Australian Government

Rural Industries Research and Development Corporation

The Benefits from RIRDC's R&D

Submission to the Productivity Commission Inquiry into Rural Research and Development Corporations

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25 June 2010

Abbreviations

ABARE	Australian Bureau of Agricultural and Resource Economics
AGO	Australian Greenhouse Office
ARLP	Australian Rural Leadership Program
ATTIA	Australian Tea Tree Industry Association
BCR	Benefit-cost ratio
BMP	Best management practices
CIE	Centre for International Economics
CME	Chicken Meat Program
CRDC	Cotton Research and Development Corporation
CRRDCs	Chair of the Rural Research and Development Corporations
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Australian Government Department of Agriculture, Fisheries and Forestry
DCCEE	Department of Climate Change and Energy Efficiency
DMSO	Dimethyl sulfoxide
EAD	Emergency animal disease
EM	Electromagnetic induction
FSANZ	Food Standards Australia New Zealand
FTAs	Free trade agreements
FWPA	Forest and Wood Products Australia
GRDC	Grains Research and Development Corporation
GVP	Gross value of production
GWRDC	Grape and Wine Research and Development Corporation
HAL	Horticulture Australia Limited
IMF	International Monetary Fund
IRR	Internal rate of return
JVAP	Joint Venture Agroforestry Program
JVFHS	Joint Research Venture for Farm Health and Safety

Contents

Tables

Figures

Boxes

Executive Summary

Introduction

RIRDC is a statutory authority established by the Primary Industries and Energy Research and Development Act 1989 (PIERD Act). It is unique in the Rural Research and Development Corporation (RDC) model: it invests in R&D in over 30 new and emerging rural industries with a farm gate value of $1billion; seven established industries with a total value of production over $3 billion; and a broad range of cross-sectoral national rural issues. Its actual expenditure in 2008-09 was $23.8 million.

This submission discusses a number of critical aspects of RIRDC's operations and outcomes to address the specific terms for reference of the Productivity Commission inquiry. It also provides a series of specific case studies to demonstrate that RIRDC:

- successfully manages a multi-industry investment portfolio; and
- delivers outcomes both to a range of rural industries as well as to the wider community through the explicit public good nature of much of its research.

The submission also comments on some changes that could make RIRDC's operations more effective.

RDCs respond to an opportunity and a challenge

RDCs are an institutional mechanism designed to capture the significant benefits from rural R&D while at the same time providing a means of dealing with the complex coordination challenges associated with undertaking research in diverse and complex rural industries.

RIRDC's Operations

RIRDC brings value to the RDC model by being able to work effectively across multiple industries and activities with a single management and board structure. Key elements of its operations are:

- a comprehensive investment framework that defines how funds are allocated at the portfolio, program and project levels and has explicit decision criteria at each level of allocation;
- an explicit evaluation framework used to monitor outcomes;
- maintaining close links with the users of R&D knowledge through the use of Advisory Committees (consisting of industry experts and other stakeholders) at all stages of project development and ensuring adoption pathways are built into all projects;
- the extensive use of collaboration and co-funding arrangements with a variety of other organisations.

The rationale for RDCs and RIRDC's activities

The most substantive policy rationale for Commonwealth Government involvement in rural R&D is that the resulting innovation provides a range of benefits to the wider community as well as to particular rural industries. The RDC model, along with Commonwealth funding of R&D,

provides an essential coordinating and leveraging role to undertake research that delivers public benefits that would not otherwise be available.

The balance between public and private investment in rural R&D

The Productivity Commission's terms of reference raise the issue of the balance between public and private funding. Three observations relating to RIRDC's operations are relevant here:

- in addition to industry productivity growth, a high proportion of research funded by RIRDC generates public benefits;
- public funding plays a vital leveraging role in encouraging private funding of rural R&D;
- the public funds invested by RIRDC generate high returns.

Wide community benefits from RIRDC's activities

RIRDC's R&D investments provide wider community benefits in a number of key areas as a consequence of:

- RIRDC working in areas that are directly related to aspects of broader government policy including trade policy, climate change policy, building regional communities, addressing Indigenous disadvantage and enhancing the status of rural women;
- spillover benefits related to health, farm safety, the environment, animal welfare, maintaining dynamic communities (including through rural leadership) and addressing Indigenous disadvantage.

The public good nature of RIRDC's outcomes can be illustrated through a number of case studies including:

- the health benefits that arise from research into emerging industries (olives, tea tree oil, native foods and kangaroo meat) as well as existing industries (chicken meat);
- the environmental benefits that emerge from existing industries (in particular, water use efficiency in the rice industry) and emerging industries (related to climate adaptation) as well as broad rural industries such as agroforestry;
- the public policy benefits that emerge from research into trade policy and farm health and safety as well as reducing Indigenous disadvantage; and
- knowledge from RIRDC's new rural industries research assists the diversification in Australia's rural industries. A more diverse base of rural industries helps to underpin successful regional economies and strong regional communities - providing production opportunities to help regions respond to changing circumstances, as well as employment, population and associated services.

The effectiveness of RIRDC

The Productivity Commission's terms of reference question the extent to which RDCs are effective in their operations. RIRDC's effectiveness can be illustrated as follows:

- RIRDC receives advice on research priorities from its industry sectors through its advisory committees and develops five-year R&D plans for its programs. Together with RIRDC's investment framework this adds considerable value by providing a systematic approach to the search for, coordination of, and ultimate adoption of rural R&D;
- RIRDC's stakeholder survey indicates very high ratings for RIRDC's activities in identifying, commissioning and implementing important research; and
- RIRDC's regular impact evaluations indicate very high returns to funds invested within each of its portfolios. Most of the 80 projects evaluated had estimated internal rates of return of between 15 and 30 per cent.

Impediments to RIRDC's effective functioning

There are two areas where changes to RIRDC's current operations would significantly enhance RIRDC's ability to deliver investment outcomes:

- extending RIRDC's mandate to include product promotion and market development would significantly increase the adoption potential of RIRDC's research and would allow industries covered by RIRDC to be treated the same as some other rural industries; and
- providing for matching government funding of voluntary levies raised by industries under the RIRDC umbrella would enhance RIRDC's ability to fund prospective research more widely than it is currently able.

RIRDC's role in broader public interests

The Productivity Commission's terms of reference also ask it to consider the extent to which RDCs provide a balance between benefits to specific industries and broader public interests.

Research into new and emerging industries is a prudent response to managing the emerging needs and challenges facing rural industries and communities. The Government has recognised the importance of adaptation, particularly in agriculture, to emerging issues of climate change and climate variability. Work is needed on a variety of fronts, including more effective use of natural resources by all industries, and particularly discovering and testing the potential for emerging and new industries that are adapted to a changing climate.

In all of these areas, there is more demand for good research than RIRDC's current resources can satisfy. In RIRDC's experience, the demand for sound research, from government and from prospective emerging and established industries, is considerably greater than can be satisfied with RIRDC's current level of resourcing. Put simply, there is scope to deliver more public benefits with additional funds.

1 Introduction and outline of this submission

RIRDC welcomes the opportunity to make this submission to the Productivity Commission's inquiry into Rural Research and Development Corporations.

This submission seeks to assist the Productivity Commission in its deliberations by setting out in some detail the nature of benefits that arise from RIRDC's research funding and demonstrating how these benefits relate to the need for government action (and in particular government funding) concerning rural R&D. It also illustrates how RIRDC works to achieve these benefits under the current R&D arrangements.

This submission examines RIRDC's activities in the context of:

- Australia's National Innovation Priorities; and
- the Commission's specific terms of reference.

In doing this, the submission examines each of RIRDC's portfolio areas and explains the nature of benefits that arise in each of these. drawing on a number of case studies.

In its *Issues Paper*, the Commission has raised a number of fundamental questions regarding agricultural R&D, its effects and the appropriate ways in which it should be funded. In contributing to the understanding of these issues, this submission focuses on a number of particularly important aspects of RIRDC's operations. These are:

- RIRDC's unique role in providing research support to new and emerging industries;
- RIRDC's role in providing collective good research on issues that cut across commodity boundaries and apply to the full rural sector;
- RIRDC's direct engagement in research to assist in broad policy areas;
- RIRDC's demonstration, through its own activities, of the possibilities for incorporating more than one commodity or sector within a single RDC; and
- RIRDC's track record in producing a variety of spillovers from research, particularly in health and environmental outcomes.

In addition, the submission considers some potential changes that the Commission could consider that would allow RIRDC's operations to become even more effective than they currently are.

This submission is structured as follows:

- Section 2 provides an overview of RIRDC's activities in the context of the specific terms of reference to be addressed by the Productivity Commission. This section sets the scene for the more detailed discussion of RIRDC's activities that follows.
- Section 3 provides an overview of RIRDC's activities, outlining RIRDC's core portfolio areas, setting out some of its operational principles and some important and relevant features of RIRDC's operations as well as demonstrating its success in operating a multi-commodity RDC;

- Section 4 examines RIRDC's new and emerging industry portfolio, with a particular focus on a number of case studies that illustrate the various benefits of RIRDC's research;
- Section 5 examines RIRDC's national rural issues portfolio, again considering a number of case studies in detail;
- Section 6 examines the established industries portfolio illustrating through case studies some of the wider benefits that emerge from this portfolio;
- Section 7 considers some changes to RIRDC's operations that could potentially improve RIRDC's outcomes.

2 RIRDC, national innovation priorities and the Commission's terms of reference

Key points

RDCs are an institutional response to the challenges and opportunities associated with agricultural R&D. As such, they provide a practical reflection of Australia's National Innovation Priorities.

RIRDC's activities demonstrate that the RDC structure, is an effective means of leveraging private investment in R&D and generating a wide range of public benefits — benefits accruing outside the industries themselves.

There are public good and spillover benefits from most of RIRDC's research. Public good outcomes include building regional communities, adapting to climate change, addressing Indigenous disadvantage, human health, more efficient resource use, improved trade policy and farm health and safety.

2.1 Background: why RDCs?

Rural Research and Development Corporations (RDCs) are an institutional response to both a significant opportunity as well as a series of practical challenges.

The opportunity

The opportunity is the well-known benefits from agricultural research and development (R&D). Numerous studies in Australia and overseas have shown the very high returns to agricultural R&D, with benefits accruing not only to producers, but also to the wider community (both in regions and in cities). As the Commission has noted in its *Issues Paper*, even accounting for uncertainty in evaluation techniques, the returns from agricultural R&D are substantial, potentially making agricultural R&D investments some of the highest returning destinations for government funds.

The challenge

The practical challenges arise because successful R&D requires coordinating the abilities of researchers to deliver genuine advances with the diverse needs of producers and consumers (both in Australia and overseas). Australian agriculture is both technically and economically diverse and modern agriculture is a highly knowledge intensive activity encompassing many different areas of scientific endeavour.

These coordination challenges are complicated by the fact that no individual operator in agriculture necessarily has the incentives or ability to fund and manage agricultural R&D. Further, a considerable amount of this R&D contributes directly to government policy 'public good' objectives.

Box 1 RIRDC and *Powering Ideas: An Innovation Agenda for the 21st Century*

In considering the role of RIRDC in the national innovation system, it is worth noting that it can be seen as a practical embodiment of the principles set out in *Powering Ideas: An Innovation Agenda for the 21st Century*, the Commonwealth Government's recent policy statement on innovation.

Powering Ideas identifies a number of National Innovation Priorities.

- Public research funding supports high-quality research that addresses national challenges and opens up new opportunities.
- The innovation system fosters industries of the future.
- More effective dissemination of new technologies… with a particular focus on small and medium sized enterprises (SMEs).
- The innovation system encourages a culture of collaboration.

RIRDC, as an RDC that supports a strong component of public good research, provides an institutional structure to address each of these priorities.

High quality research and national challenges

In both feedback from RIRDC's stakeholders (examined in detail in section 3.7), and in observed outcomes from evaluation of its research (discussed in detail in section 3.3) it is clear that RIRDC identifies, coordinates and funds high quality research. Stakeholders consider that RIRDC is identifying, funding, and delivering results in appropriate areas of research — with priorities reflecting the views of key stakeholders.

Systematic impact evaluations indicate a significant return on funds invested. Further, a considerable proportion of this research directly addresses national challenges (including, for example, climate change, international trade policy, building dynamic regional communities).

Fostering industries of the future

A major focus of RIRDC's research is on new and emerging industries — for precisely the sorts of reasons outlined in *Powering Ideas*. RIRDC currently supports more than 200 projects across more than 30 new and emerging industries (RIRDC's new and emerging industries portfolio is examined in detail in Section 4). Many of these will become industries of the future — those that can deal with the challenges that come with a changing climate and changing structures of international demand.

More effective dissemination with focus on SMEs

RIRDC works at the applied end of the R&D chain. For RIRDC, the ultimate dissemination and the incentives for adoption of R&D findings are a key factor in its investment framework (the broad details underlying RIRDC's investment framework are set out in Section 3.4). RIRDC only funds research where there is a clear path to adoption.

In the case of agriculture, this adoption clearly has to take place within SMEs, as most agricultural enterprises fall into this category.

Encouraging a culture of collaboration

Because of the nature of RIRDC's work, collaboration is essential. RIRDC has been involved in a large number of collaborative research activities with other research agencies (discussed in more detail in section 3.6). In most cases, RIRDC is a lead agency in these. Combined with RIRDC's investment framework and commitment to adoption, this collaboration contributes to the effective use of all funds devoted to agricultural R&D.

A coordinating and facilitating government role in the innovation system has long been a presumption in Australian government policy making. Within this, debate has been about the shape this role takes; particularly the degree to which it is prescriptive versus the degree to which

the government provides an institutional framework to allow innovations to emerge from the interactions of researchers, producers, consumers and the wider community.

RDCs and RIRDC

RDCs are an institutional framework that allows the many elements of research coordination to take place without necessarily placing prescriptive requirements on the nature of that research. Rather, by coordinating diverse researchers and diverse research needs, RDCs allow appropriate R&D investments to emerge in a way that ensures the findings can be adopted and ultimately lead to benefits to the wider community.

The RDC model establishes independent entities that manage the interface between the R&D investment function, the research providers and the community and industry beneficiaries of the knowledge outputs. This avoids the potential conflict of interest that would arise if research providers alone made rural R&D investment decisions.

In this regard, RIRDC's experience and demonstrated results provide insight into the value of the RDC approach, particularly as it applies to the high level of public good R&D undertaken by RIRDC. In the discussion that follows, RIRDC's activities are considered within the context of the Commission's specific terms of reference.

2.2 RIRDC and the Commission's terms of reference

Economic and policy rationale for government involvement

All agricultural R&D generates public benefits, although the nature of these benefits varies considerably from industry to industry.

The general argument for government involvement in R&D relates to the need for institutional coordination in the cases where desirable social outcomes are unlikely to be achieved through the individual actions of firms or consumers. Government actions of various kinds can serve as a mechanism either to coordinate these individual actions or to provide incentives for individuals to work together where this incentive would otherwise have been absent.

Desirable social outcomes can arise from better coordinated activity because of the public good or 'spillover' benefits from many R&D activities — particularly the knowledge spillovers that emerge from R&D. The need for coordination to ensure the maximum public good from R&D — or to ensure the spillover effects from emerging industries —results from a variety of causes: most notably the small and disbursed nature of many agricultural enterprises, or, in the case of new and emerging industries, the absence of a sufficient production base to fund even the minimal effective levels of valuable R&D.

The benefits of government action, including public funding, can accrue either within a particular industry group, or more widely to the community as a whole, whether or not they are engaged in agricultural production. In general, the argument for taxpayer funding relates to the benefits that may emerge *outside* a particular industry group, while the argument for other government actions (such as mandatory levies) relates to benefits *within* the industry.

The need for institutional coordination is not itself sufficient to justify particular government interventions. A number of other conditions must be satisfied including that the intervention results in *additionality* of R&D spending, and that the value of the *benefits* (including particular public good or spillover benefits) are in fact greater that the *cost* of the government action in the first place.

Additionality

Additionality refers to the net increase in R&D activity that results from the government's contribution. At one extreme, additionality may be zero if government funds simply substitute for those that would otherwise have been contributed. At the other extreme, all of the government funds may be additional.

While additionality is difficult to formally measure, there are several aspects of RIRDC's operations that help ensure that the funds it provides are additional to what would otherwise have been the case.

- First, RIRDC engages extensively in collaborative research. This overall process helps ensure that any other funds available for particular research contribute to the same research activities rather than directly competing with them (thus potentially duplicating research that would otherwise have taken place). Section 3.6 provides more detail on RIRDC's collaborative activities.
- Second, in a number of areas where RIRDC funds research, funding (from either private or public sources) is extremely limited, so given total research needs relative to the current scale of operations, there is very little scope for duplication of research effort.
- Third, many of the industries RIRDC is involved in are very small. This means they have some difficulty in providing an appropriate quantum of research funds without some government involvement. In this case it is very unlikely that RIRDC crowds out funds that would otherwise come from industry sources. Rather, it is likely that some of RIRDC's activities (in particular the provision of information about small but important industries) and facilitation roles actually lead to an increase in private funds that would not otherwise have taken place.

Public good and spillovers from RIRDC's research

The significant proportion of RIRDC's funding involves research that is explicitly associated with a number of types of public good or spillover benefit. These are summarised in Table 1 and Figure 1 and are considered in more detail below.

Research directly related to government policy objectives

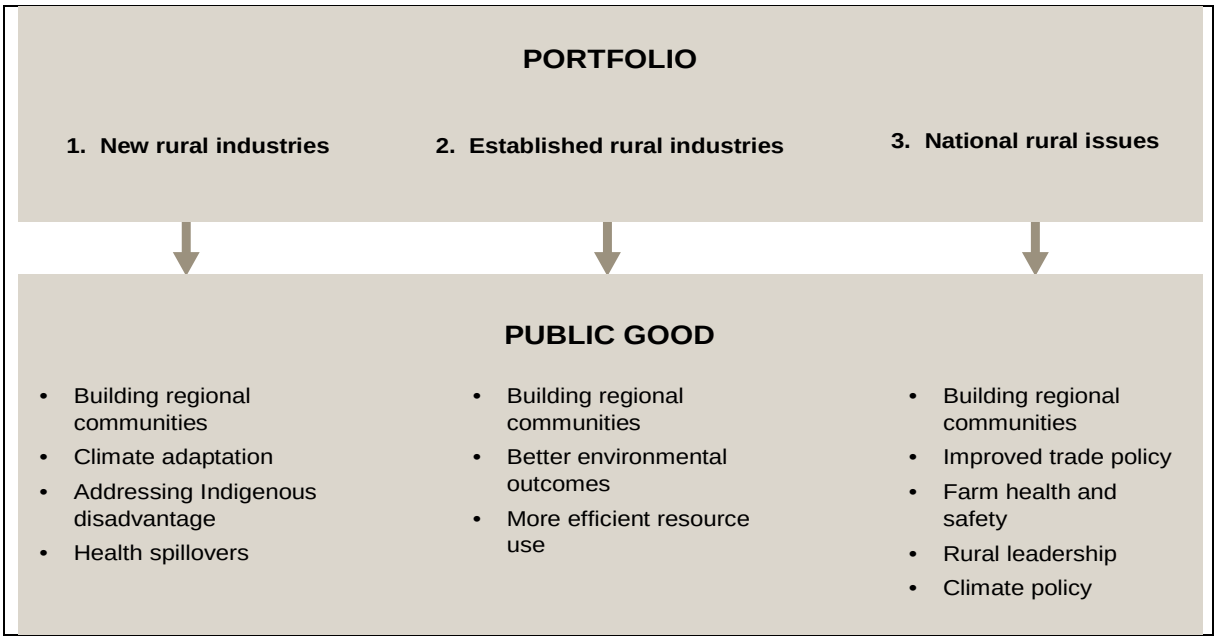
RIRDC undertakes research in a variety of areas that are directly related to aspects of broader government policy and directly responds to government policy needs. Specific examples include:

- Research relating to **increasing trade** or **improving the trade prospects of agricultural industries** (Section 5.4 provides a detailed case study of one stream of RIRDC research into international trade policy). Australian agriculture faces many barriers to trade. A major thrust of Australian government policy has always been to engage in a variety of trade enhancing activities, particularly through negotiations in multilateral and bilateral forums. RIRDC has a

Table 1: Examples of public good and spillover benefits of RIRDC's research

Public good or spillover benefit	*Example*
Trade policy	**Trade policy research** (undertaken in RIRDC's National Rural Issues portfolio and examined in Section 5.4) helped create the international intellectual recognition of the benefits of international agricultural trade reform.
Climate change policy	**Adaptation research** (in the New and Emerging Industries portfolio, Section 4) seeks to find effective new agricultural activities that will be able to respond to coming climate challenges.
	Mitigation research in the (National Rural Issues portfolio and the New and Emerging Industries portfolio) considers a variety of ways of reducing emissions including through the production of non-ruminant meat as well as through bioenergy and agroforestry.
Regional communities	Research into **new industries**, as well as improving the productivity of **existing industries** helps ensure that regional communities remain viable and vibrant.
Overcoming Indigenous disadvantage	RIRDC's research supports emerging industries including **turtles, kangaroos, crocodiles, emus and native foods** that provide opportunities for Indigenous communities (see Section 4.8)
Health spillovers	RIRDC undertakes research into the health benefits of a variety of new industries including **olives, tea tree oil and kangaroo meat** (see Section 4)
Farm safety	RIRDC has undertaken a major research program (within the National Rural Issues portfolio, see Section 5.3) into **farm safety**.
Environmental benefits	Environmental benefits arise from research in a number of RIRDC's portfolios including **water efficiency** in **olives** and **rice**, as well as **climate adaptation**.

