include greater soil conservation, reduction of chemical residues and greater water efficiencies.
- **SRDC**
 - Significant reductions in erosion risk which will lead to a reduction in nutrient and sediment runoff into sensitive water ways and marine ecosystems.
 - Reduced GHG emissions, chemical use and wastes.

4.2.2 Summary of social benefits

Below is a summary of the social benefits identified in the programs evaluated in 2009:

- **DA**
 - Increased education and career development on and post-farm, through the National Centre for Dairy Education - Australia program, which directly links industry and education providers together in partnership.
- **HAL (Potato and Nursery programs)**
 - Research indicates greater health benefits for the Australian public associated with increased consumption of avocados. Such research also gives consumers greater confidence that chemicals used on avocados are safe. The programs have also lead to greater industry networks and linkages, leading to a more cohesive industry.
- **FRDC**
 - The research has lead to the maintenance, development and attainment of a profitable and sustainable salmon farming industry in Tasmania. This leads to a more viable industry.
- **GRDC**
 - Increased industry research capacity resulting from expanding soil biology research.
 - Enhanced skills and capacity in entomology and taxonomy.
 - Reduced potential adverse health impacts to grain fumigators and limited further use of chemical grain protectants.
 - Potential health benefits from high oleic canola oils.
- **RIRDC**
 - Reduced risk of health impacts from pathogens in chicken meat litter (noting that existing risk was already low), with potential contribution to reduced dust and odour emissions in the future. Data and information to alleviate community concerns regarding the risks of pathogen emissions from meat chicken sheds.
- **SRDC**
 - The creation of resilient regional communities has been strengthened by investing in the capacity of people in the sugar industry to extend their knowledge of innovative research skills. Gains have also been made to overall public health benefits with extensive farm safety and OHS programs implemented.

4.3 Consumer benefits

Consumer benefits from RDC programs are generated largely from increased demand for products arising from improved quality, greater choice as new markets are opened, and better information.

Several programs, such as the potato and avocado programs have identified improved quality as a significant benefit of RDC investments. As quality, or even perception of product quality improves, a perception of increased value in the product increases consumer benefit.

Additional information to consumers regarding quality or safety can also improve the perception of products by customers. Programs have identified improved knowledge and confidence of consumers as facilitating increased consumption, for example in the chicken meat R&D program.

The provision of other information, such as market information standards, can also benefit consumers. In the case of the MLA's market information, better information leads to reduced costs in the red meat chain from efficient price discovery, more confident decision-making and improved capacity to meet market needs, which results in better prices for consumers. Greater transparency can also lead to more sales as consumers may feel more comfortable making informed purchases.

Several programs have also found increased demand for products and services as a result of project investments. For example, HAL nursery and garden industry projects have found benefits to the industry from increased consumer demand from the business improvement program and industry development programs, to be valued at \$2.44m and \$2.87m respectively. While not measuring consumer benefits directly, an increased demand implies considerable increases in consumer benefits. The avocado programs – market and consumer research; post harvest and fruit quality; and supply chain – also experienced increased consumption, valued between \$1,800/t and \$2,700/t for each project.

An example of a program delivering consumer benefits is the APL Project Muscle Profiling, that analysed new ways of cutting pork carcasses. The program focused on producing a consumer-driven product range of fresh pork cuts (incorporating new carcass cutting lines) to meet the evolving requirements of consumers and to drive maximum incremental profit at all levels of the supply chain. A key focus was to improve the value return from pork shoulders, as retailers had identified this product category as offering lower dollar returns but also potential for higher returns. The benefits of this program are forecast to increase consumer demand for pork, as pork products are presented in new and innovative servings and cuts. There are also considerable supply chain savings that are likely to be generated.

Higher levels of industry productivity may also generate consumer benefits as decreasing operating costs and new technologies resulting in larger yields, allow businesses to be more competitive, and reduce prices for consumers. An example of an RDC investment where benefits to consumers were as a result of increased industry profitability is the Dairy Australia System Management project contained in Box 3.

