

A Retrospective on Rural R&D in Australia

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Author Note:

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Contents

Executive Summary	v
1. Some Introductory Comments	1
1.1 The rationale for public support	1
1.2 Trends in public support.....	2
2. Sketching the Current Framework – A Snapshot	6
3. The Current Framework – Its Evolution	7
3.1 By those that do (supply) the Research	7
3.2 By those that fund (demand) the Research.....	9
4. The Current Framework – Key Reviews	13
4.1 Industry Commission Report 1995.....	13
4.2 Productivity Commission Report 2007	13
4.3 Report by the Agriculture and Food Policy Reference Group 2006.	14
4.4 The Review of the National Innovation system 2008 by an Expert Panel	15
5. The Current Framework – Priorities and Governance	17
5.1 Priorities	17
5.2 Governance.....	19
6. Monitoring, Evaluation and Impact Assessment.....	20
7. Looking Back – Some Reflections	21
7.1 Funding Support at the State Level	21
7.2 Funding Support at the Commonwealth Level.....	21
7.3 Program Priorities and Directions	22
7.4 The Balance of the Research Portfolio.....	22
7.5 Workforce Issues – Running Down the Human Capital	23
8. Some Specific Issues	24
8.1 The role and contribution of public institutions, including universities, and the private sector in rural	24
8.2 Common research themes and collaborative efforts in the rural sector over time	24
8.3 Funding trends and funding models in Australian rural R&D	25
8.4 The changing nature of extension.....	25
8.5 Changes to the positioning of rural R&D within the national innovation system as a whole across portfolios	26
8.6 Key legislative and structural reforms that have impacted on this positioning.....	28
8.7 Australia’s involvement in international rural R&D	28
9. Some Conclusions	31
Appendices	32
Appendix 1. National Innovation Strategy – May 2009	32
Appendix 2. Selected bibliography	33
Appendix 3. Consultant’s brief	34

Tables

Table 1. Gross Expenditure on R&D, by Sector	5
Table 2. CSIRO's financial performance – Five years at a glance.....	8
Table 3. Research and Development Corporations and Companies - Funding 2007-08.....	10
Table 4. Agricultural Research Expenditures by region, 1981 and 2000.....	30

Figures

Figure 1. Share of agricultural, veterinary and environmental science R&D by sector	2
Figure 2. Australian Government Expenditure on Science and Innovation, 1993–94 to 2007–08, as a proportion of GDP.....	3
Figure 3. Aggregate annual private and public sector investment in RDC R&D.....	4
Figure 4. Business sector expenditure on R&D, selected industries	4
Figure 5. Trends in Business Expenditure on R&D	5
Figure 6. Australia's Rural Research Framework – A Simplified View.....	6
Figure 7. Elements of a National Innovation System.....	27

Executive Summary

- Australian agriculture has been built on innovation. One of the drivers of this innovation has been a strong commitment by Commonwealth and State governments to fund and provide research services and by industry to provide research funding.
- Looking back over the last twenty years, the Commonwealth has substantially expanded its involvement across the research spectrum. Commonwealth funding to higher education research accounted for around 30 per cent of total direct Commonwealth financial support for science and innovation in the 2009-2010 Budget. A key Commonwealth agency - CSIRO - now has outlays of more than \$1.2 billion with around 50 per cent provided directly by the Commonwealth Government.
- Of the \$1.66 billion now spent annually on rural related R&D, the Research and Development Corporations (RDCs) fund around \$500 million. This has grown from around \$200m annually over the past twenty years and is now the largest single source of rural related research funds.
- The pressures on these joint Commonwealth/Industry RDC funds are increasing as research providers attempt to recover a higher level of their costs and the growth in RDC revenues slows because of drought and the matching funding 0.5 per cent GVP cap. The pressures on RDC funds to do more with less will continue to grow.
- A key response to these funding pressures is an increasing focus on priorities. While the RDCs have held onto productivity enhancement, we have seen a slow down in revenue growth and a diversion of overall funding away from farm productivity improvement. In that sense, agricultural R&D is at a crossroads – at a time when many are questioning our capacity to provide for a projected world population of close to 9 billion people by 2050 that is being challenged substantially by climate variability and change.
- In the face of these funding pressures, the research framework is changing. Reducing duplication through institutional consolidation to provide critical mass and efficiency is under way. The current work of the Commonwealth-State Primary Industry Ministerial Council will be vital. While entrenched interests will slow the process, the directions of more collaboration, more specialisation, larger critical mass, and less fragmentation seem inevitable. The changes on the research supply (doing) side are progressing at a faster pace than the research demand (funding) side.
- The rural research framework is arguably more vulnerable than it looks. Costs are being shifted from the States to the Commonwealth and Industry. The CRCs and CSIRO Flagships are fulfilling valuable niches, particularly in the cross sectoral agenda. In the context of the forthcoming Investment Plan for Rural Research and Development being drawn up, one option could be to revisit the industry based funding framework to ensure that sector wide priorities are addressed more strongly. In any redesign, the involvement of rural industries would be vital. One of the great strengths of the industry specific RDCs is their linkage to their constituents and these linkages need to be built into cross sectoral funding arrangements.
- Australia cannot afford to continue funding applied rural research with a cross-sectoral focus that does not have defined adoption pathways built into its design and the active engagement of the beneficiaries during and after the research phase.