Figure 1: RIRDC portfolios and the public good



solid history of research contributions to trade policy work, and the public funds provided for this work have directly increased the understanding of policy makers and negotiators of the issues at stake.

- Research concerned with **climate change policy**, including the effects of **mitigation** as well as practical steps towards **adaptation** (Section 4.7 provides a case study of new industries for climate adaptation). Climate adaptation is both a major plank of Australian Government greenhouse policy and an essential adjustment response for the Australian rural sector. RIRDC's research seeks to create adaptation opportunities that are available to the entire rural sector, not just specific industry groups.
- Research related to **building regional communities**. Rural and regional development has long been a major government policy concern. RIRDC contributes to this through research into sustainable rural activities and industry options that provide opportunities for the sector to adjust to a range of emerging challenges.
- Research concerned with **addressing Indigenous disadvantage** (Section 4.8 examines this as a particular case study). RIRDC seeks to contribute to this area of policy by making practical contributions to a range of agricultural activities and products that are of direct advantage to Indigenous communities.
- Work related to enhancing the **status of rural women**.

Health spillovers

Health spillovers arise when, either directly or indirectly, rural research leads to the potential for improved health outcomes for all Australians. Benefits can arise from specific food products (means of achieving a healthy or preventative diet) or through medical applications of non-food products (tea tree oil, for example). Given the publicly funded nature of Australia's health system, research which improves health outcomes not only directly benefits the healthier individual, but has flow on benefits through lower health costs overall.

A range of health spillovers emerge from various strands of RIRDC research into the health effects of particular rural products, especially new and emerging rural products (the case studies presented in Section 4 have various health spillovers associated with them). Many of these are associated with increased choice in either consumption or other uses of rural products.

Farm and fishing health and safety

RIRDC undertakes collaborative research on farm and fishing safety designed to lead to improvements in occupational health and safety in the rural sector (this is considered in more detail as a case study in Section 5.3). Aside from improving the quality of working life in rural communities, this research also generates spillover benefits very similar to the health spillovers.

Environmental spillovers

Agricultural activities can often have a major impact on environmental resources. Research, which improves the efficiency of agricultural activities, has a general effect in reducing the need for adverse environmental impacts. More specifically, rural R&D often leads to environmental spillovers. These benefits may emerge from the use of particular products or farming practices (including climate change adaptation, noted above).

Balance between public and private investment

The Commission's terms of reference ask about the balance between public and private investment in agricultural R&D. Defining the appropriate balance of public and private funding is extremely difficult. Strictly speaking, the balance should vary by type of research and commodity and probably over time as well.

This challenge does not just apply to RDCs, of course. Exactly the same issues arise in determining the optimal amount of government R&D funding in general. The challenge is more visible in the case of RDCs because of the particular funding mechanism (funding matched to levies), but it is nevertheless present in all government funding of R&D.

A number of observations from RIRDC's experience are relevant here.

First, a very high proportion of RIRDC-funded research generates public benefits. As set out above, and as discussed in more detail in the case studies presented in this submission, wider community benefits are a major focus and outcome of RIRDC's research funding.

Second, public funding plays a very important leveraging role. In RIRDC, a number of industries have moved from having no levy, to accepting a voluntary levy and then to a compulsory levy. It is unlikely that this inducement could have taken place without initial public funding and the subsequent demonstration of the benefits that emerge from R&D.

Finally, the public funds provided to RIRDC for research clearly generate high returns (measured as a benefit-cost ratio or an internal rate of return, for example). These returns appear to be high in comparison with measured returns from other government investments. Related to this is the fact that RIRDC's returns are very transparent — that is, RIRDC has a systematic program of evaluation so that the outcomes of its activities are clearly in the public domain. Combined with the other factors noted above, this provides some indication that the public funds are being well spent.

Effectiveness of current RDC model

One way of addressing the effectiveness of the RDC model — and in particular RIRDC's funding —is to consider the 'value added' from RIRDC's activities — what do RIRDC's operations contribute to the overall R&D coordination challenges that would be lost if RIRDC was no longer in operation?

For RIRDC, one major source of value added is its investment framework. The purpose of this framework (discussed in more detail in Section 3.4) is firstly to identify those areas for investment where there is most need and which can have the greatest impact. It amounts a systematic approach to the search for, coordination of, and ultimate adoption of agricultural R&D. There are three key points that emerge from considering this framework.

- RIRDC has an explicit and objective approach to funding at each stage of the project development cycle.
- This investment framework is combined with an evaluation framework that provides feedback on the success of past investments.
- The framework involves considerable interaction with industry stakeholders and researchers.

Thus, the framework provides an important contribution to the coordination challenges that arise in undertaking agricultural R&D. Without the RDCs, these same coordination challenges would arise and would need to be addressed through some explicit framework.

RIRDC's operating framework has evolved in response to the practical challenges of agricultural R&D. Evidence of the effectiveness of RIRDC's approach is provided by:

- the stakeholder survey which shows a high level of satisfaction; and
- past impact evaluations, which as discussed indicate a very high level of return.

Impediments to efficient operation of RDC model

In the specific case of RIRDC, Section 7 sets out two specific suggestions that would assist in making its operations more efficient and effective. These relate to the way in which funding is provided and providing RIRDC with the ability to undertake more market development activities.

How does agriculture differ from other sectors of the economy?

The Commission's terms of reference ask about the extent to which agriculture differs from other sectors in the economy with regard to R&D. There are several unique features of the industries RIRDC works with that have important implications for the conduct of R&D within agriculture.

In most cases, the substantive benefits of agricultural R&D (whether these accrue to producers or to the wider community) can only emerge if the research findings are embodied in agricultural production systems or throughout the agricultural value chain. This means that R&D must engage with a large number of producers and it needs to be relevant to their opportunities and constraints.

Further, in most cases the quantum of research effort needed to bring about benefits is large relative to the scale of individual rural enterprises. This means that for research to be undertaken and successfully implemented, some form of collective action is essential.

This is particularly true for new and emerging industries that have limited prospects for development without fundamental R&D to provide a sound basis for production.

In many cases, agricultural R&D directly influences outcomes that are of broad public interest — certainly broader than the production basis of the rural activities themselves. For example, agricultural producers have a significant influence on the environment, affecting activities and values well beyond the farm gate.

RDCs role in broader public interests

The Commission's terms of reference ask it to consider the extent to which RDCs provide a balance between research that leads to benefits to specific industries and research that addresses broader public interests including:

- mitigating and adapting to climate change;
- managing the natural resource base;

- understanding and responding better to markets and consumers;
- food security; and
- managing biosecurity threats.

As argued above when considering the rationale for government involvement in agricultural R&D, and as demonstrated in the various case studies presented in this submission, research funded by RIRDC clearly provides benefits to a variety of broader public interests, including those listed in the Commission's terms of reference.

3 Overview of RIRDC and its activities

Key points

RIRDC operates through three broad portfolio areas: new rural industries, established rural industries and national rural issues.

In each of these, RIRDC successfully manages a diverse portfolio of industries and research activities using an explicit investment framework combined with a comprehensive evaluation framework. Evaluations undertaken to date show significant benefits from RIRDC-funded research.

RIRDC's activities explicitly respond to government policy needs, as well as the needs of other stakeholders, particularly at the applied end of the innovation chain. RIRDC's approach involves considerable collaboration with other research organisations.

Regular surveys of stakeholders show very high levels of satisfaction with RIRDC's performance

3.1 Overall research structure

RIRDC is a statutory authority established by the Primary Industries and Energy Research and Development Act 1989 (PIERD Act). It was established to form a partnership between government, industry and the community in general to invest in research and development for a more profitable, sustainable and dynamic rural sector.

Specifically, RIRDC's mandate from government is to achieve results from research and development investments in three areas:

- new rural industries;
- specific established rural industries; and
- national rural issues.

The National and Rural Research Priorities of the Government provide an over-arching framework for public investment in rural research and development. RIRDC's investments are closely aligned with these priorities. Table 2 summarises RIRDC's expenditure by key portfolio.

Table 2: RIRDC total expenses by program 2006-07 to 2008-09

Portfolios/programs	***2006–07***	***2007–08***	***2008–09***
	$000	$000	$000
New industries			
New plant products	1 531	1 622	1 693
New animal products	1 748	1 240	1 168
Ratite	2	11	-
Goat fibre	218	90	85
Rate natural animal fibre	314	260	301
Buffalo	81	50	50
Kangaroo	139	187	320
Deer	391	383	127
Wildflowers and native plants	248	242	441
Essential oils and plant extracts	357	408	554

(Continued next page)

Table 2 RIRDC total expenses by program 2006-07 to 2008-09 (Continued)

Portfolios/programs	*2006–07*	*2007–08*	*2008–09*
Bioenergy Australia	202	197	338
Tea tree oil	365	455	446
Methane to Market (M2M)	-	555	451
Bioenergy, bioproducts and energy	54	395	478
PIMC[1]	-	-	14
Total	***5 650***	***6 095***	***6 466***
Established industries			
Chicken Meat	2 086	2 703	3 316
Honeybee	507	963	713
Queenbee	2	3	3
Rice	2 556	1 899	1 108
Horses	1 424	1 153	1 091
Fodder crops	810	468	457
Pasture seeds	364	552	406
Organics	297	-	248
Total	***8 046***	***7 741***	***7 342***
Natural rural issues			
Dynamic Rural Communities	4 209	5 828	5 261
Global Challenges	1 000	543	556
Farming & Fishing Health and Safety	311	145	388
Total	***5 520***	***6 516***	***6 205***
Corporate	**3 690**	**3 776**	**3 820**
Total Expenses ($ '000)	**22 906**	**24 128**	**23 833**

1 Primary Industries Ministerial Council R,D & E Strategies

Source: RIRDC.

Three portfolios

The Corporation's three investment portfolios are structured to reflect its Government mandate:

- **New Rural Industries**: This portfolio covers a wide range of new and emerging animal and plant industries. There are strong and growing pressures on Australian agriculture to diversify — declining terms of trade for commodities, new and increasing low-cost commodity competitors, structural change driven by water reform and climate change risk. New rural industries are a crucial part of Australian agriculture's response to these drivers.
- **Established Rural Industries**: This portfolio deals with honeybees, chicken meat, rice, horses, organic systems, fodder crops and pasture seeds. RIRDC's established rural industries face challenging operating environments that require ongoing innovation and responsiveness. Declining terms of trade, increasing international competition and distorted markets combined with climate variability and change and natural resource management all put pressure on these sectors. Continued productivity growth underpinned by innovation is a crucial part of this response.

- **National Rural Issues:** RIRDC has a specific mandate to invest in R&D that examines a range of national rural issues, that is, issues that are multi-sector and national in scale and scope. Research into these issues is focused on the profitability, resilience and sustainability of Australia's rural sector and communities. These investments in R&D support the rural policy priorities of Government and the priorities of rural industries and communities.

RIRDC has particular advantages as a national knowledge creator and broker. Through its wide network and extensive advisory committee structure, RIRDC is able to identify the strategic knowledge needs of stakeholders and select and manage the best R&D investments to meet those needs. Operationally, RIRDC achieves this through:

- consultation with industry, community and government stakeholders to develop five-year R&D plans for its programs;
- identifying priority research and development using the expertise of management and R&D advisory committees;
- investing in R&D where opportunities and needs are identified;
- managing R&D portfolios for performance;
- delivering the results of R&D to industries, communities and governments through quality publications, products and services and through workshops, seminars, conferences and regional events;
- building adoption pathways into its project investments and monitoring RIRDC's R&D impact by regularly evaluating research; and
- surveying stakeholders and responding to their needs.

3.2 RIRDC successfully manages a wide range of industries and activities

One of the key features of RIRDC's operations is that it manages an extremely diverse range of research activities covering more than 30 industries as well as being concerned with more than a dozen cross cutting rural issues — often in collaboration with other research and government agencies.

RIRDC has established a successful approach to managing research in a wide variety of industries and disseminating the results of the research to the wider agricultural community. Through its investment and evaluation frameworks (described further below) combined with industry based Advisory Committees, RIRDC is able to obtain both valuable research results for individual commodity and industry groups as well as outcomes in cross cutting issues of concern to the whole rural sector.

All of these activities take place within one management structure subject to the overview of a single board. This is considerably more efficient than having duplicated management and a separate board for each of the activities RIRDC covers. Having a single board, for example, means that a range of core responsibilities (financial management, regulatory compliance and so on) are collectively managed rather than being duplicated for each industry.

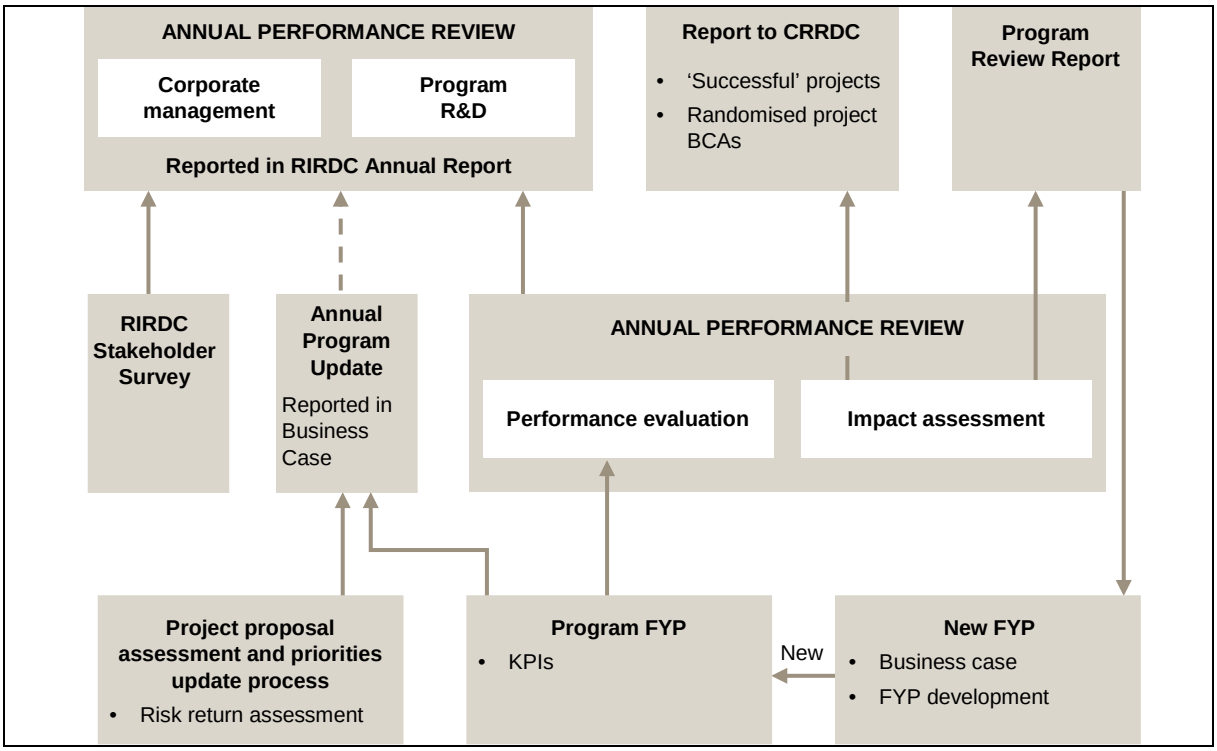
Further, by incorporating multiple industries and areas of interest into one organisation, RIRDC is able to apply the knowledge base generated through ongoing research to multiple industries. For example, RIRDC has been able to draw on experience across different agricultural industries in producing the publications *Turning a good idea into a profitable venture* (RIRDC 2009a), and *Critical success factors for new rural industries* (RIRDC 2009b). Both of these publications provide advice to agricultural entrepreneurs on establishing new agricultural industries by drawing on case studies and experiences across multiple agricultural industries in which RIRDC has experience.

3.3 RIRDC's evaluation framework

RIRDC's comprehensive evaluation framework (along with its investment framework, discussed further below) is an important part of successfully managing its wide range of activities.

In 2008 RIRDC codified its evaluation framework, setting out a consistent process for reviewing RIRDC programs and the performance of its investments. Figure 2 provides an overview of the framework.

Figure 2: Overview of RIRDC's evaluation framework



The main component of the framework is the Program Review that looks at the past performance of a Program relative to its objectives and also compiles evidence on the impact of the R&D. This information supports the proposal for renewal of programs in the Investment Framework. The Program Review also provides information on the effectiveness of management, which is an input into the assessment of corporate performance, and the value added of RIRDC as an organisation. This information is complemented using feedback from RIRDC's Annual Stakeholder Survey.

The evaluation framework has three main outputs:

- Program Review Report — every Program is evaluated on a rolling basis, once every five years. The Program Review provides an evaluation of Program Performance and includes impact assessments on selected clusters of projects completed within the Program period.
- Performance information for the Annual Report — this draws on the new and past Program Reviews, portfolio allocations and Stakeholder Survey to provide information on the overall performance of the organisation. This includes a summary of the findings of each Program's annual update.
- Report to the Chair of the Rural Research and Development Corporations (CRRDCs) — this compiles information from the Program Reviews in the format required for reporting to the CRRDCs on the overall performance of the Rural Research and Development Corporations (RRDCs).

In an analytical sense, the evaluation framework contains three components:

- Data collection — providing the information required for analysis. This includes baseline data, performance indicators and measures, benchmarks and stakeholder views.
- Analysis — providing the tools for evaluating Program performance and impact assessments of project clusters, and for corporate performance measurement. Program reviews are conducted by randomly selecting projects conducted under the program and calculating the net present value (NPV), benefit-cost ratio (BCR) and internal rate of return (IRR), based on total benefits including future expected benefits. The analyses also assess (although not numerically) the environmental and social benefits arising from the projects.
- Reporting — providing report templates for the Program Review, Annual Performance Review and the Report to the CRRDC.

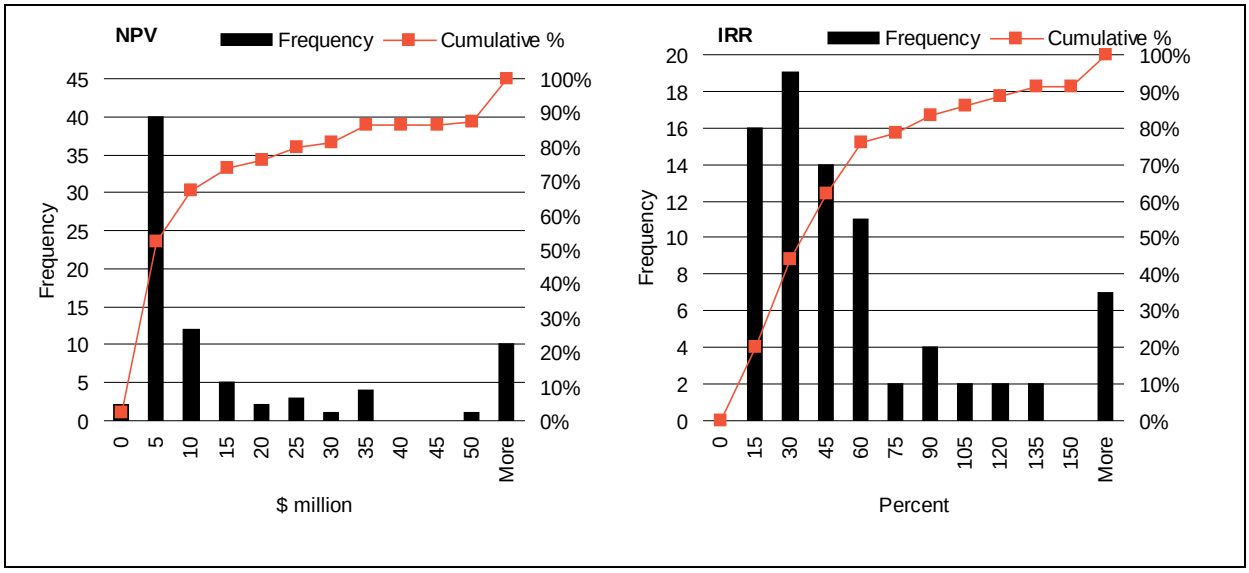
Evaluation outcomes

The regular evaluations of RIRDC funded projects show that RIRDC projects consistently return positive net present values, high internal rates of return and significant benefit cost ratios. The consistent positive results indicate that RIRDC's overall approach has proved to be very successful and that the advantages of combining many activities within a single RDC also translate to successful outcomes.