Box 3 Consumer benefits case study– Dairy Australia

Dairy Australia’s System Management project was established with the aim to equip the dairy industry with resources and tools to increase farm profitability through a more efficient and productive workforce and for dairy farmers to embrace innovative technologies to improve farm productivity over time.

In addition to economic benefits such as increased farm profits, value of information, reduced staff turnover etc, benefits to Australian consumers of dairy products were also incorporated into project cost benefit analysis. Gains from the project to consumers come as a result of increased industry profitability, and as a result lower dairy prices.

Consumer benefits were estimated at approximately \$5 million between 2009 and 2020. These consumer benefits were estimated on the basis that 10% of farm level benefits are captured by Australian dairy consumers through lower prices.

Source: Cost benefit analysis of randomly selected Dairy Australia investments.

4.4 The 2009 results

There were 59⁴ projects and project clusters randomly selected this year. These were conducted from 2001 to 2009 (some are ongoing but all had reached a significant milestone by 2007-08) and cover a wide range of topics, as would be expected from RDCs covering industries as diverse as grains, wine, red meat and cotton production.

The total expenditure on these projects was \$676 million of which one, Northern Beef Research (a MLA co-investment with the Queensland Department of Employment, Economic Development and Innovation), was \$411 million or approximately 60 per cent. Of the total cost of the projects, the RDCs contributed \$181 million. This demonstrates that the RDCs collaboratively manage co-investment in R&D that is well in excess of their own direct contributions, underpinning the RDCs pivotal role in coordinating and leading a majority of the rural research expenditure in Australia. Each program analysis was asked to report NPV, BCR and IRRs at 0, 5, 10, and 25 years following the last year of investment in the program. The results are summarised in the tables below.

The simple average results clearly show a strong positive return

⁴ 58 of the 59 projects provided quantified results.

Table 1 **Aggregated results of the CBAs randomly selected in 2009 (\$million)**

	By 5 years	By 10 years	By 25 years
NPV (total)	749	1699	1884

Table 2 **Mean results of the CBAs randomly selected in 2009 (simple average \$million)**

	5 years	10 years	25 years
NPV	12.61	21.97	32.74
BCR	2.36	5.56	10.51

As with the simple average results the weighted average (by total program cost) shows a strong result. By comparing the weighted average results with the simple average, biases due to project size can be detected. Over time this will provide a useful insight into the relative performance of large and small projects. As this year's results have one project that accounts for 60 per cent of the total investment in all projects (around 80% of the investment in this project was made by non RDC participants), the weighted results will be heavily influenced by the results of this single project. This influence can be seen in table 3 where the total project and RDC attributed weighted returns are less than the simple average returns.

Table 3 **Mean results of the CBAs randomly selected in 2009 (weighted average by program cost)**

	5 years	10 years	25 years
BCR (Total project net returns)	2.49	3.72	6.04
BCR (RDC attributed net returns)	2.65	3.90	6.15

The benefit of using a series of time horizons is that it shows how the benefits accumulate over time. The results show that 60 per cent of projects are NPV positive by year 5 and 76 per cent positive by year 10. This shows that the pay back on these projects is quick. This means that there is a low level of risk of the innovation becoming obsolete, either through the next innovation becoming available or industry circumstances becoming unfavourable to further adoption, before the costs of the project can be recouped.