Figure 3 summarises the broad distribution of evaluation results (in terms of the NPV and IRR) of the projects that have been evaluated to date (further details are provided in Appendix B). This summarises the results of 13 evaluation reports, covering 80 projects[1].

[1] Of the evaluations reported here, 9 were explicitly undertaken under the 2008 framework. For these, a discount rate of 5 per cent was used for calculating the net present value and benefit-cost ratio. All dollar costs were expressed in 2008-09 dollar terms. A 40 year time frame was used in all analyses. The other evaluations used a similar approach. The discount rate used in the evaluations ranged from 5 to 10 per

Figure 3: Summary evaluation outcomes across all portfolios



NPV = present value of net benefits of the project. IRR = internal rate of return

Source: RIRDC.

Of the 80 projects evaluated, only two had negative NPVs (Cashews breeding had a NPV of $-2.3 million and Horses — progestagens and pregnancy had a NPV of $-10,000). Four projects were estimated to have NPV of greater than $100 million, these projects were new oat varieties ($118 million), Trade policy ($136 million), Rice EM-31 ($157 million) and Olives for oil (high quality outcome) ($264 million). Most of the projects (50 per cent) had an estimated NPV of between $0 and $5 million.

The projects also had widely varying estimated internal rates of return, ranging from 1 per cent (Horses — progestagens and pregnancy project) to 604 per cent (Use of carbon dioxide for euthanasia of poultry project). Most of the projects however, had estimated returns of between 15 and 30 per cent.

Of the 42 project evaluations that reported benefit-cost ratios (BCRs), five had estimated BCRs of over 100 (Use of carbon dioxide for euthanasia of poultry project, New oat varieties project, Eggs — high density diets post-moult project, Trade policy project and Managing Lucerne seed wasps project). Similarly, five projects had net benefit investment ratios (NBIRs) of over 100 (Olives for oil (high quality outcome), New oat varieties project, Annual ryegrass toxicity, Managing Lucerne seed wasps and Hay bale loading). The Hay bale loading project had an estimated NBIR of 1817.

RIRDC's most recent evaluations have included an identification of public benefits but only in descriptive form, given the difficulty in quantifying these benefits.

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cent, most frequently 5 per cent was used. Dollar costs were expressed in the dollars at the time of evaluation (that is, 1997-98 dollar terms for evaluations conducted in 1998).

3.4 RIRDC's investment framework

RIRDC's investment framework allocates funding to its wide range of activities at three broad levels:

- first, at the *portfolio* level;
- second, at the *program* level for research within each portfolio; and
- third, at the *individual project* level.

At each of these levels, specific evaluation criteria and interaction with Advisory Committees are used to decide funding allocations.

Portfolio investment

Each portfolio puts forward an operational plan that proposes an overall level of investment for that portfolio and specific rational for that investment. This is based on past performance assessment and relevant changes in the external environment.

Portfolio operational plans are approved on the basis of specific selection criteria including whether the proposal will:

- deliver on the portfolio objectives consistent with the portfolio strategy; and
- contribute both in extent and to the desired balance to the three RIRDC portfolio areas.

In addition, the operational plan must demonstrate why the approach represents a good investment for RIRDC, in particular considering:

- whether the R&D should be supported by someone else;
- whether the R&D would otherwise not be undertaken;
- whether the industry is engaged with and supportive of the proposed program;
- whether the potential return is high and whether:
  - the R&D is addressing issues that are clearly limiting or threatening growth or profitability of the industry or a number of industries;
  - the whole of the value chain is being considered in allocating the R&D to the issues that present the greatest opportunities or constraints on the industry;
  - R&D is the most cost effective approach to addressing the issues;
- whether there is a demonstrated pathway for adoption of the R&D outputs or there is clear scope to develop a pathway:
  - industry has communication mechanisms and a cooperative approach for technology transfer (usually there is an active industry association but for small industries this may be through an industry champion); and
- whether capacity exists or can be created for high quality R&D that can effectively address the issues.

Program investment

Program investment strategies are presented in a series of five-year R&D plans that are developed by RIRDC management and the relevant Advisory Committee. The plans:

- set the context for R&D in the industry or cross sectoral area covered by the program;
- indicate the specific role RIRDC funded research will play in expanding the knowledge base of the industry or the cross sectoral area;
- take account of national research priorities, Ministerial guidance and RIRDC policies;
- encourage collaboration and coordination in the R&D area, including new joint investment;
- outline the broad R&D priorities that RIRDC will pursue through its investment in the program over the next five years.

The process of developing a five-year plan involves a number of activities including:

- a review of performance against the last five-year plan (using RIRDC's evaluation framework) if the program has already been in place;
- undertaking consultation with a wide range of stakeholders (industry, marketing, government, key researchers and members of Advisory Committees).

Five-year plans are approved on the basis of a number of criteria:

- that areas of investment are a priority for the industry(s) or other stakeholders;
  - participation of relevant stakeholders in the identification of priorities for investment;
  - contributions by industry and/or other stakeholders to the R&D (including demonstrated commitment to voluntary contributions for industries not subject to statutory levies);
- the applicability of the R&D priorities identified in the plan to the whole industry or rural sector;
- that alternative objectives and strategies for investment in R&D across the whole of an industry supply chain have been considered;
- the extent to which the proposed strategies will deliver on the program objectives;
- the feasibility of the strategies, targets and performance indicators and the risks attached to them, given the availability of financial and other resources; and
- that the process for developing the five-year R&D plan was participative, inclusive and transparent.

Project selection

Projects for investment within the relevant approved five-year plan are identified by RIRDC management and the relevant Advisory Committee. RIRDC issues an annual program call as well as directly commissioning projects. Research proposals are assessed by research managers and the Advisory Committees against a number of criteria:

- Potential benefits — who benefits and what are the nature, and likely magnitude of the benefits? What are the economic, environmental and social benefits? How do they contribute to the Program objectives and the RIRDC outcome areas?

- Environmental impact — what is the likely impact on environmental sustainability and/or biodiversity?
- Project design — is the project conceptually sound and technically feasible? Are there alternative approaches that could achieve the outcomes more efficiently? Is the proposed work innovative?
- Pathway to adoption — is there a demonstrated pathway to adoption, resources to achieve this and a commitment to implement the results?
- Supply capacity — are the research organisations capable of undertaking the work? What is the track record of the Principal Investigator in undertaking research? Are industry members involved in action research?
- Adequacy of funding — is funding sufficient for the activities and timetable proposed? How sensitive are returns to increases or decreases in the budget?
- Exposure to external events — how robust is the implementation of activities, delivery of outputs, adoption, and achievement of outcomes to external events, and are these events likely and can the impact be mitigated?

3.5 Some important implications of RIRDC's approach

Several features of RIRDC's operations are particularly important in the context of the Productivity Commission inquiry.

RIRDC responds to government policy needs

As will be illustrated throughout this submission, RIRDC's research investments are deliberately structured to respond to government policy needs as they relate to rural Australia. The Government's National and Rural R&D priorities are taken into account in the five-year R&D plans for individual programs; they are explicitly stated in RIRDC's advice to researchers, and they are addressed in program and research evaluations. Research is today targeted at a need within the Australian community rather than simply being an outcome of the desires of researchers or producer groups.

Providing research support for broader policy objectives is an important component of ensuring that the public funds provided to RIRDC directly generate benefits for the whole Australian community rather than just to specific interests within the industry.

RIRDC works at the applied end of the innovation chain

RIRDC's processes, both in project selection and in monitoring and evaluation, are very much concerned with working towards the applied end of the innovation chain. RIRDC focuses on research activities that are likely to be adopted, or where there is a well-defined incentive for adoption. Put another way, RIRDC specifically plans for adoption of its research activities.

Given RIRDC's mandate to provide industry and community-wide benefits, adoption is viewed in a broad context: the objective is to facilitate adoption for as wide coverage as possible.

Ensuring benefits are available industry wide

RIRDC's overall approach is to ensure the widest possible dissemination of its research results. This specifically includes mechanisms to ensure that research results are not restricted to particular users or groups. For example, RIRDC's intellectual property and commercialisation principles are designed to:

- maximise the uptake and benefits flowing from research investment in rural industries by making new technologies, products, processes and services available as quickly and as cost-effectively as possible;
- ensure the building of strong, sustainable alliances with the rural sector, related commercial industries and other key stakeholders;
- be viewed in the broader context of increased profitability and sustainability of Australian rural industries. That is, returns through royalties, licence fees, etc, are products of commercialisation and not key objectives; and
- ensure RIRDC funded intellectual property is available free of charge for research purposes.

Facilitation

RIRDC explicitly sets out to facilitate the effective use of community and scientific expertise in the creation of new knowledge and in its adoption. In a number of aspects of its work, particularly in emerging industries and national rural issues, RIRDC provides a coordination point for a very diverse range of community and industry players.

This facilitation role is another major mechanism to ensure that the incremental research funds provided by government are well used, leveraged to the maximum and are not simply displacing funds that would otherwise have been spent on R&D.

3.6 RIRDC's collaboration activities

RIRDC consults widely with industry and Government stakeholders to determine investment strategies and priorities, and seeks strong collaborative arrangements with other funding partners and research providers in order to enhance research outcomes.

Collaboration is a major mechanism to ensure that research funds are well used and targeted and to ensure that duplication or 'crowding out' is avoided. Table 3 sets out some of the major areas of collaboration RIRDC is currently involved in.

In many of these collaborative partnerships, RIRDC has taken the lead in establishing and managing the projects. For example, the Joint Venture Agroforestry Program, which ran from 1993 to 2009, was initiated by staff at RIRDC and Land & Water Australia (LWA). The partnership brought together the expertise and knowledge of RIRDC, LWA and Forest and Wood Products Australia (FWPA) staff and also included funding from the then Murray Darling Basin Commission (MDBC), the Grains Research and Development Corporation (GRDC), the Government Department of Agriculture, Fisheries and Forestry (DAFF), and the Australian Greenhouse Office (AGO). RIRDC managed the research program over 15 years covering three 5-year plans, eight funding agencies, $29 million of investment in research and over 200 research

reports, papers, articles and websites. The research projects undertaken have, together, successfully demonstrated the benefits associated with farm forestry (see Powell 2009).

Table 3: Some of the main areas of collaboration RIRDC is involved in

What	Who	Goal
Bioenergy Australia	More than 80 industry, government and research (state and federal) stakeholders.	To foster and develop the use of biomass for sustainable production of energy, transportation fuels, chemicals and other value-added products.
Methane to Markets	RIRDC, Department of Agriculture, Fisheries and Forestry, Dairy Australia, Australian Pork Ltd and Meat and Livestock Australia.	To encourage and enable development, adaptation and use of methane capture and use technology in the intensive livestock industries.
Bioenergy in Forest Industries	RIRDC, Department of Agriculture, Fisheries and Forestry, and Forest Wood Products Australia.	Develop the Bioenergy in Forest Industries with the Australian Government Department of Agriculture, Fisheries and Forestry and Forest and Wood Products Australia.
Collaborative Partnership for Farm Fishing Health and Safety	RIRDC, Department of Health and Ageing, Grains Research and Development Corporation, Fisheries Research and Development Corporation, Sugar Research and Development Corporation and Cotton Research and Development Corporation.	Undertake R&D to improve the physical and mental health of farming and fishing workers and their families, and the safety of their workplaces.
Investing in Youth program	RIRDC, Meat and Livestock Australia, Australian Egg Corporation Ltd, Australian Pork Ltd, Cotton Research and Development Corporation, Grape and Wine Research and Development Corporation, Horticulture Australia and Grains Research and Development Corporation.	To provide financial and mentoring support to Australian students committed to contributing to Australia's rural sector.
RIRDC Rural Women's Award	Funding support is provided by the Department of Agriculture, Fisheries and Forestry, the Department of Infrastructure, Transport, Regional Development and Local Government and local government.	To build capacity and leadership for Australian rural women.
RIRDC Pollination Five-Year Plan	RIRDC, Horticulture Australia, Pollination Australia.	To support research, development and extension activities that will secure the pollination of Australia's horticultural and agricultural crops into the future on a sustainable and profitable basis.
Food Integrity and Biosecurity program	RIRDC, CRC for Plant Biosecurity.	To expand and enhance the plant industry biosecurity planning process by developing a more rigorous tool for identifying and prioritising emergency plant pest threats.
Cooperative Venture for Capacity Building	RIRDC, Australian Wool Innovation, Cotton Research and Development Corporation, Dairy Australia, Grains Research and Development Corporation, Grape and Wine Research and Development Corporation, Horticulture Australia Limited, Land & Water Australia, Meat & Livestock Australia, Sugar Research and Development Corporation and the Australian Government Department of Agriculture, Fisheries and Forestry and the Murray-Darling Basin Commission.	To ensure an effective system for continuous capacity building in primary industries in Australia by coordinating and funding a targeted R&D program.

RIRDC has also successfully taken the lead role in initiating and stimulating collaboration in the following projects:

- Collaborative Partnership for Farm Fishing Health and Safety;
- Co-operative Venture for Capacity Building;
- Methane to Markets;

- Bioenergy Australia; and
- New Rural Industries Australia and Pollination Australia.

3.7 Stakeholder views of RIRDC's performance

RIRDC undertakes a regular stakeholder survey to assess how it is meeting the needs of, and interacting with, industry, government and researchers. The results of the survey are published in the annual report and are used to refine RIRDC's approach to research and priorities. The survey results show that the majority of RIRDC stakeholders have an excellent working relationship with RIRDC and in general, stakeholders are well informed about RIRDC activities.

In 2010, RIRDC's overall performance was rated as excellent or good by over 80 per cent of respondents. The responses show that RIRDC has been successful in managing the full research process from identifying priority areas for research and managing the projects to generating valuable knowledge, disseminating information and encouraging adoption of the technologies and information (Figure 4).

In particular, RIRDC performance was rated highly by key industry stakeholders (Figure 5) where over 85 per cent replied excellent or good to RIRDC's performance regarding:

- alignment of RIRDC's 5-year industry/sectoral R&D plan with industry needs and priorities;
- inclusion of industry people in decisions regarding priorities for the R&D program;
- generating knowledge that meets the needs of industry; and
- understanding industry needs.

An independent review of RIRDC's new rural industry portfolio conducted by L.E.K Consulting supports the results of the stakeholder survey. It found that the new rural industries portfolio has been successful in delivering against its objectives and has strong and positive relationships with industry stakeholders and a track record delivering results that meet industry priorities. The review found that industry was very satisfied with RIRDC performance and that it was performing especially well in helping industries to unite, setting R&D priorities and funding the highest priority issues within an industry. Industry stakeholders appreciate the industry consultation, as well as the RIRDC's ability to unite industries and provide valuable knowledge. Industry stakeholders also recognized the valuable role RIRDC plays in facilitating market access and product development.

Figure 4: Respondents' ratings of RIRDC's performance 2007–2010

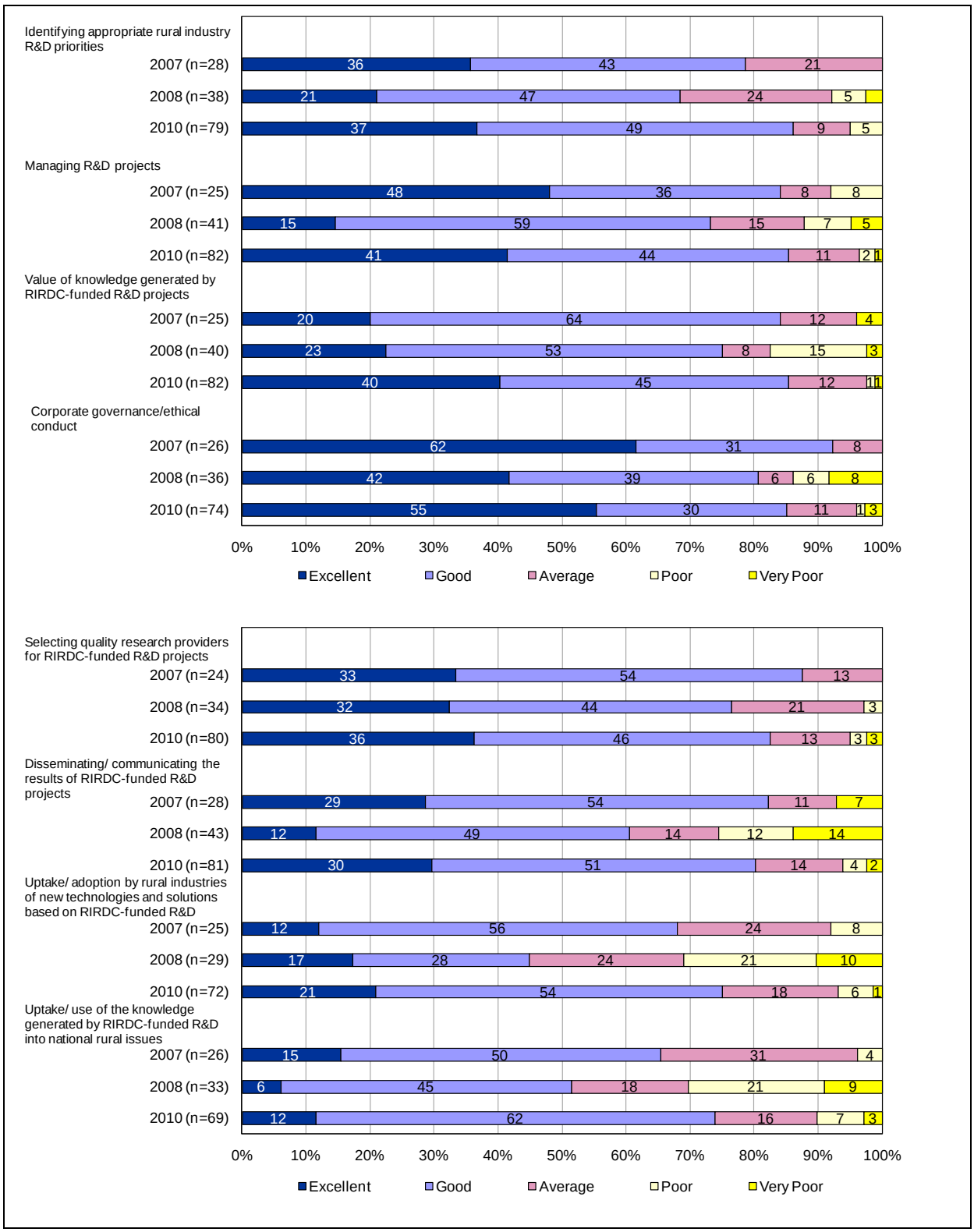
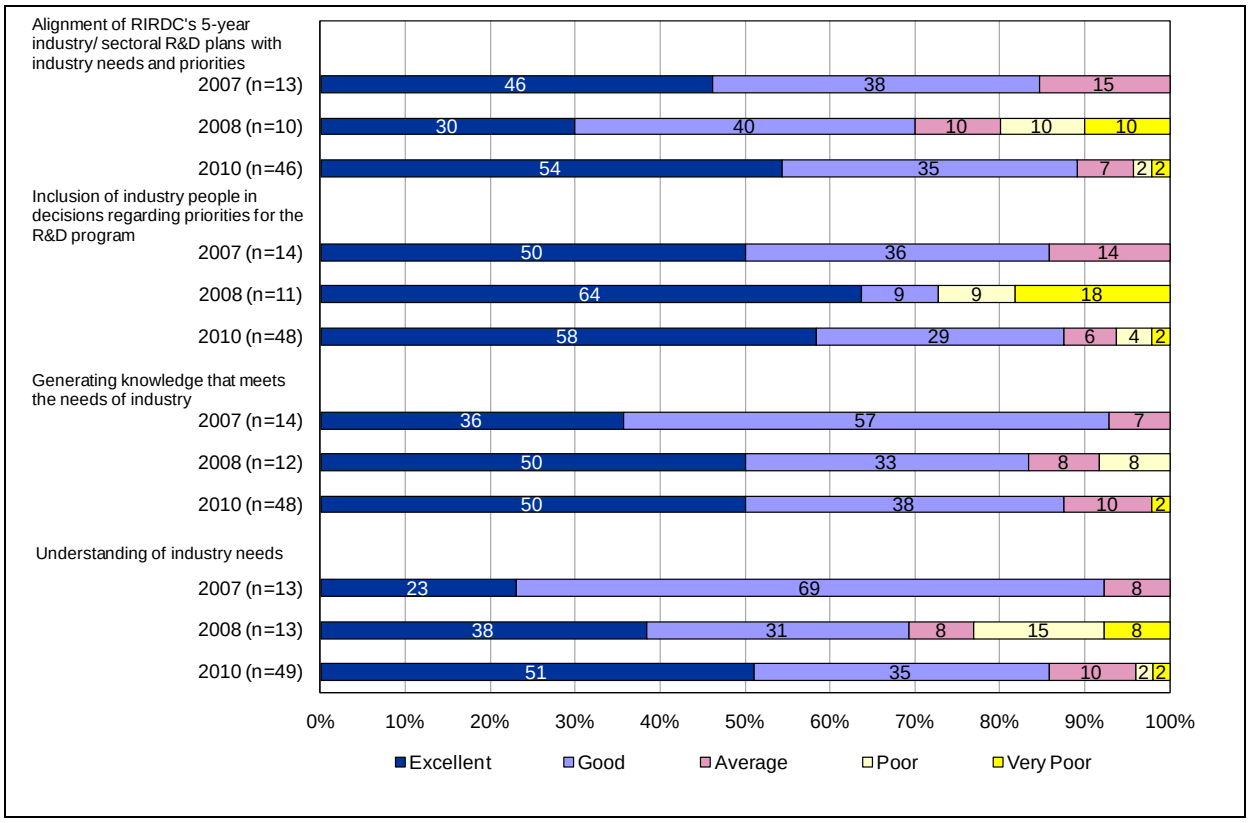


Figure 5: Key industry stakeholders' ratings of various aspects of RIRDC's performance 2007–2010



4 New and emerging industries

Key points

New and emerging industries have important and unique research needs that without RIRDC funding would probably not be satisfied. RIRDC adds value to the RDC model by providing research funding for new and emerging industries.

This research looks at issues across the supply chain from production, through processing, distribution and marketing, to industry training and development. There is also a wide range of other benefits that arise from support of new and emerging industries. These include building the resilience of regional communities, facilitating climate change adaptation, producing a range of health benefits and addressing Indigenous disadvantage.

4.1 The New Rural Industries portfolio

What are new rural industries?

New rural industries comprise a very diverse range of plant and animal products. Essentially they are 'non traditional' products and activities that can take place in a wide variety of geographic and agroeconomic zones within Australia.

In 2006-07, emerging industries had an estimated gross value of production of $940 million (2.7 per cent of the total value of Australian farm production) and earned export revenue of $465 million (6 per cent of total farm export revenue). Figure 6 illustrates the gross value of production of a range of emerging industries, while Figure 7 shows a time series for four particular products.

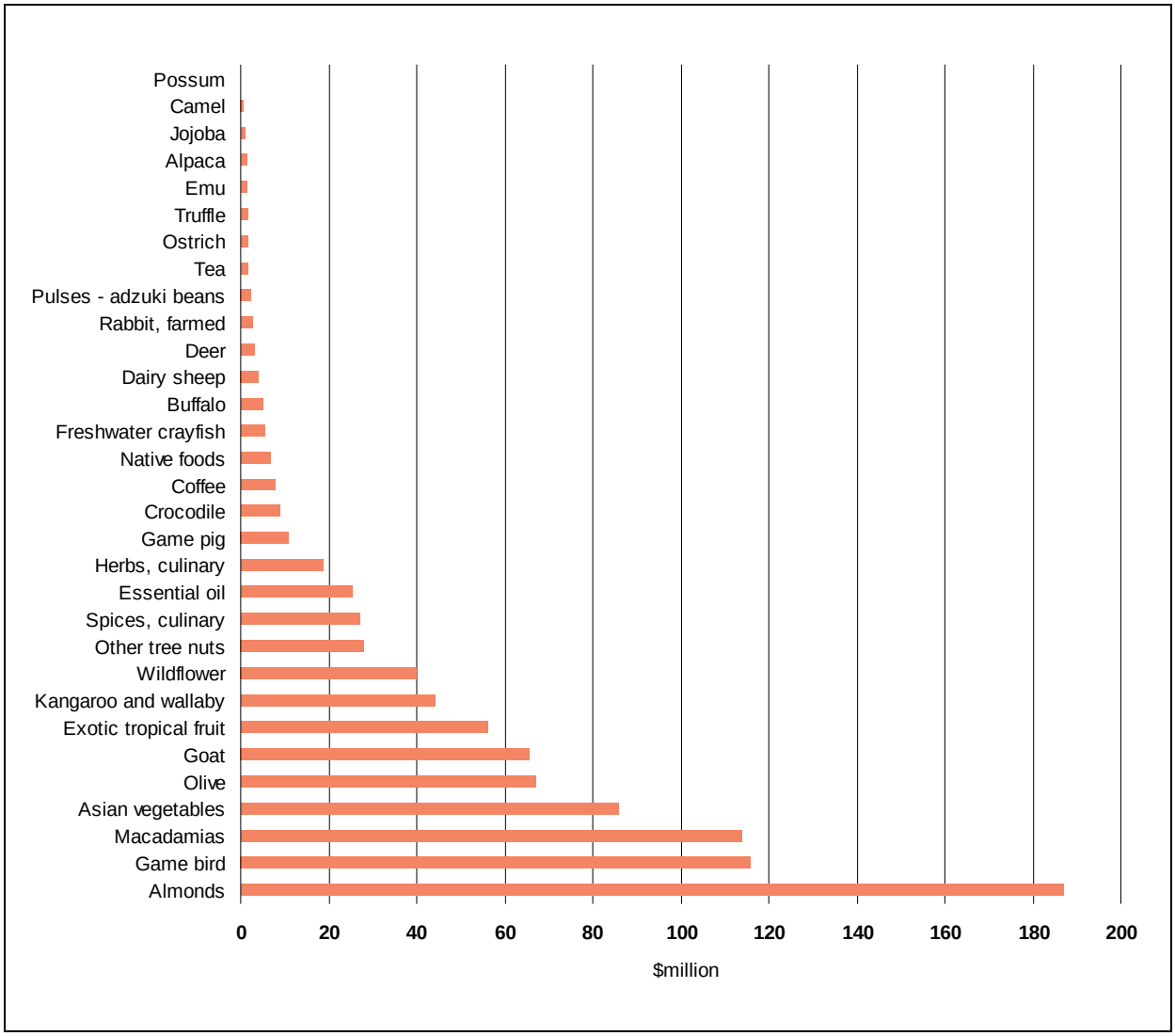
A number of what were formerly 'new industries' have become very well established and now account for a significant proportion of the total value of Australian agricultural production. However, there is no guarantee that the current broad structures of production either reflect the best possible current use of Australia's agricultural resource base or will reflect the best way to respond to emerging threats and opportunities.

Research into new rural industries is therefore a prudent response to managing the emerging needs and challenges facing rural industries.

RIRDC's role

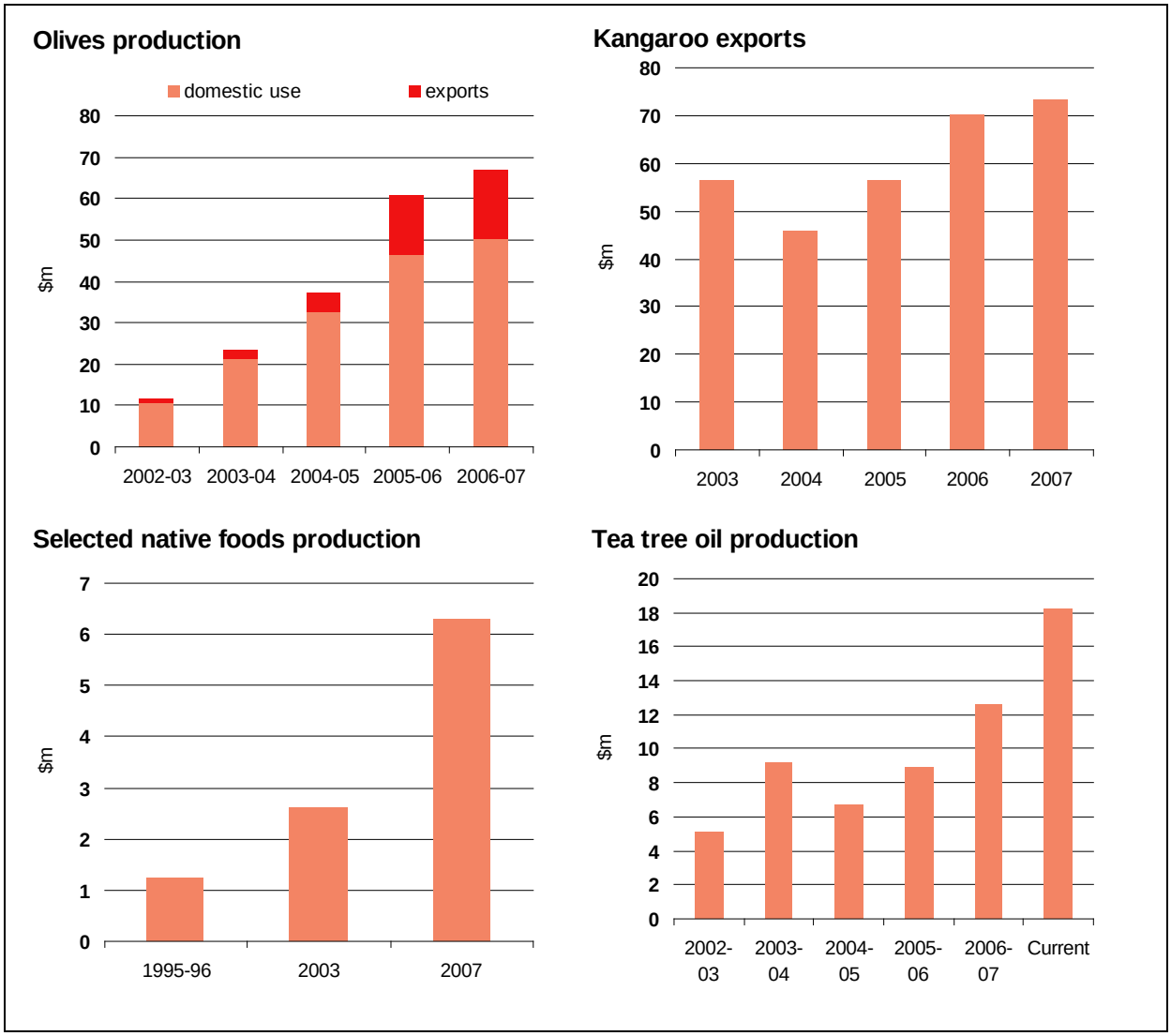
RIRDC is unique in undertaking research relevant to new and emerging agricultural industries. Within the New Rural Industries portfolio, RIRDC currently supports in excess of 200 projects across more than 30 industries. The current research portfolio includes projects relevant to industries including native foods, herbs and spices, tropical exotic fruit, olives, hazelnuts, jojoba, truffles, coffee, cocoa, tea tree, Asian vegetables, crocodiles, ducks, and rabbits. The research looks at a wide range of issues across the supply chain, from production through processing, distribution and marketing and also industry training and development.

Figure 6: Value of emerging industry production



Source: Foster (2009).

Figure 7: Growth in selected emerging industries



Source: Foster (2009), RIRDC.

RIRDC's New Rural Industries portfolio aims to maximise the knowledge outcomes from R&D investments for Australian industries and government in new rural industries. The objective is to provide the knowledge for diversification in Australia's rural industries. RIRDC invests in R&D for new rural industries:

- that have significant market opportunities;
- where Australian industry has a competitive advantage; and
- that provide an opportunity for producers to enter and expand the industry.

The research needs of new rural industries

New rural industries face a number of unique challenges. Before they can be established they generally require a significant amount of fundamental research into issues including an initial examination of market prospects, the appropriate genetic stock for production, key production techniques and the ways in which production can be combined with other products, better understanding of the basic use properties of the products and so on.

Initially, the production base of most new rural industries is very small which means that funds for research are very difficult to put together, either through industry resources or through any form of levy that is production or turnover based. Without specific funds directed at promising products it is very unlikely that sufficient levels of research would ever be undertaken.

Given that research into emerging industries is usually very new, it is likely that this research will be highly 'prospective' in that it could produce significant productivity and other advances for relatively small amounts of initial funding. Research into new industries is likely to be in an 'increasing returns' proportion of the research curve. Even with specific funds for research into new rural industries, there is currently a shortage of funds that could effectively be used within the new rural industries portfolio. There are many more prospective projects than there are research funds available, and RIRDC is a long way from running into 'diminishing returns' from additional research funds.

Wider benefits arising from research into, and establishment of, new rural industries

Research into new and emerging industries yields benefits to both the industries themselves and to the wider community. In the case of new industries, the distinction between 'industry' and 'community' benefits is not always clear, as the 'industry' may not have a unique location or definition. Rather, new industries comprise range of activities available to all rural producers. What ultimately becomes a particular 'industry' is likely to be a very diverse range of agricultural enterprises that, prior to the outcomes of the research that helped establish the industry, would not have been part of a defined industry group.

It is this flexibility in the uptake of new industries that provides a range of benefits to rural communities: providing them with production opportunities to increase their resilience and to respond to changing circumstances.

The available evidence suggests that in many cases, new industries do emerge to become profitable and sustainable activities that are able to compete on international markets without direct government support or production subsidies. This is in sharp contrast to many of Australia's manufacturing 'infant industries' which have proved to require many decades of ongoing government support.

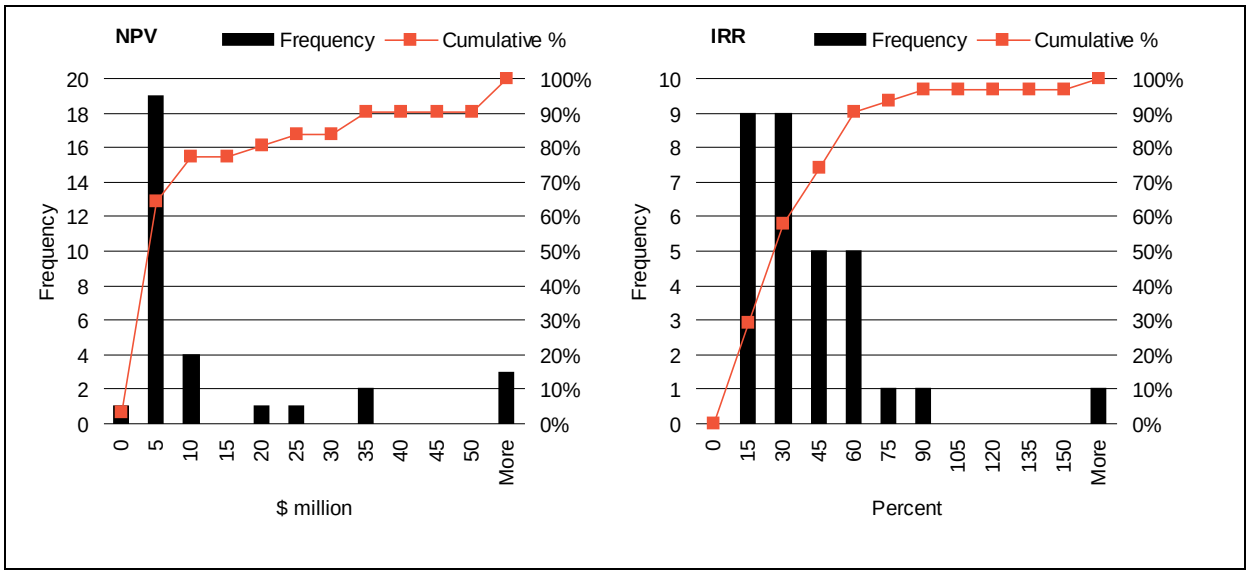
Research into new rural industries also generates a variety of spillover benefits to the broader community. These benefits are considered in more detail through a number of case studies presented below.

4.2 Evaluation outcomes

As previously noted, RIRDC undertakes regular impact evaluations of its programs and projects. To date, around 30 evaluations have taken place within the new and emerging industries portfolio. Figure 8 summarises the range of results from these evaluations in terms of the net present value (in dollars) of the research as well as in terms of the internal rate of return. Individual evaluation results are reported in Appendix B.

Figure 8 shows that most of the outcomes are clustered around an NPV of $5 million to $10 million with associated rates of return around 15 to 30 per cent. These results confirm that there are valuable research opportunities within new rural industries. The evaluation outcomes are likely to understate the full benefits, as they do not always incorporate the full health and environmental benefits of the research. They also do not fully capture the prospective benefits of increasing rural resilience.

Figure 8: Evaluation outcomes: new and emerging industries



NPV = present value of net benefits of the project. IRR = internal rate of return

Source: RIRDC.

4.3 Case study: olives

The gross value of production (GVP) in the Australian olive industry (including table olives and olive oil) has grown from $11.7 million in 2002-03 to $66.9 million in 2006-07, an annual average growth rate of 54 per cent. In 2006-07 around 82 per cent of the GVP was for olives for oil. In 2006-07 Australian exports of olives and olive products were $16 million while imports were $252 million. Production of olive oil is expected to increase to 25-30 million litres by 2013, around three times the current level of production (Foster and Bird 2009).

Research has shown that Australia is well suited to the production of olives. The climate in southern Australia is very similar to traditional olive growing regions in Europe. Australia also has the physical resources and horticultural infrastructure and expertise suited to olive production (Sweeney and Davies 2004).

RIRDC is the most significant funder of research in the olive industry (L'Heureux 2002). R&D for the olive industry was first formalised by RIRDC in 1997. RIRDC research has focused on addressing threats to the industry and improving productivity to ensure the olive industry is sustainable. Research projects funded by RIRDC include determining the most appropriate olive varieties for different regions and uses, identifying the optimal harvesting time, ascertaining the water requirements of olive trees, and identifying pests and diseases affecting olive production

and appropriate management options (L'Heureux 2002). This research has enabled the industry to grow significantly in the past decade.

Water use efficiency and climate adaptation in the olive industry

Research funded by RIRDC has found that olives are an irrigated crop resilient to decreased irrigation water availability. At production levels below maximum yield, olives require less water compared to traditional crops such as grapes, pome fruits and citrus (Cullen et al. 2010). Olives, therefore, are likely to be better suited to areas with low and variable irrigation water availability compared to the traditional crops. These conditions are expected to prevail in much of Australia in the future due to climate change. This research allows landowners to allocate their available water resources to water efficient olives rather than citrus.

Research findings indicate that when comparing water use efficiency and farm incomes, olive farms perform better than citrus under the water allocations observed over the past 10 years in northern Victoria. Compared to citrus, water use efficiency (gross value of production per megalitre of water) was 26 per cent higher in olives and gross farm incomes were 15 per cent higher. The results would be more pronounced under lower water availability. Olives are also more resilient in times of water stress, with production recovering more rapidly than citrus after periods of moisture stress — in effect, olives have a better chance of surviving a drought (Cullen et al. 2010).

Other research funded by RIRDC (De Barro 2005) found that olive producers were over-irrigating their crops. The research showed that trees receiving less water had the same growth patterns as those trees receiving more water indicating that the water, and related energy and infrastructure resources, were not being optimally used. This research enables olive producers to maximise the returns from their water resources.

Health benefits of Australian olive oil

A range of medical studies have found that consumption of olive oil, as part of a healthy diet, can have a wide range of health benefits and can lower mortality. Some of the health benefits identified include:

- reduced risk of stroke, heart disease;
- reduced risk of breast cancer, lung cancer and some dementias;
- reduction in high cholesterol levels;
- reduced risk of diabetes; and
- appetite suppressant thus helping with weight loss and addressing obesity.