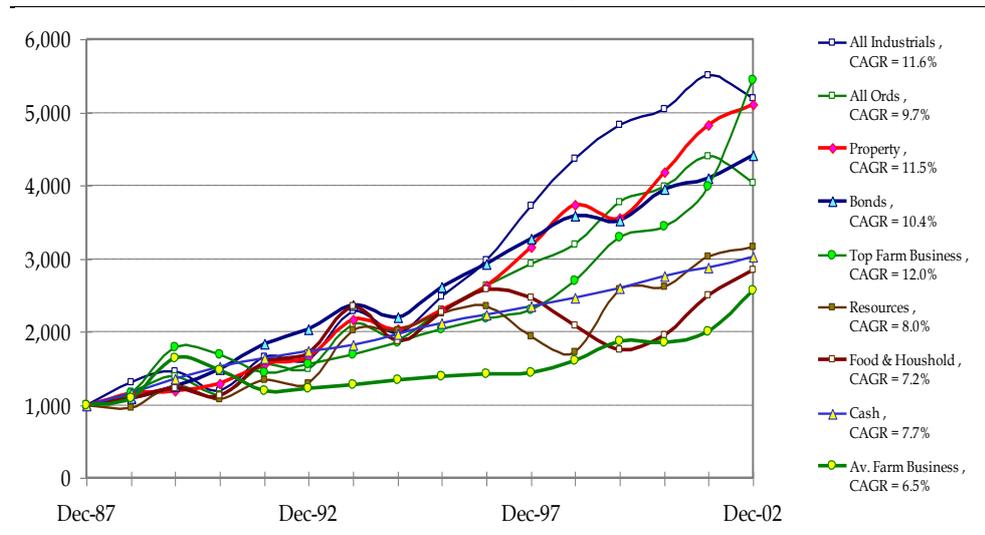
Pay back on these projects is quick

These results are consistent with the benefit ratios calculated in international cost benefit studies on agricultural research and development.

A characteristic of cost benefit studies on agricultural R&D is the calculation of the benefit over a long timeframe. This is because long lead times in some R&D projects need to be catered for. Typically,

agricultural R&D cost benefit studies are calculated over a 25 year timeframe. This is compared to 15 year returns for asset classes shown in Chart 1. The nominal rate of return on the 2009 CBA results is estimated at approximately 15% pa⁵ compared to other asset classes, such as property at 11.5% pa and the All Ordinaries at 9.7% pa. Clearly there are differences in the diffuse nature of R&D returns, compared with the well defined financial returns of the asset classes shown. However, comparing R&D returns with other investments provides some perspective on the scale of return from the programs and projects evaluated.

Chart 1 **Accumulation indexes for a range of asset classes**



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 Note: Presentation to ABARE Outlook Conference 2003

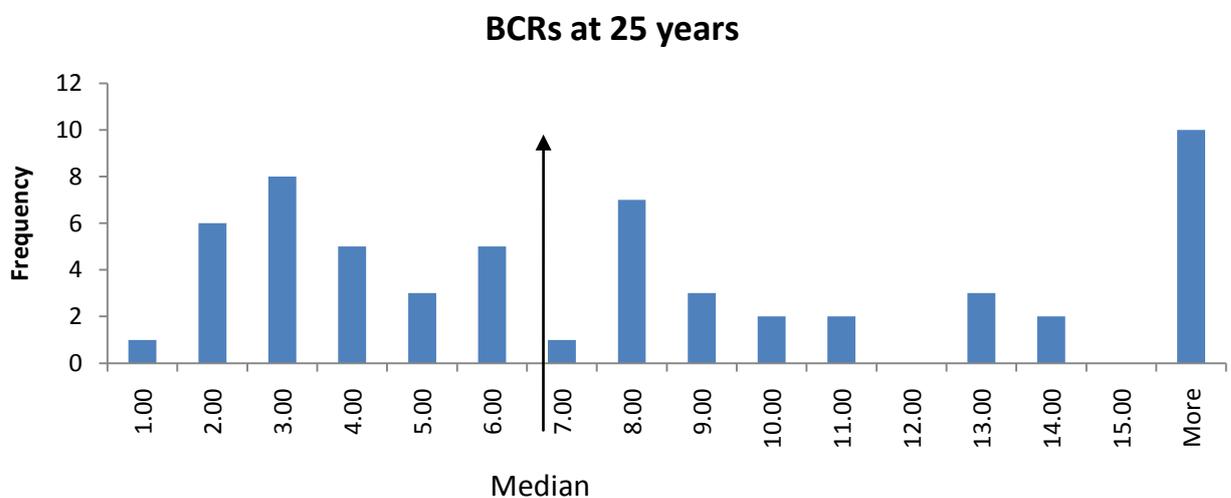
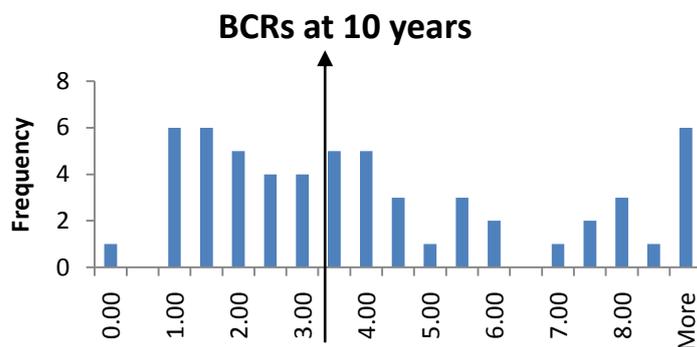
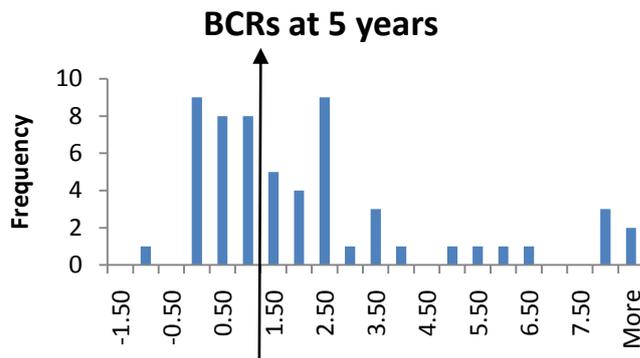
4.5 Distribution of the results