It has also been found that virgin olive oil has greater heart health benefits than refined olive oil and the fresher the oil, the greater the health properties. Around 95 per cent of olive oil produced in Australia is extra virgin, and Australian products are fresher than imported oils.

Olive oil consumption, and in particular the consumption of fresh, extra virgin olive oil produced in Australia, leads to improved health and wellbeing in the community and hence is generating a spillover. The reduced occurrence of heart disease, cancer, high cholesterol and diabetes from consumption of olive oil will reduce health care associated costs to government and society.

4.4 Case study: tea tree oil

Tea tree is native to northern coastal New South Wales and is also grown commercially in the Atherton Tablelands region of Queensland. Many coastal regions of northern Australia are potential growing regions for this tree. Australia is the dominant producer of tea tree oil in the world, however, production in China and Zimbabwe is increasing (Foster and Bird 2009).

The gross value of production of tea tree oil in Australia increased from $5m in 2002-03 to $12.6 million in 2006-07 (Foster 2009) and RIRDC currently estimates this to be around $18 million. This represents an annual average growth rate of around 24 per cent. The oil is currently used predominantly in cosmetics, pharmaceuticals, toiletries, household products and industrial products (solvents and disinfectants). The oil has significant potential use in the health sector and this is the focus of much of the research on tea tree oil.

The current research plan aims to enhance production systems, address barriers to the use of tea tree oil including safety standards, demonstrate new applications for the oil, especially in the health sector, and communicate the advantages of using tea tree oil. The results of previous research have been positive, for example, the breeding program led to a 90 per cent yield improvement and has contributed considerably to reducing the cost of production and enabled the industry to compete with overseas low cost and low quality competition (RIRDC 2006).

Research on the health benefits of tea tree oil

Much of the research on tea tree oil funded by RIRDC is related to the potential health benefits of the oil.

Recent research funded by RIRDC has highlighted the role tea tree oil may play in treating cancer, including malignant mesothelioma and malignant melanoma. The research showed that a combination of tea tree oil and dimethyl sulfoxide (DMSO) significantly inhibited the growth of these cancerous tumours in mice. The next step is to research how tea tree oil could be used to treat cancers in humans.

Other RIRDC research has indicated that tea tree oil is effective at treating conditions including cold sores, skin inflammation from irritant histamines, radiation skin reactions and fungal infections. Cold sores affect 20-40 per cent of the population but there is no cure for the condition. The anti-viral activity of tea tree oil is effective against the herpes simplex virus which causes cold sores (RIRDC and the Australian Tea Tree Industry Association (ATTIA) 2007). Tea tree oil has also been found to provide relief from radiation skin reactions in cancer patients. These reactions occur in 95 per cent of patients undergoing radiation treatment for cancer. The treatment with tea tree oil gave better results than paw paw ointment, a common treatment for radiation related skin irritations (RIRDC and ATTIA 2007).

Furthermore, tea tree oil can also be effective in eradicating golden staph in hospitals, treating acne and as a hand wash (RIRDC and ATTIA 2007).

4.5 Case study: native foods

The Australian native foods industry covers a wide range of different products and activities. The industry, as defined by Foster and Bird (2009), employs around 800 people and gross value of production of around $6.8m. Over the decade to 2007, the industry was estimated to have grown by over 450 per cent (Foster and Bird 2009). The native foods industry includes Bush tomato, Lemon aspen, Lemon myrtle, Anise myrtle, Muntries, Tasmannia pepper, Dorrigo pepper, Quandong, Warrigal greens, Wattleseed, Native currants, Riberry, Desert lime, Finger lime, Round lime, Kakadu plum, Davidson's plum, and Illawarra plum. These foods are used as fresh, frozen or processed fruit, spices, flavour additives, vegetables or in pharmaceutical applications.

Research and development in the native foods industry has covered a wide variety of projects, including production systems, marketing, industry development (supporting the development of an industry organisation) and food safety (RIRDC 2008). RIRDC has provided support to the industry to meet compliance with Food Standards Australia New Zealand (FSANZ) and international food standards. Part of this support included developing a framework for achieving this compliance that can be applied to new food products.

Researching the health benefits

RIRDC has undertaken research to identify the health and nutrition qualities of native fruits, herbs and spices. Previously, there was limited information about the composition and health attributes of native foods. The research funded by RIRDC provided information for producers and consumers about the health benefits and antioxidant properties of 13 Australian native foods (fruit: Kakadu Plum, Davidson's Plum, Desert Lime, Riberry, Lemon Aspen and Quandong; and herb/spices: Tasmannia Pepper Berry and Leaf, Bush Tomato, Anise Myrtle, Lemon Myrtle and Wattleseed). The research compared the composition of the native foods with the benchmark products, blueberries and avocados, recognised for health-enhancing properties (Konczak et al 2009).

The research concluded that a number of the native food products had higher antioxidant capacity than blueberries and other common fruits which help to lower oxidative stress levels and can result in healthier old age and reduce the probability of diseases such as Alzheimer's disease, autoimmune and cardiovascular disease, cancer, cataractogenesis, diabetes, and macular degeneration (Konczak et al 2009).

The foods were also found to contain significant levels of vitamins and minerals including vitamins C, E, folate and lutein, magnesium, calcium, zinc, iron and molybdenum (Konczak et al 2009). These vitamins and micronutrients can help prevent specific acute illnesses, chronic diseases, growth problems early in life, and can aid in bone and cartilage formation and glucose metabolism (Konczak et al 2009).

It is likely that the increased availability and consumption of these native foods will lead to general health benefits for the community. The research funded by RIRDC has also identified areas of potential additional research to further substantiate the health benefits of these native foods and potential development of nutraceuticals (Konczak et al 2009).

4.6: Case study: kangaroos

The kangaroo industry has grown over 30 years from a pest control method to an industry for producing meat for pet and human consumption and harvesting skins. Harvesting of kangaroos is monitored and controlled by state and federal governments through regulations and a quota system. State governments set the quotas based on estimated populations; however, the number of kangaroos harvested consistently falls short of the quotas. Gross value of production of the kangaroo industry has grown from $34.6 million in 2003 to $43.9 million in 2007. The majority of meat produced for human consumption is exported, particularly to the Russian Federation (Foster and Bird 2009).

R&D for the kangaroo industry is administered by RIRDC using industry and government funds. Projects funded by RIRDC cover a wide range of issues from addressing regulatory barriers to the operation of the industry, and determining the nutritional benefits of kangaroo consumption. RIRDC research has identified a range of benefits external to the industry provided by kangaroo harvesting and commercialisation (Kelly 2009). These benefits include:

- generation of jobs in regional areas associated with harvesting and processing;
- improved animal welfare as kangaroo kills are controlled under regulations rather than left to inexperienced and unregulated farmers;
- generation of revenue for improved conservation efforts (regulation of the industry allows for governments to raise revenues to fund efforts to monitor the population, manage species and impose conservation safeguards);
- increased productivity in pastoral industries; and
- improved road safety from reduced kangaroo populations crossing roads.

Most of the research funded by RIRDC is targeted towards establishing a sustainable, resilient and profitable industry. RIRDC research has included projects on promoting kangaroo meat to consumers, establishing the comparative carbon footprint of kangaroo products, understanding the social and institutional issues around kangaroo management, and marketing new value added kangaroo products.

By establishing the kangaroo industry and increasing consumption of kangaroo meat, RIRDC is helping to further improve Australia's health and greenhouse gas emission balance.

Health benefits of eating kangaroo

Establishing a strong kangaroo meat industry provides the general population with access to a lean red meat alternative to beef and sheep meat. Kangaroo meat has less than 2 per cent fat content (and no cholesterol) and is the richest known source of conjugated linoleic acid that has been shown to reduce obesity and heart disease and has anticarcinogenic properties (CSIRO 2004). RIRDC research has also demonstrated that fat components are generally consistent in different cuts of meat and different species and geographical location of kangaroos (Beilken and Tume 2008). Kangaroo meat also has high levels of protein, iron and zinc. Greater consumption of kangaroo meat is likely to lead to health benefits for the Australian population and reduce costs associated with healthcare for the government.

Reducing greenhouse gas emissions

Livestock produce around 11 per cent of Australia's total greenhouse gas emissions (Department of Climate Change and Energy Efficiency (DCCEE) 2009). Kangaroos are non-ruminant animals and produce negligible amounts of methane. Research indicates that if cattle and sheep numbers on rangelands where kangaroo harvesting occurs were reduced, and kangaroo numbers were increased, Australia's greenhouse gas emissions could be reduced (Wilson and Edwards 2008).

4.7: Case study: climate adaptation

Adapting to climate change impacts that cannot be avoided is a key element of the government's response to climate change. Agriculture is likely to be one of the most affected industries by climate change. The Australian government is committed to helping Australians better understand and manage the risks and develop strategies to adapt to changes in the climate. RIRDC funded research is contributing to this effort to aid adaptation to projected climate change in the agriculture sector.

Many of the new rural industries supported by RIRDC research provide opportunities for climate change adaptation. Broadly speaking, diversifying the range of agricultural industries available for producers to participate in will help producers cope with the risks associated with climate change impacts and maintain incomes.

RIRDC has focused research efforts on identifying industries that are likely to be resilient to climate change impacts including higher temperatures, higher evaporation, more variable rainfall and increased extreme climatic events. Some of the crops identified by RIRDC research as being more suited to the changing conditions include olives, jojoba, pomegranates, capers, dates, mustards, tree crops and Australian native foods. Generally, these crops exhibit traits such as drought tolerance, salinity tolerance, water use efficiency and resilience to low irrigation water availability.

The report *New Rural Industries for Future Climates* (Cullen et al 2010) outlines the RIRDC funded research into opportunities for farmers to adapt to climate change. The report examines the projected impacts of climate change in different regions of Australia, identifies where current agricultural industries may be strongly challenged by future climates and investigates industries that may be well suited to the predicted climates.

In addition to this specific research on industries for future climates, the RIRDC new rural industries program actively funds research into specific industries that are likely to be successful under future climates, such as olives, and researching relevant issues, such as water efficiency. For example, RIRDC research has included reports on the water and energy needs of goats, water use in olives, efficient irrigation for parasitic quandong and acacia seed producers and the ability of jojoba to cope with salinity and effluent water.

4.8 Case study: addressing Indigenous disadvantage

All Australian governments have made a commitment to work towards a better future for Aboriginal and Torres Strait Islander people (Australian Government 2010). Part of the efforts to reduce Indigenous disadvantage include increasing employment opportunities. Many emerging agricultural industries provide opportunities for Indigenous Australians to gain employment, often on traditional land. Some of these industries are turtles, kangaroos, crocodiles, emus and native foods. RIRDC has funded research to help in developing these industries, and research has identified specific opportunities for Indigenous communities.

RIRDC has established a crocodile research and development program aiming to improve the profitability and sustainability of commercial crocodile production in Australia. The research has covered a range of issues. Sustainable use of crocodiles is successfully carried out in the Northern Territory and Western Australia and benefits both Indigenous and non-Indigenous landholders. Further development of the industry, for example through the addition of a sustainable egg harvesting program in Queensland, would offer Indigenous communities in remote areas a source of employment, and economic opportunity (Peucker and Jack 2006).

Some native foods research has also been specifically targeted at involving Aboriginal communities in harvesting native foods in central Australia (Miers 2004). One of these studies focused on establishing a trial native foods garden in a remote Aboriginal community. The project provided the Aboriginal community in Central Australia with an opportunity to play an important research role in the emerging Australian native foods industry. It is hoped that this community and others will continue to be involved in the native food industry thus generating recognition, employment opportunities and income for the communities. From the establishment of this trial a model for future enterprises on Aboriginal communities has evolved (Miers 2004).

5 National rural issues

Key points

RIRDC has a specific mandate to examine cross cutting national rural issues. Most of these are directly related to areas of public policy interest. This portfolio, therefore, is strongly grounded in public good outcomes.

Specific areas of research include farm and fishing health and safety; agricultural trade policy; agroforestry and farm forestry; and rural leadership.

5.1 The National Rural Issues portfolio

RIRDC has a specific mandate to invest in R&D into national rural issues — those issues that are multi-sector and national in scale and scope. In addressing these issues, RIRDC is focused on the profitability, strength and sustainability of our rural sector and communities. These investments in R&D support the rural policy priorities of government and the priorities of rural industries and communities.

The RIRDC National Rural Issues Portfolio covers research on global issues such as international and domestic trade policy, agricultural productivity, food security, biosecurity, climate change and emerging rural issues; community issues including regional development and communities, rural learning and leadership; and health and safety issues for agriculture and fishing communities.

Solid public good foundation

A considerable amount of research undertaken by RIRDC in this portfolio has a solid public good foundation, both because it is directly related to areas of public policy interest and because the benefits accrue throughout the economy, not just to rural industries.

Addressing the risks posed to human health and agricultural industries from agricultural pests and diseases will result in benefits to the wider community as well as the Australian agriculture sector. RIRDC has funded biosecurity research including *Assessment and communication of risk in agricultural quarantine issues* that identified ways quarantine risks can be reduced, and *Biosecurity risk management in the food chain* which identified options for adopting biosecurity controls in the food chain.

Similarly, the benefits of environmental conservation accrue to the community. RIRDC has funded studies into environmental management issues, for example the report *Can Regional-Scale Conservation Planning Influence Farm-scale Actions?* explores ways to encourage environmental conservation on agricultural land through the use of spatial data.

Health and safety objectives pursued by RIRDC research include the adoption of safe systems of work on farms, development of on-farm safety management packages, and maintenance, support and utilisation of data on farm health and safety issues. The ultimate aim is to contribute to a reduction in death and injuries on farm and ensure the efficient allocation of public resources aimed at reducing the risk of death and injury. These benefits include health benefits, reduced

medical costs to the patient and the government, reduced time and costs incurred in caring for patients and quality of life benefits for patients and third parties (Chudleigh and Simpson 2008).

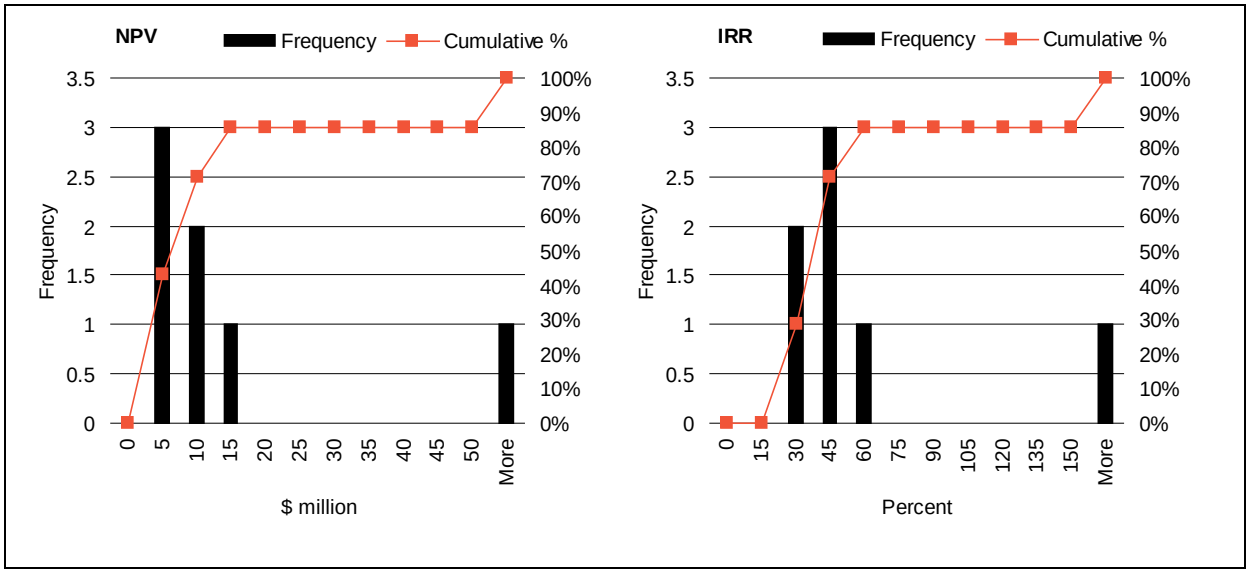
Free rider and coordination issues can also arise within the agriculture sector. RIRDC led a coordinating role by managing the Cooperative Venture for Capacity Building on behalf of the other rural RDCs. Research conducted into capacity building highlighted its importance and the need for industry groups to cooperate in this area. The venture also highlighted the need for RDCs to engage with policy makers and the private sector to ensure that the R&D undertaken by the RDCs is implemented and the benefits of the research are maximised. This last finding provides value to the taxpayer by ensuring that the benefits of taxpayer funded rural research are fully realised.

The benefits of the national rural industries portfolio are examined further through three case studies.

5.2 Evaluation results

To date, evaluations in the national rural issues portfolio cover seven projects. The range of outcomes (in terms of the net present value and internal rate of return) is summarised in Figure 9 (more detailed results are presented in Appendix B).

Figure 9: Evaluation outcomes: national rural issues



NPV = present value of net benefits of the project. IRR = internal rate of return

Source: RIRDC.

5.3 Case study: farm and fishing health and safety

RIRDC manages Collaborative Partnership for Farming and Fishing Health and Safety Program on behalf of Department of Health and Ageing, the Cotton Research and Development Corporation, the Grains Research and Development Corporation, the Fisheries Research and Development Corporation, the Sugar Research and Development Corporation and RIRDC. The

aim of the program is to change safety culture (beliefs and values) within farming and fishing communities in order to minimise accidents, injuries and fatalities. The Partnership replaces the Joint Research Venture for Farm Health and Safety (JVFHS) which ran from 2001 to 2007, also managed by RIRDC.

Projects undertaken as part of the program have addressed issues including farm machinery injuries, child safety on farms, health related behaviour of farmers and fishers, factors to improve the adoption of safety systems, mental health of Australian farmers, communication strategies for farm safety and data collection on the state of farm health and safety.

Chudleigh and Simpson (2008) undertook an evaluation of the JVFHS. They found that program has contributed to the achievement of the key objectives:

- reduced risk of death and injury on-farm, to workers, residents and visitors (including children); and
- more efficient allocation of resources for public policy and research efforts aimed at reducing risk of death and injury on farms.

Injury prevention is recognised as a National Priority Area by Australian Health Ministers. In the National Injury Prevention and Safety Promotion Plan: 2004–2014, rural and remote populations are identified as a key area for intervention (National Public Health Partnership (NPHP) 2004). RIRDC has been working with Farmsafe Australia, an organisation bringing together 19 other departments and organisations investing in farm safety, including the Australian Government Department of Agriculture, Fisheries and Forestry, on research into injury prevention. A reduction in farm deaths and injuries can benefit the community through cost savings for the government by reducing health care costs. Other benefits include reduced medical costs in individuals and families, reduced grief and anxiety, improved quality of life and improved productivity.

National Farm Machinery Safety Program and Regulatory Review

Farm machinery related injuries have been linked to around 27 deaths and 1037 injuries per year. As part of Farmsafe Australia's National Farm Machinery Strategy, RIRDC funded two projects; the first examined injuries arising from, and made recommendations about the safety of, four machinery types; the second reviewed national, state and territory legislation and regulations relating to farm machinery design and safety.

As a result of the project, 47 recommendations were made to the Farmsafe Australia Machinery Safety Reference Group regarding the four machinery types examined (posthole diggers, power take-off shaft guards, grain augers and tractors). The implementation of recommended strategies was subsequently funded by the Australian Government Department of Health and Aging (Chudleigh and Simpson 2008).

The regulatory review successfully identified major shortcomings in standards and regulations, made recommendations for a best practice regulatory regime, agreed to the use of performance standards rather than stricter specifications standards, recommended enforcement approaches ranging from advice to prosecution, and identified potential solutions for child safety issues, changing technology and remoteness on farm concerns.

The research reports from the two projects have been used by a number of groups for information, to inform safety measures associated with the equipment and implementation of government initiatives to improve farm health and safety. It is expected that the research will contribute to the following results.

- Avoided deaths and less pain and suffering by those and their families involved in farm machinery accidents.
- Avoided higher workers compensation premiums for the sector and individual enterprises.
- Reduced risk of prosecution under Occupational Health and Safety legislation.

While there has not been time to fully implement the recommendations and collect relevant data on reductions in death and injury, a conservative estimate of the present value of the benefit of the two projects (through expected reduced deaths and injuries) is $6.11 million and the net present value is estimated at $5.66 million (Chudleigh and Simpson 2008).

Effective Safe Play Area Fencing Option for Rural Properties

Around 30 children lose their lives on Australian farms each year, and around half of these deaths are of children under four years old. The most common causes of child deaths are drowning and coming into contact with machinery and vehicles. Improving house fencing has been identified as an effective way to reduce these deaths (Chudleigh and Simpson 2008).

In 2003 RIRDC managed a research project, on behalf of the JVFHS, with the objectives of identifying available fencing options, identifying the effectiveness of fencing for creating a barrier to children and providing the findings to farmers to help in the construction of safe play areas. The project identified a fence design similar to pool fence standards and another moderately priced fence that offered potential as an option for creating a child safe play area. Prior to this research, there was no information available on the child resistance of farm fencing or advice as to the most appropriate fence design.

The project successfully raised the awareness of the importance of house fencing on rural properties. It is expected that even minimal adoption of improved fence designs will decrease the risk of injury or death. The evaluation of the project undertaken by Chudleigh and Simpson (2008) found that the present value of the benefits of the project was $2.06 million, and the net present value of the project was $2.02 million.

5.4 Case study: RIRDC trade policy research

The need for international trade reform

Australia exports approximately two thirds of its agricultural production by value. Australia's competitiveness in global markets is therefore vital to the future success of the rural sector and to the livelihood of all Australians (RIRDC 2010a).

However, Australian farmers face many impediments to their exports. Agricultural export markets are the most protected and distorted by overseas government policies of all goods traded. Australian agriculture has very low levels of assistance compared to agriculture in most

other countries, especially other OECD countries. The measured Producer Subsidy Equivalents provided by the OECD for member countries consistently show Australian agriculture to be one of the lowest assisted agricultural sectors in that grouping (RIRDC 2010b). There has long been recognition of the importance of trade liberalisation for Australian agriculture.

Through gaining additional access to overseas markets, Australia stands to benefit $4 billion per year (net of adjustment costs and other costs on the economy) from the removal of all world restrictions on agricultural trade (RIRDC 2010c).

RIRDC's trade policy research

Under its Global Challenges Program, RIRDC has provided a comprehensive and coherent series of trade policy analyses resulting in a variety of publications that have been used on an ongoing basis in international forums and negotiations.

RIRDC's research efforts on trade liberalisation have encompassed analysis of the gains to the world economy, to consumers in protectionist countries and assessment of the various measures used by governments around the world as barriers to trade.

RIRDC's publications have been used extensively by different groups including Australian Government, Australian farm organizations, members of the Cairns group, Australian farm leaders, Australian farmers, opinion making bodies in other countries (including think tanks, universities, media) to achieve the following outcomes (RIRDC 2010b):

- helped keep the Australian Government and Australian farm organisations in a pre-eminent role in the Cairns group of nations and in international trade negotiations forums. The publications have been one means of ensuring the interests of Australian agriculture are not sidelined in future trade agreements.
- provided the intellectual framework from sound analyses for the Cairns group and helped ensure the cohesiveness of both farmers in other member countries and their governments in pursuing the policy aims of agricultural trade reform in the international trade architecture.
- provided the intellectual framework for reforming international trade and provided education and knowledge on the benefits of more open trade arrangements for a generation of Australian farm leaders. A simple indication of this has been the election of Australian farm leaders to senior international positions.
- helped build the policy understanding of Australian farmers and farm leaders and therefore help build a more robust domestic policy environment for Australian agriculture.
- helped create the international intellectual recognition of the benefits and justness of international agricultural trade reform. This was achieved by the analyses having been taken up and used by influential opinion makers and opinion making bodies in other countries. They have been cited by think tanks, universities and mainstream media outlets.

The research and resulting publications commissioned by RIRDC have helped to identify the impediments to advancing agricultural trade reform. The research has successfully been used by a range of different actors in the agricultural trade policy field including governments, industry and international organisations. The research undertaken has been relevant and successfully addressed the issues as they arose. The extent that the research has been used provides an indication of the value of the research commissioned by RIRDC.

Appendix A provides a more detailed thematic narrative of RIRDC's contribution to international trade policy reform. It illustrates the ways in which RIRDC's research is very responsive to developing policy needs.

5.5 Case study: Agroforestry and farm forestry

RIRDC has managed the Joint Venture Agroforestry Program (JVAP) from 1993 to 2009. The program is a joint initiative of RIRDC, Land and Water Australia and Forest and Wood Products Australia. The program seeks to assist the development of a profitable agroforestry industry while also delivering beneficial natural resource management outcomes (RIRDC 2010). Farm forestry provides six main products and services: wood and fibre, eucalyptus oil and oil products, other extractives, biofuels, carbon sequestration and environmental services, and food and fodder.

Farm forestry includes both planted and native forests, and contributes an estimated $100-362 million gross value of production. 155 290 hectares of farm forests (9 per cent of Australia's plantations), and 400 000-500 000 hectares of woody shrubs have been planted, mostly over the past twelve years, for tree products, fodder and more drought resilient agricultural systems (RIRDC 2010d).

The JVAP has funded a broad range of research including farm forestry design, species-site evaluation, biodiversity, managing dryland salinity, product testing and market evaluation. Other recent research includes trade in carbon, and screening for new tree-based products such as secondary chemicals from cineole (RIRDC 2010d).

Farm forestry and natural resource management are recognised in a range of national policy documents and government initiatives (RIRDC 2006a):

- Plantations for Australia 2020 Vision;
- Farm Forestry National Action Statement;
- National Research Priorities;
- Rural Research Priorities;
- National Land and Water Resources Audit;
- National Action Plan for Salinity and Water Quality (NAP);
- Natural Heritage Trust (NHT2);
- Environmental Industry Action Agenda; and
- Renewable Energy Action Agenda.

Trees and salinity management

A key area of research conducted under the JVAP has been salinity management through tree plantations. The JVAP conducted a number of workshops that have lead to significant progress in addressing salinity in Australia. These workshops include the *Agroforestry and Hydrology: What do we need to know* workshop in 1996 that led to the development of a catchment classification and groundwater flow systems framework. This classification and framework is used to conduct cost-

effective modelling of salinity management options and confidence in the effectiveness of tree plantings for salinity management (Powell 2009).

As part of the JVAP, the report *Trees for Saline Landscapes* was published. The report provided a synthesis of research results relevant to addressing salinity in Australia. The report targeted areas of Australia where the majority of salt-affected land is and is expected to develop. In the report, the salinity problem is explained and vegetation management options are explored including location of plantings, species selection, classification of types of saline soils and management of trees in saline areas. This report, and others produced by the JVAP (for example *Trees, Water and Salt: An Australian guide to using trees for healthy catchments and productive farms*) provided important information to land holders on how to manage saline soils when salinity arose as a major problem for rural industries (Powell 2009).

Biodiversity benefits of agroforestry

The JVAP supported research has demonstrated and identified the key principles and practices that can be implemented to maximise biodiversity conservation in private native forests, industrial plantations and farm forestry plantings. This research included investigating options for measuring the biodiversity of private native forests to ensure government regulations resulted in ecologically sustainable forests. The report *Trees and Biodiversity* provided a comprehensive guide for landowners to protect and enhance biodiversity within agricultural areas (Powell 2009). As well as providing information on species selection, location, configuration and ecological management, the report also outlined why biodiversity is a desirable outcome in predominantly agricultural areas. These practical guidelines provided farmers with the information required to establish farm plantings to enhance biodiversity.

The series of the JVAP projects means that lack of knowledge is no longer an impediment to improving biodiversity outcomes on private land. The remaining issue that needs to be addressed in the area is the extent that public benefits cannot be accurately valued (Powell 2009). The JVAP is investing in research to support the development of markets for environmental services, including biodiversity.

Carbon Sequestration

Sequestration of carbon in forestry plantations is an option for reducing the level of carbon dioxide in the atmosphere, contributing to efforts to mitigate climate change. With the establishment of a carbon market, landholders are provided with incentives for carbon sequestration. Before these opportunities can be taken up, landowners need information on what costs will be involved in establishing carbon plantations and what the carbon sequestration rates are. The JVAP have sought to provide the relevant information and advice. Polglase et al (2008) published estimates of growth rates for different species under different conditions and assessed the cost of production. The study concluded that "carbon farming looks promising" and the results of the study were used in the Garnaut Climate Change Review. Through this program of work, The JVAP have made a significant contribution toward preparing Australian land owners for a carbon market and contributing to the government's aim of reducing greenhouse gas emissions in the most cost effective way.

5.6 Case study: rural leadership

A key objective of RIRDC's Dynamic Rural Communities R&D Program is to develop leadership and human capacity in primary industries and rural communities. RIRDC supports and invests in initiatives that build leadership capacity and skills in young people, women and Aboriginal and Torres Strait Islander communities to ensure they have opportunities to contribute to positive change in rural communities resulting in economic, social and environmental benefits. This objective includes the highly acclaimed Australian RIRDC Rural Women's Award; the Australian Rural Leadership Program, the Investing in Youth Undergraduate Studentships Program, ABC Heywire (a voice for rural youth) and the Aboriginal and Torres Strait Islander Rural Development R&D Program.

Australian RIRDC Rural Women's Award

RIRDC instituted and has managed the Rural Women's Award for 11 years. There are now 170 women who have won or been runners-up for this award and are making significant contributions to agricultural industries and rural communities. Current partners of the Award are the Department of Infrastructure, Transport, Regional Development and Local Government; the Department of Agriculture, Fisheries and Forestry; ABC Radio; the New South Wales, Victorian, Queensland, Western Australian, South Australian, Tasmanian and Northern Territory Governments; Westpac Banking Corporation; The Australian Women's Weekly; ABC Rural and Rural Press Ltd.

The Australian RIRDC Rural Women's Award is not just an award. It has important promotional, human capacity building, leadership development and networking components. It comprises the high profile Award Dinner in the Great Hall Parliament House; the opportunity for the winner to represent rural women through the Award for the coming year, the project bursary for state/territory winners to pursue individual projects that meet the objectives of the Award; an Australian Institute of Company Directors' leadership course for state/territory winners and runners-up; a Mentoring Rural Women for Success program; and an Alumni for members to maintain contact, collaborate and network.

The Department of Infrastructure, Transport, Regional Development and Local Government has recently granted RIRDC funding to RIRDC to evaluate the impact of the Rural Women's Award on regional development, rural communities and local government with a view to expanding the associated programs such as Mentoring Rural Women for Success.

Australian Rural Leadership Program (ARLP)

RIRDC has been a long-term sponsor of the ARLP, which was established in 1992 to develop rural leaders with commitment, strategic thinking, negotiating skills and the foresight to influence communities, industries, businesses and policy makers. The Australian Rural Leadership Foundation now has over 500 graduates of the Program who are committed to the resilience of rural Australia through their industry, community, and family leadership roles. RIRDC as an ongoing sponsor has been a major contributor to this leadership capacity with many of the graduates contributing to RIRDC's industry and rural communities programs.

Investing in Youth Undergraduate Studentships

This studentship program was commenced as a pilot program in 2010 to attract school leavers into study a degree in agriculture and then follow on with a career in agriculture or progress to post-graduate studies. It is a collaborative venture between RDCs and has the support of the Minister for Agriculture, Fisheries and Forestry.

In 2010, RIRDC (including its Dynamic Rural Communities Program and its Chickenmeat Program), Meat and Livestock Australia, Grains Research and Development Corporation, Horticulture Australia Limited, Cotton Research and Development Corporation , Grape and Wine Research and Development Corporation, Pork Australia Ltd, Australian Egg Corporation and the Australian Government Department of Agriculture, Fisheries and Forestry have each sponsored a studentship. The pilot program attracted 68 high quality applications from school leavers and led to offering ten studentships through an independent merit based selection process.

The studentships provide financial support; professional mentoring to support students with career advice and direction, career relevant industry placements; employment opportunities during and after undergraduate study, and a national event in Canberra that explores the workings of the federal Government. The program provides a high quality support network for students that instils a sense of belonging within primary industries. This encourages and supports the students in continuing with their tertiary studies and pursuing a career in primary industries.

The Investing in Youth Program complements the efforts of the national Primary Industries Centre for Science Education (PISCE) and the Primary Industries Education Foundation (PIEF) in raising awareness amongst secondary students of the diversity of careers in primary industries and inspiring students to undertake relevant undergraduate studies. The program complements and works with other school and scholarship schemes, or similar initiatives, to ensure the future supply of skilled labour, researchers, teachers and rural leaders and meets the growing demand for graduates in the rural sector.

ABC Heywire

RIRDC has been a long-term sponsor of ABC Radio's Heywire, which is now in its twelfth year. Heywire is a platform for young leaders from rural, regional and remote Australia, to create, blog and share their stories and opinions. The purpose of Heywire is to hear directly from young people about what it is like for them living and working in regional and rural Australia. Heywire exists to find out how the young people of rural and regional Australia think and react to their world, about their concerns, issues, hopes, experience and ideas.

Over twelve years around 7000 young people have submitted stories to Heywire. In 2007, the Heywire competition shifted from being a purely text-based radio essay competition, into being a cross-media competition where young people from rural and regional Australia could enter via audio, text, photos or film.

Over 400 young people have been selected as winners and had their stories heard via ABC radio. Most of them have been part of the annual Heywire Youth Issues Forum in Canberra.

The Heywire Forum is a chance for the winners to work together developing outstanding ideas and proposals that will create positive change in their communities. As part of this focus, the winners participate in mentoring, training, networking, skill building and learning activities during the week, and have the chance to meet members of parliament, government and leaders from across the Australian youth sector and the ABC.

The Heywire stories continue to be heard throughout the ABC network — on regional and metropolitan ABC Local Radio stations, on triple j and nationally on Radio National, via ABC online and through social networking spaces such as Facebook, Youtube, Myspace and Twitter.

Heywire manages a website open all year for submissions. Young people can create their own Heywire profile page and network with other Heywirers from across Australia; upload their video, audio, text and photo entries live to the site; and comment on other entries and leave their own thoughts and comments.

Heywire currently has four areas of strategic focus:

- Continue to focus on building its overall online process, both on its website and across all major social networking platforms;
- Review and strengthen its relationship with the Australian Government, including investigating the feasibility of establishing new initiatives to take Heywire beyond the Canberra Youth Issues Forum;
- Focus on creating partnerships and opportunities for collaboration within the ABC; and
- Continue to develop its relationships in schools, universities and educational institutions.

Aboriginal and Torres Strait Islander Rural Development

RIRDC will commence a five-year R&D Plan on 1 July 2010 that includes an objective for investments that supports Indigenous people and communities to build leadership capacity and skills to more effectively participate in rural development opportunities. Indigenous opportunity is often constrained by capacity — including capacity for effective communication or 'know how' and capital to establish new rural businesses. This program will involve engaging Indigenous people in the research process — consultation, project design, delivery and interpretation. The ultimate measure of success for this program will be the creation of real, long-term employment opportunities in rural Australia.

6 Established industries

Key points

RIRDC funds research for seven established rural industries.

There are a variety of public benefits that emerge from research into these industries including quarantine benefits from honeybee research; resource use efficiency from research in the rice industry; and animal welfare and health benefits from research in the chicken meat industry.

6.1 The portfolio

RIRDC's established industry portfolio covers research into seven industry groupings: honeybees, chicken meat, rice, horses, organic systems, fodder crops and pastures seeds. Some of these research programs are funded by a statutory levy, while others are based on voluntary contributions.

Unlike RIRDC's other portfolios, research in these areas does not necessarily have an explicit public policy focus, so the return to government funding contributions is more difficult to define (as is the case for most activities supported by rural R&D corporations).

Nevertheless, there are clear public benefits emerging from RIRDC's research programs in these industries. These benefits are diverse. Three good illustrations are provided by the honeybee industry, the rice industry, and the chicken meat industry, each of which is presented as case studies below.

6.2 Evaluation outcomes

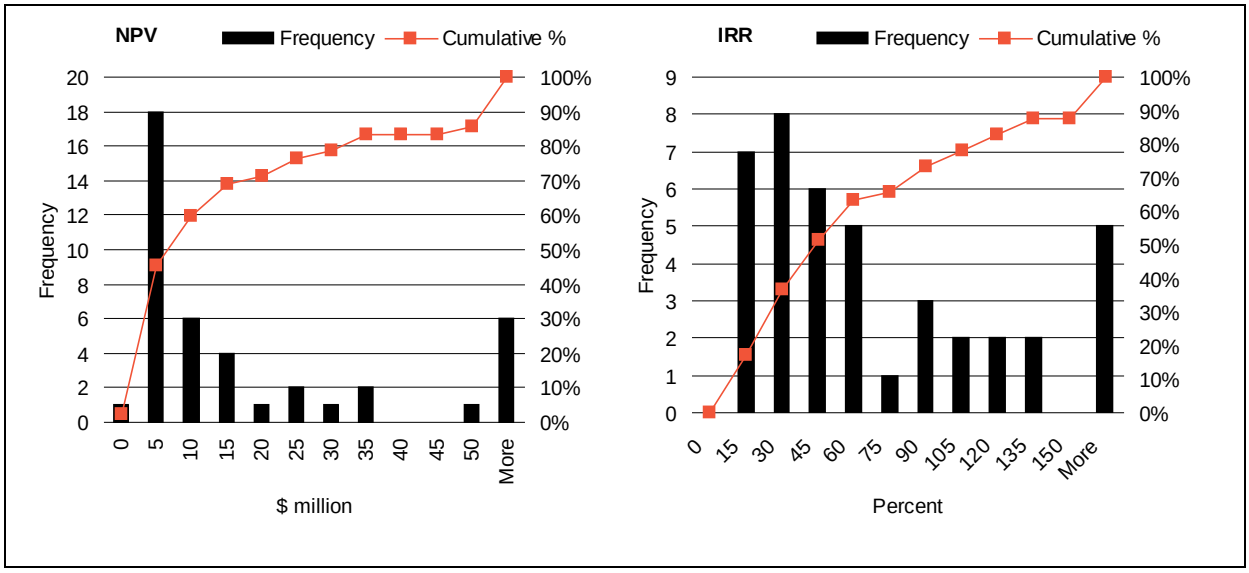
Around 40 evaluations have been undertaken within the existing industries portfolio. Figure 10 summarises the distribution of outcomes in terms of the present value of net benefits and in terms of the internal rate of return. Further details are provided in Appendix B.

6.3 Case study: honeybees

One of the established industries that RIRDC manages R&D for is the Australian honeybee industry. The stated objective of RIRDC's honeybee R&D program is to 'improve the productivity and profitability of the Australian bee keeping industry' (RIRDC 2010). The program funds are derived from statutory levies from industry participants, matched by the government.

The gross value of honey and beeswax production was around $75 million in 2007-08. As well as producing honey and beeswax products, honeybee businesses also provide pollination services to cropping businesses, in particular almond, cherry, other fruit, pumpkin, apple, lucerne and canola businesses. Some apiarists receive payment for their pollination services, but not all (Crooks 2008).

Figure 10: Evaluation outcomes: established industries



NPV = present value of net benefits of the project. IRR = internal rate of return

Source: RIRDC.

Honeybees are the most important agent of pollination in Australia; around 65 per cent of Australian crops rely on honeybees for pollination (either from feral honeybees or from managed pollination services). Managed pollination services are expected to become more prominent; honeybee businesses are expecting to expand their pollination services by over 30 per cent over five years from 2007 (Crooks 2008).

A subprogram of RIRDC's honeybee program is the RIRDC pollination R&D program. The pollination program aims to support research, development and extension activities that will secure the pollination of Australia's horticultural and agricultural crops into the future on a sustainable and profitable basis (RIRDC 2009).

Within the honeybee program, RIRDC has conducted projects on bee husbandry, bee nutrition, genetics, identifying pollen resources and health benefits of honey consumption (RIRDC 2007). RIRDC has also funded significant research into biosecurity issues related to honeybees.

Public costs of an Asian honeybee incursion

For example, RIRDC recently released the report *Estimating the potential public costs of the Asian honeybee incursion* (Ryan 2010). This report provides evidence to policy makers of some of the costs that would be incurred as a result of the Asian honeybee becoming endemic in Australia. There has been an incursion of Asian honeybees in Queensland.

Asian honeybees, if allowed to become widespread, could destroy the feral and domesticated European honeybee population by competing for resources and mating with the European honeybees, reducing their productivity. Asian honeybees cannot be domesticated for the production of honey and are unreliable pollinators. Thus, the introduction of Asian honeybees is expected to impact on the Australian honeybee industry and potentially have impacts on Australian crop production. Since Asian honeybees became established in the Solomon Islands, honey production and the local honeybee population has fallen sharply.