The following charts are simple histograms⁶ of the programs' BCR results. The distribution has been calculated for the 5, 10 and 25 year horizons consistent with the results in the tables above. The histograms show several important aspects of the results of the CBAs.

The first aspect is the steady generation of benefits over time. That is, the median benefit level moves to the right and the quantum of benefits grows as the benefits accumulate over time.

⁵ The 10 to 1 return over 25 years could be interpreted as \$1.00 invested at 10 per cent per annum. This would be worth \$10 in 25 years. However, as the results of the CBAs are already discounted by 5 per cent per annum, the nominal rate of return of these projects is likely to be approximately 15 per cent per annum.

⁶ Histograms calculate the number of observations (CBAs) that fall into a particular range. In this case the histograms are based on BCR increment ranges of 0.25.



Another feature of the distribution curves is that the left side of the curve does not contain negative results in the 10 and 25 years curve. This suggests that there may be under investment in rural R&D as there are no programs at or below zero. This means that the marginal rate of return may not be zero. There are several possible explanations for this.

One explanation is that the subprograms are being managed at the project level, where poor performing projects are being terminated early enough or masked by other successful projects in the cluster so that they do not drag the program level returns below zero. This means that the marginal

returns need to be measured at the project level or an adjustment made to the program results to account for this.

Another explanation is that there are R&D opportunities not currently being funded. It is mostly likely that both these explanations affect the shape of the curve.

5 Ongoing work on the evaluation process

To overcome some of the constraints in quantifying the social and environmental impacts, the RDCs are developing a comprehensive program to:

- Identify 5 to 6 social and environmental management priorities common to the majority of the RDCs;
- Invest in a series of projects to understand how RDC investments lead to a change in the common social and environmental priority areas;
- Align the information gathering activities of the RDCs (including grower, client, collaborator surveys and mandatory research project data collection obligations); and
- Link where possible to wider Government programs such as the National Land and Water Resources Audit, Signposts for Australian Agriculture and Caring for Our Country Program.

The first stage of this process has been completed and the social and environmental management priority areas of the RDCs are contained in Table 4.