Ryan (2010) has also shown that there may be significant public costs of an Asian honeybee incursion. The human health impacts could be as much as $88 637 per 100 000 people and $33 660 per 100 000 people for the public nuisance costs. The public health impacts are likely to result because Asian honeybees are more aggressive than European honeybees, they have a greater propensity to swarm and there is likely to be up to three times more nests and swarms of Asian bees compared to the existing feral European bees. The health costs analysed include the cost of deaths, hospitalisations, medical practitioner visits, medications, sick leave/workers compensation, venom allergy treatments and anti-allergy medications.

The public nuisance costs refer to the costs of removal or extermination of swarms or hives from private property and public buildings or facilities. While it is expected that the Asian honeybee will replace the feral European honeybee population, the costs associated with the Asian honeybee are expected to be higher for two reasons. Firstly, the Asian honeybee is of no value to apiarists. Apiarists often remove beehives and swarms free of charge because the swarms are of some value to them. Asian honeybees however are not valuable to apiarists and therefore it is unlikely this service will be conducted free of charge. Secondly, Asian honeybees form smaller colonies and therefore, with the same number of bees, there is going to be a greater number of hives or swarms to be removed (Ryan 2010).

The information generated in this study is contributing to a response plan to prevent the Asian honeybee from becoming endemic. The extent of the public costs demonstrates that the benefits from stopping the Asian honeybees would extend beyond the honeybee industry (Ryan 2010). The report will be used by policy makers undertaking a benefit cost analysis of the Asian honeybee incursion and deciding the most appropriate response plan.

6.4 Case study: the rice industry

Through focused research and development, the RIRDC Rice R&D Program seeks to improve the profitability and sustainability of Australia's rice industry. The Rice R&D Program is funded by statutory levies and matching contributions from the Australian Government.

Australian rice production peaked in 2001 with over 1.7 million tonnes being produced. The amount of rice produced in 2003 to 2005 was severely affected by poor climatic conditions with only 390 000 tonnes in 2003, 528 000 tonnes in 2004 and 305 000 tonnes in 2005. Weather conditions improved in 2006 with just over 1 million tonnes being produced. However, rice production was less 167 000 tonnes in 2007 due to a return to severe drought conditions (RIRDC 2010e). In 2008-09, production was 63 000 tonnes (ABARE 2009).

GVP has fluctuated over the last five financial years due to changes in production caused by severe drought conditions in 2003, 2004 and 2005. GVP has averaged $96 million over the last five financial years, peaking at $284 million in 2005-06 (ABARE 2009). GVP was estimated to be $32 million in 2008-09 (ABARE 2009). As well as the high dependence on seasonal conditions, prices received by rice growers are highly variable.

The key focus of R&D in the rice industry is on water use efficiency. Other areas of research include improving crop establishment, agronomy and physiology, nutrition and protection from weeds, pests and diseases, improving the profitability and sustainability of the rice-based

farming system, fostering and achieving innovation, both on and off farm, supporting ongoing Australian rice research and extension capacity and optimising participation and develop people's potential to contribute to the industry (RIRDC 2010e).

Water use efficiency

Water efficiency (measured as water use per tonne of rice produced) is improved in a number of different ways. Improvements in yield (tonnes of rice produced per hectare planted), water efficient varieties, site/soil selection and field preparation methods all contribute to improving the water use efficiency of rice without compromising the quality of rice produced.

Through RIRDC research, a technique for identifying water efficient soils was developed. The research project developed an instrument that uses electromagnetic induction (EM) to create a picture of the soils. From the pictures developed, rice farmers can identify areas of soil with minimal drainage to the groundwater system. The EM survey is combined with soil sodicity assessments to find the most appropriate site for rice paddies (RIRDC 2006b). Groundwater recharge, or water that seeps through the soil to the groundwater supply, is a loss of water and a continual cost to rice farmers. Minimising groundwater recharge can substantially reduce water use in the rice industry. Without the EM technique, soil testing was conducted by taking soil samples every 4 hectares. This testing method was time consuming and was unable to identify localised sites that allowed groundwater discharge. RIRDC contributed to two projects on EM. The results of the projects were further refined by the CRC for Sustainable Rice Production.

The research into EM technology has led to reduced water costs for farmers, improved ability for farmers to cope with decreased water allocations and more efficient use of land. The water not used by rice farmers can be released back to the environment as environmental flows leading to improvements in biodiversity, protection of native vegetation along rivers and improvements in water quality in rivers and streams. Furthermore, reduced groundwater recharge can help to reduce irrigation salinity of rice farms by maintaining low water tables (CIE 2004).

While developed for use in the rice industry, the EM technology has been applied to other areas including investigating the leakage of reservoir sites, identifying irrigation channel seepage, identifying different recharge rates across irrigated and dryland catchments, detecting areas of high groundwater recharge under pastures to optimise irrigation management and locating appropriate areas for irrigation field experiments to reduce the probability of failure (CIE 2004).

6.5 Case study: the chicken meat industry

The real price of chicken meat has declined over the past several decades and has led to increasing domestic consumption of chicken meat. The gross value of poultry production was $1862m in 2008-09, but is expected to decline in 2009-10 and 2010-11 (ABARE 2010). Maintaining the competitiveness of chicken meat requires continued productivity improvements.

The key areas of RIRDC research investment in improving productivity are bird health, husbandry, nutrition and feed management. RIRDC also has a significant research program to address challenges posed by increasingly stringent food safety, animal welfare and environmental standards (RIRDC 2010f).

Animal welfare in the chicken meat industry

Chicken meat, as an intensive animal production system, attracts continuous scrutiny regarding the humane treatment of animals. To address the concerns of the public and consumers, RIRDC and the chicken meat industry have invested in research to ensure that high levels of animal welfare are maintained. Welfare considerations are incorporated into nearly all of the projects that RIRDC funds in the chicken meat industry.

In 2003 RIRDC funded a project to develop and implement a welfare audit in the chicken meat industry. The audit provides documentation on standards of welfare that can be incorporated into a quality assurance program. Implementation of the audit was expected to result in improvements in animal welfare, public reassurance of high welfare standards, market protection by minimising industry-wide risks and a mechanism for implementing upgrades to welfare standards. Companies representing 70-80 per cent of the national chicken meat flock have committed to implementing the welfare audit (Barnett 2003). Companies implementing the audit have greater opportunities to recognise and address animal welfare issues as they arise.

More recently, RIRDC established a research project to trial a humane method to euthanase poultry in the event of an outbreak of an emergency animal disease (EAD), such as avian influenza. This project addressed concerns of animal welfare as well as biosecurity risks. The presence of an EAD requires control and eradication programs to ensure the disease is contained, often involving the slaughter of a large number of birds. The method of slaughter needs to be reliable and involve minimal exposure of personnel to the EAD to ensure the disease does not spread, but also needs to be quick and humane. The approach trialled by RIRDC addresses all of these concerns and is currently used overseas (Simpson and Chudleigh 2009). The project conducted a field trial to assess the effectiveness and cost in Australian poultry systems.

The results of the field trial will be used to update the *AUSVETPLAN Destruction of Animals Manual* to provide guidelines on the destruction of birds. The method of destruction trialled is an improvement over currently used methods because it does not require the birds to be moved which distresses the birds (Simpson and Chudleigh 2009). Additionally, the trialled method reduces the risk of diseases spreading to native birds or to humans, reduces the cost of euthanasia and reduces the costs to government from their contribution to disease eradication efforts.

Reducing pathogens in chicken meat

Food safety has been identified as a major research priority in both the current RIRDC Chicken Meat Program's Five-year R&D Plan (2009-2014) as well as in its previous plan. Microbiological safety is of particular concern to the industry, and is therefore the primary target of the Chicken Meat Program in this respect.

One of the activities the RIRDC Chicken Meat Program undertook to address this research priority was to hold Pathogen Reduction Workshops for Australian chicken meat primary processing plants.

The two main bacteria of concern in a food safety context in chicken meat are *Salmonella* and *Campylobacter*. Both these organisms are often present in the live bird (where they are considered commensals, in that they do not cause health problems in the birds themselves), and can be present on the finished product. However, past research and industry experience has shown that

the implementation of particular interventions along the processing line can minimise the levels of these potential pathogens on the finished product.

The RIRDC Chicken Meat Advisory Committee identified that the single biggest impact it could have in terms of reducing the potential risks associated with these organisms, would be to help industry participants understand:

- what the key, existing interventions in processing were for these bacterial pathogens; and
- how to consistently and effectively apply these known interventions on a daily basis.

With this in mind, the Chicken Meat Program organised, funded and ran two Pathogen Reduction Workshops for chicken meat primary processing plants in June 2008. The aim of these workshops was to engage companies in an industry driven commitment to improve microbiological status of the finished chicken meat product and to provide and share information, which will help them to achieve this outcome.

Chicken meat processing company General Managers, Processing Plant Managers and Quality Assurance Managers for each of the primary processing plants were invited to attend these Workshops. Over industry 90 people attended the workshops, including representatives from all significant meat chicken companies in Australia (representing at least 98 per cent of all chicken meat production), as well as representatives from several duck, spent hen meat and game bird processors.

The workshops provided participants with an understanding of the current situation regarding *Campylobacter* and S*almonella* levels on chicken carcasses post-processing, what control options for improving microbiological outcomes are currently available (and may be on the horizon) and an what improvements in pathogen control in plants are achievable through the implementation of existing knowledge and technologies.

They provided an update on the latest information available on pathogen control in processing, including information from recently completed research projects conducted here in Australia as well as results from research and practice change overseas.

With the cooperation of one of Australia's largest chicken meat companies, Inghams Enterprises, the participants were also provided with an insight into the pathogen management practices in place at two of Australia's largest processing plants, as the workshops included an opportunity to tour the company's processing plants in Queensland and Victoria, to see and discuss the interventions that have been put in place to control key bacterial pathogens in these operations, how these interventions are managed and their outcomes. The significant contribution of Inghams Enterprises to this project, as well as the incredibly high participation rate of industry in the workshops, served to highlight the importance of this initiative to the industry.

A follow-up questionnaire was sent to the participating processing plants one year after the workshops. All 27 participating processing plants responded to the survey. Of these 27 plants, 25 plants said that they had introduced new pathogen reduction interventions since the 2008 workshop. Twenty-six of these plants reported that they were testing for at least prevalence of *Campylobacter* and *Salmonella*. Twenty of these reported that they were getting the improvements they expected from these new interventions.

Feedback received at the close of each of the 2008 workshops recommended that follow-up workshops be held in at least 12 months' time, so participants could share and learn from each other's experiences and results from their implementation of improved plant hygiene and pathogen reduction practices. As a result of this feedback, the RIRDC Chicken Meat Program is once again holding Pathogen Reduction Workshops in May 2010. Based on feedback from the previous workshops, one workshop is being held for primary processing plant managers, while a new second workshop is being held for company livestock managers. This latter workshop is being conducted to extend the industry's pathogen reduction programs back up the production chain into farming. Its aim is to help industry minimise the pathogen load entering the processing plants on live birds. Once again, response to these workshops has been strong, with in excess of 98 per cent of industry being intending to participate.

7 Changes that could improve RIRDC's operations

Key points

RIRDC's operations could be enhanced if it were also allowed to fund work in market development and product promotion. This would allow recognition of the fact that market development is often the final phase of R&D, and would place RIRDC on the same basis as other RDCs.

Extending the provision for voluntary levies raised under the RIRDC umbrella to be matched by government funds would allow RIRDC to generate more public good benefits as well as going some way to maintaining the value of RIRDC's funding in real terms.

The Productivity Commission's terms of reference seek comment on the scope for improvements to the current RDC model. This section addresses two changes to RIRDC's operations that could enhance its effectiveness.

7.1 Market development and product promotion

Under its current operating arrangements, RIRDC is unable to undertake activities in market development (a range of activities that enhance the ability of industry to properly satisfy markets) and product promotion (particularly, promotion of the benefits of products in general, rather than specific brands of those products). However there are a number of reasons why obtaining the ability to do so would be beneficial to RIRDC's operations (and therefore to increasing the benefits available to the community).

Promotion and market development as the final stage of R&D

Product promotion and market development are ultimately about providing customers (within Australia or overseas) with information about the features, characteristics, values and uses of particular products. Product promotion is concerned with promoting the product itself rather than particular brands of that product — consistent with RIRDC's commitment to providing industry wide benefits. Market development is concerned with identifying and helping to remove barriers to the successful sale of products to consumers or other users. Again, market development produces industry wide benefits.

In many ways, promotion and development can be seen as the final stage of an R&D project. This is particularly the case for RIRDC's projects because, as already noted, RIRDC works very much at the applied end of the research chain.

Indeed, RIRDC's overall strategic approach to R&D is to emphasise the need for a whole of chain approach to industry development. This comprises a number of elements including:

- understanding markets;
- developing and improving products;
- improving production systems;

- improving post harvest systems; and
- facilitating intra-industry communication.

This approach effectively starts with understanding what consumers want and then working back up the chain to ensure that production processes are able to deliver this (consistent, of course, with producer incentives to supply). Product promotion and market development is a missing element in RIRDC's overall production chain approach. Without effort applied to market development, there is a risk that valuable research outcomes will not ultimately be realised.

Better managing the product cycle

In the early stages of industry development there is an emphasis on solving production problems through traditional R&D. At this stage, industry development programs are primarily and sometimes exclusively funded from government contributions. As the industry develops further, however, mechanisms for industry funding contributions are established by statutory levy or other means and the government contribution as a proportion of total budget declines — at the same time in the industry development cycle as the need for promotional activity is increasing. A shift in the balance between the need for traditional R&D and the need for product promotion occurs later in the industry development cycle. Statutory authority for RIRDC to apply promotion levy funds or voluntary contributions to product promotion could be used very effectively by RIRDC to demonstrate outcomes and to leverage greater industry contributions to its programs. This could be particularly important for new industries (such as native foods) where there is very little consumer experience of the product.

Consistency with practice in other industries

General product promotion has played an important role in all of Australia's large rural industries. In most of these industries, levy funds are available for both research and promotion and market development activities. Indeed, a number of large R&D corporations explicitly recognise that R&D and promotion are mutually reinforcing activities.

Without a promotion and market development function, RIRDC supported industries are in effect not receiving equal treatment with other rural industries. This has the potential to lead to market distortions and can lead to industry uncertainty about what R&D umbrellas they are best suited to.

Efficiently managing promotion across a range of industries

Given the small size of the industries with which RIRDC is concerned, the establishment of separate levies or separate organisational infrastructure for product promotion in each industry would not be efficient. The expansion of RIRDC's charter to cover product promotion would allow for the efficient management of promotion and market development funds.

7.2 Funding issues

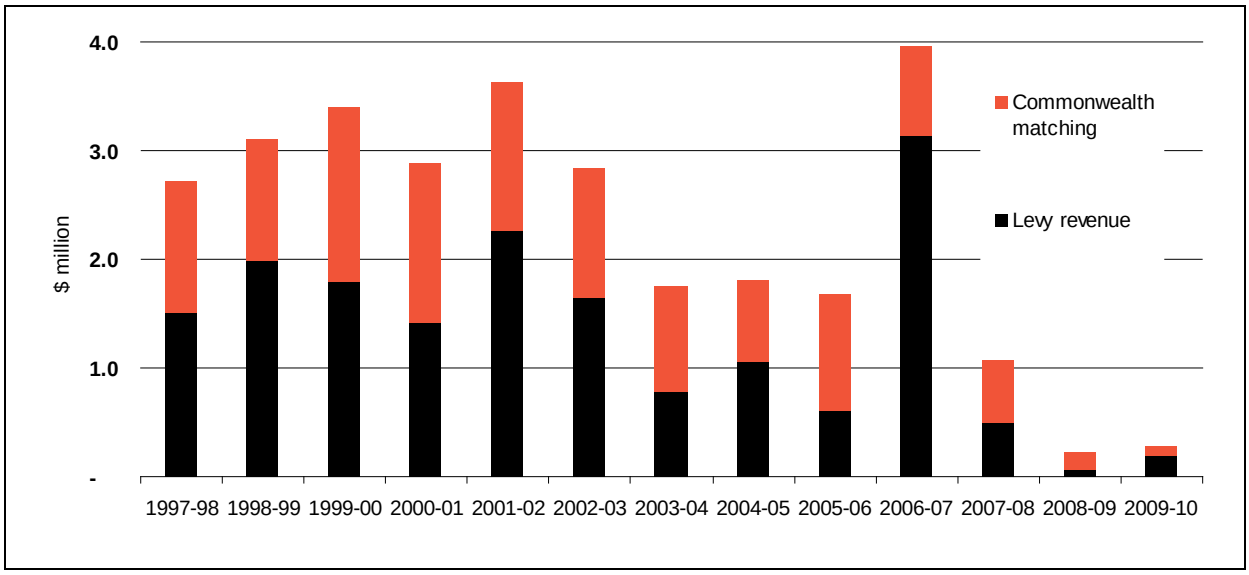
Funding based on GVP

The Commission's *Discussion Paper* raises the question as to whether the general appropriations for RIRDC 'give too much or too little weight to the somewhat different nature of the R&D projects they fund'. It also asks whether basing the government contribution on GVP provides an appropriate means to calibrate contributions given the inherent risks in trying to pick winners or losers.

There is no easy answer to the question of the appropriateness of GVP as a basis for the government contribution. The Government's contribution might be determined on some other basis and separately managed, but this model would also have deficiencies, particularly as the overall level of funds may not relate to any criteria of R&D need. It may also result in greater separation between funding decisions and stakeholders, including those to whom the outcomes are delivered, and would possibly result in higher transaction costs.

GVP at least links the level of R&D investment to the size of an industry, which provides an indirect proxy for the potential benefits from R&D and for research needs. However, it also has drawbacks. In particular, if the level of output varies widely (because of predictable factors such as drought, for example) so too will research funds. This can jeopardise the viability of R&D projects such as breeding programs and can in some cases lead to a loss of R&D capacity. Rice is a good example of this point. Figure 11 summarises levy and matching funding for rice. As can be seen, it has varied dramatically in recent years.

Figure 11: Levy and matching research funding for rice



Note: The rice levy increase in January 2006 at the request of rice producers.
Source: RIRDC.

RIRDC's case

RIRDC has three sources of income:

- an annual appropriation from government (61 per cent of total revenue in 2008-09);
- matched levy funds from a range of industries (19 per cent of total revenue in 2008-09); and
- funds from a range of outside sources associated with collaborative activities and voluntary contributions (16 per cent of total revenue in 2008-09).

The annual government appropriation is used principally to fund research into new and emerging industries and cross-sectoral research with a small proportion augmenting funds for some established industries. The Board uses the Investment Framework to determine the allocation of these funds.

RIRDC's government appropriation has fallen in real terms over the last decade, which has resulted in good projects not being funded. By contrast, the income of RDCs such as GRDC or HAL has grown because it is linked to GVP.

One option for partially addressing this disadvantage would be to extend the provision for voluntary levies raised by the industries under RIRDC's umbrella to be matched by government funds; similar to the provisions applying to products covered by HAL and the Fisheries RDC. While currently RIRDC has a policy of matching voluntary levies from its existing government appropriation, there is clearly limited capacity to do this over the longer term.

There are a number of additional arguments in favour of such an arrangement:

- First, research funds provided by voluntary levies clearly result in a wide variety of wider public and spillover benefits. On this basis, an additional contribution from government funds would be justified to contribute to these public benefits.
- Second, matching funding for voluntary contributions is likely to encourage additional voluntary funds, particularly for new and emerging industries.
- Third, providing matching funds for voluntary contributions would allow for consistency of treatment with other RDCs where this facility is currently available.

Appendices

A A thematic summary of RIRDC's trade policy research

The failed attempt to launch a multilateral round of trade talks at Seattle 1999 highlighted the large gap between those wishing to liberalise and those not. The seminar staged by RIRDC and the Cordell Hull Institute at Seattle at the time showed a complete lack of understanding on the basics of free trade and how easily protectionists could create hysteria by appealing to emotional fears. The publication *Reason versus Emotion* directly addressed those issues and it became apparent that far greater diagnosis of the problem would be required to see progress. The Cairns Group of Farm Leaders took ownership of the seminar and the resulting publication at the time (RIRDC 2010b).

Hence, the study *Solving the Problem* was commissioned. That study showed that the essence of the problem was a political one — there were simply not enough groups who stood to benefit from liberalisation engaged in the debate. These groups had to be identified and a broader coalition of support for liberalisation built. Again, the Cairns Group of Farm Leaders claimed ownership of this publication and its release.