Table 4 **Top social and environmental resource management reporting priorities⁷**

RDC	Environmental reporting priorities	Social reporting priorities
APL	<ul style="list-style-type: none"> • Environmental best management practice • Climate change adaptability through greenhouse gas management and mitigation • Waste nutrient management 	<ul style="list-style-type: none"> • Food safety • Food traceability and issue response • Industry capability
RIRDC	<ul style="list-style-type: none"> • Environmental sustainability • To assist industries adapt, sequester and mitigate climate change impacts 	<ul style="list-style-type: none"> • Enhance change management capacity of rural communities • Improve farm and fishing health and safety

⁷ Cited in survey conducted by the CRRDCC

		<ul style="list-style-type: none"> • Support indigenous rural development • Develop new rural industries for a changing climate
GRDC	<ul style="list-style-type: none"> • Climate variability and climate change • Greenhouse gas management • Water use efficiency • Soil health and biology • Biosecurity 	<ul style="list-style-type: none"> • Capacity building • Improving social welfare in regional communities
MLA	<p>Whole of supply chain approach to:</p> <ul style="list-style-type: none"> • Water use • Atmosphere • Soil • Biodiversity <p>Level of priority will vary across sectors within the red meat industry supply chain</p>	<p>Whole of supply chain approach to:</p> <ul style="list-style-type: none"> • Industry capability building across the supply chain • OHS risk management across the supply chain • Building research capability • International collaboration • Building rural & regional social capital • Animal welfare
CRDC	<ul style="list-style-type: none"> • Soil structure and nutrient management • Water use efficiency • N2O emissions • Energy use efficiency • Biosecurity 	<ul style="list-style-type: none"> • Building industry capacity • Building cotton community capacity
FRDC	<ul style="list-style-type: none"> • Biosecurity • Aquatic animal health • Bycatch management • Threatened, endangered and protected species management • Reducing fishing environmental 	<ul style="list-style-type: none"> • Human capital • Communicating responsible fishing practices • Managing fisheries and aquacultures contribution to meeting customary, consumer, lifestyle and community needs

	<p>impact</p> <ul style="list-style-type: none"> • Land use impacts • Fish stock management • Oceanographic and biophysical processes in aquatic systems 	<ul style="list-style-type: none"> • Community resilience and development • People development
DA	<ul style="list-style-type: none"> • Whole of farm nutrient management and water quality • Water use efficiency • Green house gas management 	<ul style="list-style-type: none"> • Human health and nutrition • Satisfaction with farming • Farm and post-farm skills and education • OHS • Dairy industry leadership in regional communities
FWPA	<ul style="list-style-type: none"> • Water use efficiency • Increase GHG sequestration potential of forestry • Improve forest biodiversity 	<ul style="list-style-type: none"> • Human capacity building
GWRDC	<ul style="list-style-type: none"> • Adaptation to climate change • Improved water management • Reduction in chemical use • Improved soil health • Improved salinity management 	<ul style="list-style-type: none"> • Industry capacity building • Occupational health and safety
HAL	<ul style="list-style-type: none"> • Climate change variability • Pests and weeds • Water management • Improving soil health 	<ul style="list-style-type: none"> • Human health and nutrition • Industry capacity building
Livecorp	See MLA	See MLA
AMPC	See MLA	See MLA
SRDC	<ul style="list-style-type: none"> • Improvement in water quality • Improvements in NRM • Improvements in soil conservation 	<ul style="list-style-type: none"> • Occupational health and safety • Creation of resilient regional communities • Building innovative skills for the sugar

	<ul style="list-style-type: none"> • Reduction in GHG emissions • Reduced impact from chemical use • Reduction in wastes 	<p>industry</p> <ul style="list-style-type: none"> • Building research skills • Improved communication and understanding
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A related area of RDC impact assessment is the likely contribution of RDC investments to total factor productivity (TFP) growth. Two RDCs have taken the lead in investigating RDC contributions to TFP growth. GRDC is partnering ABARE in a series of projects looking at productivity and R&D in the grains industry and RIRDC has commissioned several projects to assess the on-farm practice change and innovations that drive productivity growth.