To further demonstrate the importance of global trade reform, RIRDC commissioned the development of *Why Market Access Reforms Matter*. This publication brings together pertinent research results from a variety of World Bank, International Monetary Fund (IMF), Australian Government (ABARE), World Trade Organisation (WTO) and United Nations Conference on Trade and Development (UNCTAD) research publications, presented in a series of concise charts and diagrams. It includes estimates of the levels of protection in different groups of markets (industrialised and developing), the direction and composition of agricultural trade flows and projections of the impact of different approaches to agricultural trade liberalisation, contrasting the impacts of cutting export subsidies and reducing market access barriers (RIRDC 2010b).

One of the groups opposed to liberalisation by themselves were the developing countries — yet they stood to gain the most from their own reform. They were being 'bought off' by preferential deals to protected markets that amounted to little. Hence, the study *Preferential Trade and Developing Countries: Bad Aid, Bad Trade* was undertaken. It demonstrated the fallacies that surround preferential trade access. Preferences were not giving effective aid — in fact, by way of example, it was costing $13 to transfer $1 of aid to those banana producers with favoured access to the European market. That finding was also used in the dispute hearing on bananas in the WTO. This work was also picked up and used by the World Bank who sought copyright permission to use the study (RIRDC 2010b).

The influence of this publication on policymakers around the world was profound. The Government of Thailand cited this publication as a crucial piece of evidence in an application to the WTO. The WTO itself had already noted the importance of this analysis and the Cairns Group of Farm Leaders claimed ownership on its launch.

Related to the granting of preferences to developing country exporters as a form of aid, was the issue of granting food aid to poor countries. While granting food aid in emergencies is ethical and appropriate, food aid is granted in other circumstances and this can have trade distorting effects.

The RIRDC publication *Food Aid and Agricultural Trade Reform*, addresses these issues. It found a substantial amount of food aid is provided in ways that distort markets of the rural industries of recipient countries (RIRDC 2010b). Key findings from the *Food Aid and Agricultural trade Reform* include:

- Food aid should result in targeted flows of commodities that match consumption preferences.
- Evidence suggests that fluctuations often involve surplus disposals by donor countries.
- For some donors the provision of food aid has more to do with promoting extra external outflows of products when the need arises.

Realising that the United States was going to be pivotal in the Doha talks, RIRDC contributed to a 'strategy' meeting held at a weekend retreat near Washington DC. Major policymakers and those with influence in trade talks participated. It was chaired by Ambassador Clayton Yeutter, the lead negotiator for the US during the Uruguay Round. The discussion was valuable so the proceedings were written up in the publication *Opportunity of a Century to Liberalise Farm Trade* and taken to the Cairns Group Farm Leaders meeting in Bolivia. It was used to inform the Cairns Group farmers on the issues and what action could be taken (RIRDC 2010b).

By then it was realised that green groups were a key group opposing liberalisation of trade, claiming more damage to the environment as a result. But the opposite was true as a study on *Greening Farm Subsidies: The Next Step in Removing Perverse Farm Subsidies* found. Of the US$600 billion of world farm subsidies a year ($A2 billion a day!) around 80 per cent were 'perverse'. That is, they not only damaged the environment, they also harmed the economies giving those subsidies as well as the economies of other countries. To encourage green groups to be part of the coalition for reform, the study was conducted with the World Wide Fund for Nature. The arguments presented here were picked up by US academic environmental economists who showcased the analyses as counterproductive policies of the US government (RIRDC 2010b).

Still the Doha talks lurched from crisis to crisis and for all the good analyses produced by RIRDC, the World Bank, the OECD and many others, the wider public was not convinced of the benefits of liberalisation. Part of the problem was the foundations of the WTO itself. So a closer look at the issues was undertaken and published as *Termites in the Basement: To Free up Trade, Fix the WTO's Foundations*. It was seen that many of the WTO's rules and agreements were inconsistent with each other. For example, there were rules stating non-discrimination as the key principle but other rules permitted discrimination. There was a rule banning dumping but part of another WTO agreement that sanctioned dumping. There was a rule banning quotas in favour of tariffs but part of another agreement sanctioned the use of quotas. These major contradictions made it impossible for the broader community to make sense of the rules (RIRDC 2010b).

In addition to these contradictions, the whole basis of the negotiation, that of reciprocity ('I will reduce my tariffs if you reduce yours') was flawed in economics. It conveyed the implicit neo-mercantilist message that 'exports were good, but imports were bad'. The truth is exactly the opposite – the whole purpose of economic activity is to consume. As imports give better value-for-money for consumers they make people better off. Imports are good but they have to be paid for and that is why exports are also good. The most recent imbalance in world current account balances (China, Japan and other Asian economies with massive surpluses and the US with a

massive deficit) partly explains the financial dislocation on world financial markets that is unravelling now (RIRDC 2010b).

Throughout the cut and thrust of the Doha negotiations, it became apparent that there was a fundamental lack of knowledge about agricultural trade policies around the world and how they worked. In fact, protectionist forces worked to make things complicated. They would engage in obfuscation and avoid transparency of what was at stake and why. It was becoming all but impossible for the lay person to make sense of 'tariff-rate-quotas', 'green box', 'blue box', 'modalities', 'multifunctionality' and the 'Swiss formula' to name a few. So a simple, easy-to-read publication *Agricultural Trade Policy Made Easy* was produced. It was taken to South America and proved to be very useful. So much so, it was translated into both Portuguese and Spanish and widely distributed by Australian embassies. It highlighted this constant need to educate the public about the basics of trade and agricultural trade policy if there was to be any shift in public thinking about the benefits of freer trade. The agricultural trade policy analyses commissioned by RIRDC are widely used in the Inter-American Development Bank, South American universities and think tanks and have helped contribute to the improved understanding of trade policy issues in many Cairns group countries in that region (RIRDC 2010b).

To further support the need for transparency about the costs of protection and benefits of trade, RIRDC commissioned *Rural Industry Adjustment to Trade Related Policy Reform*. This work demonstrated the fallacy of some of the ideas about the costs of adjustment to policy change that are popularly promulgated by opponents of change. It has been used and cited by the OECD as a contribution to the understanding of the issues (RIRDC 2010b). An example of this is the Closer Economic Relations (CER) agreement. Bilateral liberalisation generated through this agreement was one of adjustment for the Australian dairy industry. As the Australian dairy industry became more competitive it became easier to shift towards unilateral liberalisation (RIRDC 2010c).

Slow progress with Doha saw countries resort to bilateral free trade agreements (FTAs). These 'free' trade agreements are preferential and so have a down side as well as any trade liberalisation benefits. A major debate emerged on the efficacy of the FTAs. While some FTAs showed that benefits exceeded the costs, for others the reverse applied. So a study was undertaken '*Free' Trade Agreements: Making them Better* to identify the factors that made for good FTAs and what led to bad ones. This included the question: 'does the FTA allow for expansion to include new members and potential integration with other FTAs?' It suggested a new initiative to stop the plethora of FTAs and encourage multilateral liberalisation of trade. If this initiative were successful, it would have removed preferential trade, the need for rules of origin, the need to form FTAs in the first place and it would mean the multilateral liberalisation of trade (RIRDC 2010b).

The growing number of FTAs may result in a positive cycle of bidding wars. For countries that are already party to a FTA each additional FTA results in less trade diversion and so increases the likelihood of a positive impact upon welfare. This increases the incentive to join additional FTAs creating a 'race towards free trade' as countries out-bid each other in offering more and more liberalisation (RIRDC 2010c).

Another blocking force in the liberalisation debate was the stance of the European Union. They argued that the adjustment costs were too great so liberalisation had to be small and gradual with plenty of 'sensitive' sectors left out. Yet anecdotal evidence suggested otherwise (RIRDC 2010b). When Japan halved (roughly) its beef protection in 1991, domestic Wagyu beef production went

up slightly over the following decade. When Australia liberalised its dairy market, dairy exports increased. So a study examined the impact of liberalisation on structural change. It was titled *Trade Liberalisation and Structural Change* and found that simple analyses of the consequences of liberalisation of farm products were wrong. They overstated costs and understated benefits. The study demonstrated that a more comprehensive examination of the issue in an economy-wide framework that allowed for flow-on productivity effects as a consequence of liberalisation was a more accurate representation of incomes. The benefits of liberalisation were larger and the costs smaller than commonly found. The European position was weakened. The slow process of obtaining consent from the European Union for agricultural trade reform has been making progress through the provision of this information and can be demonstrated with their gradual transitioning of their assistance arrangements to less distorting means such as the Single Farm Payment (RIRDC 2010b).

Still a major stumbling block in the Doha talks was the developing countries. They were looking for a 'free ride' and insisted that they were poor because rich countries did not accept their exports. Therefore, rich countries should liberalise first. So an analysis of the veracity of this position was analysed in *Trade Policy and Developing Countries: Where to Now?* It found that the primary reason developing countries were poor was because of their own domestic and trade policies and not from the policies of other countries. Often around 90 per cent of the benefits from liberalisation were gained by a developing country *removing their own* barriers to trade. Moreover, those developing countries doing the best, such as Chile, had unilaterally reduced their trade barriers. Developing countries (and rich countries too) needed to set up *domestic* processes to identify the benefits and costs of their own actions. If this became widely understood a major obstacle to a successful outcome from the Doha talks would be overcome. The impact of the arguments presented can also be assessed by how the opponents of agricultural trade liberalisation react to the RIRDC publications. South Korea is an example of a nation that monitors very closely these publications and the arguments presented, however it is not known what actions they take (RIRDC 2010b).

That study led to the final major study on *Policy Transparency: Why does it work, Who does it best*. The fundamental problem with the Doha talks failing so far is that countries are not taking decisions in their own national interest. But decisions in the national interest cannot be made if people do not know what is in the national interest. And rarely is the national interest from trade policy liberalisation made in each domestic capital in a way that a wider public and policymakers understand the right path to choose (RIRDC 2010b). Where such domestic processes are used to measure the national interest impacts of trade policy in an open and transparent way there has been significant trade liberalisation for the benefit of the domestic economy. Australia is a case-in-point. In launching this publication, the then Assistant Treasurer stated "*Australia's economic resilience over the past two decades owes a lot to our transparent policy processes and the reforms we have undertaken in that time. This report is a useful contribution to the debate about economic policy and how more transparent decision-making can benefit all sectors of an economy.*"

Good policy transparency involves the open public scrutiny of the economy-wide national benefits and costs of changing trade policies. Transparency has several inter-related elements and for best results each has to work well. Transparency identifies the national interest, it informs and educates the government and the public, it exposes narrow vested interests, weakening their influence, and it helps build coalitions for reform. It also leads to a more predictable policy environment and reduces uncertainty faced by investors (RIRDC 2010b).

B Summary of research evaluation outcomes

Project		*NPV*	*IRR*	*BCR*	*NBIR*	*Discount rate*	*Dollar terms*	*Source*
		$m	*%*			*%*		
New and emerging industries								
Alpacas	Productivity and marketing improvement	2.2	34		4.6	5	1997-98	Michael 1998 (in Gordon et al. 2005)
Black truffles	Black truffles	58.4	16	2.1	38	5	2004	Gordon et al. 2004
Buckwheat	Buckwheat	6.4	46.2	9.2		5	1999-2000	CIE 2000
Cashews	Breeding	-2.3	2.8		0.4	5	1997-98	Chudleigh in CIE 1998 (in Gordon et al. 2005)
	Pest management	1.6	26		20	5	1997-98	Chudleigh in CIE 1998 (in Gordon et al. 2005)
Coffee	Harvester	8.6	8.2	4.9		5	1999-2000	CIE 2000
	Coffee	4.99	19	2.9	19.2	5	2004	Gordon et al. 2004
Coriander	Coriander	4.2	35.7		15.7	5	2004	Gordon et al. 2004
Crocodiles	Farm productivity	0.1	5.5	1.1		5	1999-2000	CIE 2000
Dairy goats	Farm productivity	1.2	42	10		5	1999-2000	CIE 2000
Emus	Processing and product development	2.4	46		5.3	7	1994-95	Bathgate and Coyle 1997 (in Gordon et al. 2005)
	Processing and product development	1.8	19		2.4	5	1997-98	Michael 1998 (in Gordon et al. 2005)
Essential oils	Boronia	0.17	11		1.3	8	1997-98	Brennan in CIE 1998 (in Gordon et al. 2005)
	Boronia	0.46	16		2.3	8	1997-98	Brennan in CIE 1998 (in Gordon et al. 2005)
	Boronia	1.74	35		4.8	8	1997-98	Brennan in CIE 1998 (in Gordon et al. 2005)
	Boronia	3.66	61		6.8	8	1997-98	Brennan in CIE 1998 (in Gordon et al. 2005)
Herbs and spices	Calide Valley	0.8	9	1.9		5	1999-2000	CIE 2000
Jojoba	Current outcomes sustained	3.5	12.8	1.5	5.9	5	2004	Gordon et al. 2004
	Yield and area growth	34	38	2.8	46.3	5	2004	Gordon et al. 2004
Kangaroos	Trading manual	1.5	231	36		5	1999-2000	CIE 2000
Lentils	New varieties	31.8	54	81.6		5	1999-2000	CIE 2000
Myoga (Japanese ginger)	Myoga (Japanese ginger)	10	26.9		18.8	5	2000	CIE 2000a (in Gordon et al. 2005)
Olives	Olives for oil (lower quality outcome)	58.6	29.7		12	5	2004	Gordon et al. 2004
	Olives for oil (high quality outcome)	264.2	45.2		103	5	2004	Gordon et al. 2004

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Project		NPV	IRR	BCR	NBIR	Discount rate	Dollar terms	Source
		$m	%			%		
Rabbits	Crusader farmed rabbit	4.55	15.7		4.6	5	2003	Gordon and Garrett 2004
Rare and natural animal fibres	Measurement of goat fibres	3.4	48		29	7	1994-95	Bathgate and Coyle 1997 (in Gordon et al. 2005)
Tea tree oil	Breeding	19	23		14	5	1997-98	Chudleigh in CIE 1998 (in Gordon et al. 2005)
	Pest control	21.5	89		1.2	10	1992-93	Fearn 1994 (in Gordon et al. 2005)
Wildflowers	Post harvest quality	0.13	13		1.4	7	1994-95	Bathgate and Coyle 1997 (in Gordon et al. 2005)
	Breeding and selection projects (22 projects)	9.3	14		2.2	5	1997-98	CIE 1998 (in Gordon et al. 2005)
	Geraldton wax breeding	0.12	12		1.3	10	1992-93	Fearn 1994 (in Gordon et al. 2005)
Established industries								
Agroforestry	Agroforestry and hydrology	4.1	21		2.4	5	2002	Bauer et al 2003
	Cabinet timbers	10.5	10.6		8.4	5	2002	Bauer et al 2003
	Master Tree Growers	17.2	15		11	5	2002	Bauer et al 2003
	Site and species selection (base) a	70.7	23.6		26.2	5	2002	Bauer et al 2003
	FloraSearch (Stage 3) - Selection of development of multi-purpose perennials	2.79	11.1	3.1		5	2008-09	Chudleigh and Simpson 2009a
	Viability of single-desk marketing of farm forestry timber	0.98	25.4	9.9		5	2008-09	Chudleigh and Simpson 2009a
	Prioritisation of regional opportunities for agroforestry investment	7.55	35.4	37.1		5	2008-09	Chudleigh and Simpson 2009a
	Farm trees in New England Tablelands	5.9	59		10	5	1997-98	CIE 1998 (in Gordon et al. 2005)
Chicken meat and eggs	Eimeria vaccines	46.14	31	20.8		5	1997-98	Gordon and Davis 1999
	Amino acid feeds	32.71	93	69		5	1997-98	Gordon and Davis 1999
	Project group: Evaluating risks posed by pathogen emissions from meat chicken sheds; Literature review and risk assessment for the safe and sustainable utilisation of spent litter from meat chick sheds; Trials of odour control technologies on broiler farms; Efficacy of windbreak walls for odour reduction	0.92	8	1.5		5	2008-09	Simpson and Chudleigh 2009
	New diagnostic assays to improve control of coccidiosis in poultry	1.29	12.6	3		5	2008-09	Simpson and Chudleigh 2009

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Project		NPV	IRR	BCR	NBIR	Discount rate	Dollar terms	Source
		$m	%			%		
	Field exercise - use of carbon dioxide for euthanasia of poultry	4.49	604	102.8		5	2008-09	Simpson and Chudleigh 2009
	High density diets post-moult	22.99	226	164		5	1997-98	Gordon and Davis 1999
Deer	Alternative feed	0.1			2.1	7	1994-95	Bathgate and Coyle 1997 (in Gordon et al. 2005)
Fodder crops	Inoculants for lucerne	0.14	26		2.8	7	1994-95	Bathgate and Coyle 1997 (in Chudleigh and Simpson 2009b)
	Hay and silage management	1	60		4.2	7	1994-95	Bathgate and Coyle 1997 (in Chudleigh and Simpson 2009b)
	Oaten hay exports	5.4	97		20	7	1994-95	Bathgate and Coyle 1997 (in Chudleigh and Simpson 2009b)
	Best practice super conditioning to produce quality export oaten hay	0.94	31.2	11.7		5	2008-09	Chudleigh and Simpson 2009b
	Industry practices to meet mandatory export market standards	3.39	47.3	12.6		5	2008-09	Chudleigh and Simpson 2009b
	Technology transfer of BMP/QA systems for quality lucerne hay production	1.4	42.9	18.9		5	2008-09	Chudleigh and Simpson 2009b
	Haymaker	5.07	114	11.3		5	1997-98	Gordon and Davis 1999
	Microbial inoculants for hay production	33.07	22	8	31	5	2004-05	Gordon et al. 2005
	Annual ryegrass toxicity	78.4	237	8.9	143	5	2004-05	Gordon et al. 2005
	New oat varieties	118.2	81	105	105	5	2004-05	Gordon et al. 2005
	Hay bale loading	62	484		1817	5	2004-05	Gordon et al. 2005
Honeybees	Control of American foulbrood	10.43	18	18.9		5	1997-98	Gordon and Davis 1999
Horses	Progestagens and pregnancy	-0.01	1	0.8		5	1997-98	Gordon and Davis 1999
Pasture seeds	New temperate legume varieties	2.44	28	4.5		5	1997-98	Gordon and Davis 1999
	Improving subterranean clover seed production	0.15	7	1.3	1.3	5	2004-05	Gordon et al. 2005
	Updated valuation of new varieties	1.75	19	3	3	5	2004-05	Gordon et al. 2005
	Water balance of lucerne seed production	4.92	31	21	21	5	2004-05	Gordon et al. 2005
	Managing lucerne seed wasp	10.32	118	214	214	5	2004-05	Gordon et al. 2005
Rice	Fertiliser management	63	132		8.6	5	2002	CIE 2004
	Weed management - resistance	7.8	45		13	5	2002	CIE 2004
	Pest management – bloodworm and snails	28.4	180		18	5	2002	CIE 2004

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Project		*NPV*	*IRR*	*BCR*	*NBIR*	*Discount rate*	*Dollar terms*	*Source*
		$m	*%*			*%*		
	Pest management - rotations	23.6	73		23	5	2002	CIE 2004
	Weed management - SCWIIRT	1.5	87		70	5	2002	CIE 2004
	EM-31	156.9	81		99	5	2002	CIE 2004
	Aromatic varieties	11.5	55		7	5	1992-93	Fearn 1994 (in Gordon et al. 2005)
	Early maturing	9.9	55		16.4	5	1992-93	Fearn 1994 (in Gordon et al. 2005)
	Harvester efficiency and trash	2.6	129	11.8		5	1997-98	Gordon and Davis 1999
National rural issues								
Farm Health and Safety	National Farm Injury Data Collection	1.87	15.3	2.52		6	2005-06	Chudleigh and Simpson 2008
	National Farm Machinery Safety Program and Regulatory Review	5.66	33.9	13.63		6	2005-06	Chudleigh and Simpson 2008
	Effective Safe Play Area Fencing Options for Rural Properties	2.02	175	55.3		6	2005-06	Chudleigh and Simpson 2008
Future Agricultural Systems	EMS	8.93	34	6.5		5	2000-01	Gordon et al 2001
	RAINMAN	13.65	29	6.7		5	2000-01	Gordon et al 2001
	Tractor seats	2.55	38	16.4		5	2000-01	Gordon et al 2001
	Trade policy	135.59	49	190		5	2000-01	Gordon et al 2001

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