6 Conclusion

This report forms the second year of evaluations of RDC investments in what will be an ongoing annual program of evaluation.

The results show a strong return on investment for 2009, consistent with the results of the 2008 evaluation report and demonstrate that the pay back on the investment dollar is quick.

Further work is being undertaken to better demonstrate the environmental and social impacts arising from RDC investments and this analysis will be included comprehensively in future evaluation reports.

The evaluation program will continue to be refined as standards and tools are developed to assist the RDCs. This program is likely to be useful for other forms of investment in research and development both in Australia and overseas, where assessment of innovation programs and projects is desirable.

A. Statutory and industry owned RDCs

Statutory bodies	
Cotton Research and Development Corporation	CRDC
Grains Research and Development Corporation	GRDC
Fisheries Research and Development Corporation	FRDC
Land and Water Australia*	LWA
Rural Industries Research and Development Corporation	RIRDC
Sugar Research and Development Corporation	SRDC
Grape and Wine Research and Development Corporation	GWRDC
Industry owned companies	
Dairy Australia	DA
Australian Wool Innovation	AWI
Meat and Livestock Australia	MLA
Australian Egg Corporation Limited	AECL
Horticulture Australia Limited	HAL
Australian Pork Limited	APL
LiveCorp	LiveCorp
Australian Meat Processors Corporation	AMPC
Forests and Wood Products Australia	FWPA

- Land and Water Australia was wound up in December 2009

B. List of projects evaluated in 2009

RDC	Project name
HAL	Nursery and Garden Industries Projects - Business Improvement Program
HAL	Nursery and Garden Industries Projects - Market Information Cluster
HAL	Nursery and Garden Industries Projects - Industry Development Cluster
HAL	Nursery and Garden Industries Projects - Environment cluster
HAL	Potato Program - Seed Production and Seed Quality Cluster
HAL	Potato Program - Projects in Processed Potatoes - DNA Monitoring Tools
HAL	Potato Program - Potato extension cluster
HAL	Potato Program - Potato environment and health cluster
HAL	Potato Program - Potato Agronomy and Production Management cluster
HAL	Potato Program-Disease and soil amendments
HAL	Avocado Projects - Plant Protection cluster
HAL	Avocado Projects - Market and Consumer Research cluster
HAL	Avocado Projects - Post Harvest and Fruit Quality cluster
HAL	Avocado Projects - supply chain cluster
CRDC	Value Chain: Agronomic and management practices for optimal fibre quality characteristics
CRDC	People and Knowledge: Cotton Extension Team
CRDC	Farming Systems: Research to improve water use efficiency
GRDC	Soil Biology Program
GRDC	Grain Storage
GRDC	Australian Winter Cereals Molecular Marker Program
GRDC	Oilseeds Breeding (Brassicas and Soybeans)
GRDC	Summer Coarse Grains- Breeding in the Northern Region
GWRDC	Vine Physiology - Water component 1
GWRDC	Vine Physiology - Water component 2
GWRDC	Vine Physiology - Water component 3
GWRDC	Vine Physiology - Water component 4
GWRDC	Control of Measurable Grape Characteristics Cluster - Winegrape Tannin and Colour Specification Project
GWRDC	Control of Measurable Grape Characteristics Cluster - Flavanoid Pathway Genes in Grapes
FRDC	Salmon Aquaculture Subprogram

FRDC	Marine Protected Areas and Spatial Management
FRDC	Southern Bluefin Tuna Aquaculture Subprogram
RIRDC	Chicken meat R&D program - Investment in humane restructure of poultry in an emergency disease response - use of carbon dioxide
RIRDC	Chicken meat R&D program - Investment in new diagnostic assays to improve control of coccidiosis in poultry
RIRDC	Chicken meat R&D program - Investment in understanding and reducing dust, odour and pathogen emissions in poultry
RIRDC	JVAP Program - Investment in Flora Search (Stage 3)
RIRDC	JVAP Program - Investment in Prioritization of Regional Opportunities for Agroforestry Investment
RIRDC	JVAP Program - Impact Assessment of Investment in the Viability of Single Desk Marketing of Farm Forestry Timber
RIRDC	Fodder Crops R&D Program - Investment in Mandatory Export Market Standards
RIRDC	Fodder Crops R&D Program - Investment in Best Practice Super Conditioning
RIRDC	Fodder Crops R&D Program - Investment in technology transfer of BMP/QA systems for quality lucerne hay production
MLA	Northern beef
MLA	Market Information
APL	Food Safety
APL	PigPass Physi-Trace Project
APL	Muscle Profiling Project
APL	Studies of a novel agent causing stillbirths and pre-weaning deaths in pigs due to myocarditis
LWA (NPSI)	Horticulture Salinity
LWA (NPSI)	Harver Waters
LWA (NPSI)	Irrigation Futures
LWA (NPSI)	North Australian Irrigation Futures
LWA	Stream - Aquifer Interaction - Technical and Management Challenges
LWA	Indigenous Natural Resource Management
SRDC	Evaluation of genotypes for controlled-traffic farming
SRDC	A new cropping system for the Central District
SRDC	Enhancing an economic way of doing business in the cane industry
SRDC	A regional partnership approach to developing a sustainable sugar cane system
Dairy Australia	Cowtime Extension
Dairy Australia	Systems Management
Dairy Australia	NCDEA

C. Glossary of terms

Term	Definition
Benefit to cost ratio (BCR)	The ratio of the quantified benefits to the cost of investing in the R&D project.
Collaboration	Where two or more RDCs (or external agencies) agree to work together through enhanced communication, coordination or co-investment to leverage their respective investments.
Discount rate	A discount rate serves the purpose of discounting from the original investment the benefits otherwise obtained if the investment had been placed in the financial system at a market interest rate (5 per cent was used in this report). It can also be interpreted as a foregone income for having undertaken the investment in the RDC project. The discount rate, jointly with inflation rate, is used to determine the real value of investment (cost/benefits) at some point in time, usually present terms.
Economic benefits	Benefits such as improved productivity, market share or market access.
Environmental benefits	Benefits which directly affect the environment, such as water or air quality, salinity, endangered species and biodiversity. These benefits generally represent a 'public good' or 'spillover' benefit, although some benefits are accrued to levy payers.
Internal rate of return (IRR)	The discount rate that makes the net present value equal zero or the rate of growth the project is expected to generate.
National Research Priorities (NRPs)	An Australian Government initiative to help focus R&D efforts on issues of national importance. Rural Research Priorities are aligned with National Research Priorities.
Net present value (NPV)	After the stream of nominal benefits of an investment project has been determined, for instance \$100 per year for the next five years, the NPV comprises in one single value, usually the current year, such stream of future benefits. Its calculation implies the use of inflation rate and a discount rate in order to account for the loss of value from future inflation and the opportunity cost of an alternative investment, respectively.
Randomly selected project	A project selected from a defined set of projects that will contribute to a pool to demonstrate the distribution of returns to the total RDC investment portfolio.
Rural Research and Development Corporations (RDCs)	A unique co-funding partnership between the Australian Government and the agriculture, forestry and fisheries industries which commission and manage targeted research and foster uptake and adoption based on the identified needs and priorities of both industry and the Australian Government.
Rural Research Priorities (RRPs)	An Australian Government initiative to balance new and ongoing R&D investment needs for the primary industries sector, and to ensure that the R&D objectives of the Australian Government are met. RDCs align their R&D investments with these priorities: productivity and value adding; supply chain markets; natural resource management, climate variability and climate change; biosecurity; and supporting priorities.
Social benefits	Benefits stemming from a project that directly affects the wider Australian public, such as public health, occupational health and safety, resilient regional communities and animal welfare.
Spillovers	Costs and benefits borne by those not party to the transaction are called 'spillovers' or 'externalities', as they are external to the activity.