1. Some Introductory Comments

Australia's rural industries have a strong tradition of being innovative and adaptive to new challenges and have proven to be highly efficient and competitive in international markets. Innovation has been a major factor in providing primary producers with a competitive advantage and in maintaining the environmental sustainability of Australia's primary production systems.

The Rural Research and Development Council, established by the Minister for Agriculture, Fisheries and Forestry in 2009, has been tasked with developing an investment plan for rural research and development. In order to do this in an informed way, the Council sought to understand the history of rural research and development in Australia and what has shaped our research and development system and influenced research priorities.

This brief history attempts to illustrate how rural research has developed over past decades. It has a long history. Farrer solved the problems of summer droughts settling in before the wheat crop was ready for harvest by crossing Indian and European varieties in 1901. He also began the research that led to rust resistant wheat varieties. Other well known early breakthroughs were Ridley's grain stripper and Smith's stump jump plough. And it was McKay who, in 1884, invented the combine harvester. Today Australia is one of the world leaders in conservation agriculture practices. Its broad acre agriculture has a strong record of productivity growth.

The paper explores how, under Australia's federal system of government, the different, but complementary roles of the States and the Commonwealth have evolved as the research needs have changed. From the Commonwealth's perspective, the paper looks at the significant policy changes and legislative milestones that have occurred. Finally, the paper attempts to point to some of the more recent trends and pressures that are shaping the rural research agenda.

Before turning to the substance of the paper, a short précis of the rationale for public support and some data on the trends in this support are provided.

1.1 The rationale for public support

Strong public support for rural research has a long history in Australia. So does industry funding of this research. The first legislated levy on industry for research commenced in 1936. This was the *Wool Purity and Research Act 1936* and today all the major industries have levies that raise revenue for research. This industry revenue is matched by general taxpayer revenue. The policy rationale for providing this support to rural research is that:

- the sector is characterised by many industries with a large number of producers unable to capture sufficient benefits from R&D they would fund as individuals, which potentially leads to **under-investment**;
- the collection of compulsory levies avoids **free-riding** by some on R&D provided by others; and
- there are **spillover benefits** to the wider community that are not captured by the immediate industry.

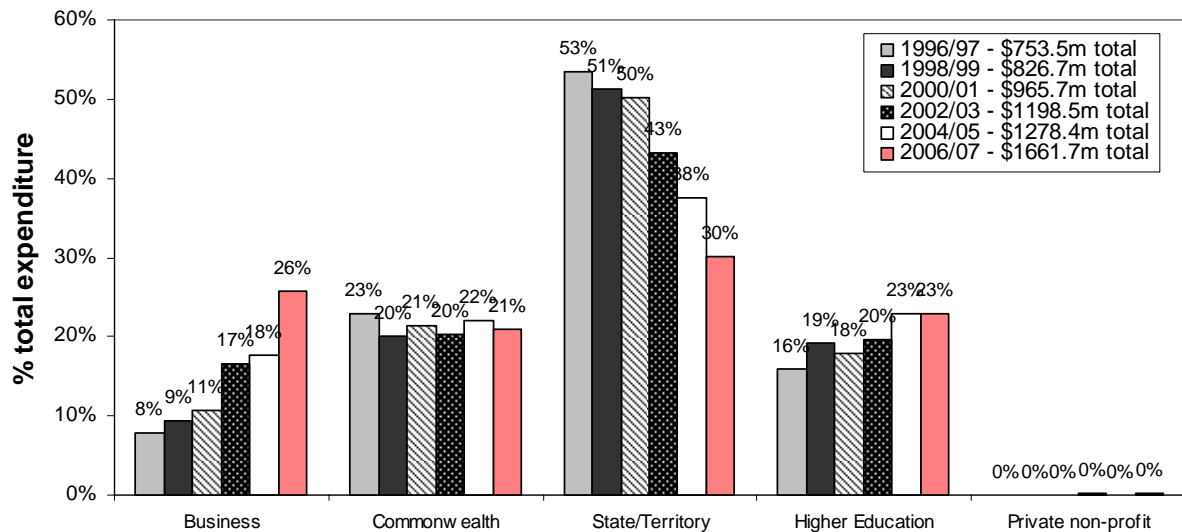
In addition there is substantial general taxpayer funding to research institutions that undertake the research at both the Commonwealth and State levels. At the Commonwealth level, there is core funding to the CSIRO and Universities and by the States to their Departments responsible for agriculture, fisheries and forestry.

Putting aside the question of quantum, the rationale of public support for rural research is well grounded. There is a broader economy wide agenda to foster productivity growth and, in the case of rural industries, research generates substantial spillover benefits to the broader community. There is now substantial public expenditure on research across nearly all sectors of the Australian economy. Publicly funded rural research is not the exception.

1.2 Trends in public support

- Aggregate data on rural research funding levels is weak, in the sense that there is little on the allocation of funding to priorities. The published ABS data only provide very broad trends in research and development expenditure by providers, and do not provide any depth in the flow of funds from the Commonwealth or RDCs to researchers or how the funds are spent against priorities.
- A breakdown of expenditure by source as a proportion of the total since 1996 is shown at **Figure 1**. While total R&D expenditure has increased by all key providers, the trend among providers has changed. Expenditure by the states/territories — while still predominant over other sources — has declined proportionally over the period of the Australian Bureau of Statistics (ABS) survey on research and experimental development (from 1996–97 to 2006–07). Over the same period expenditure by business and higher education has increased as a proportion of total expenditure.

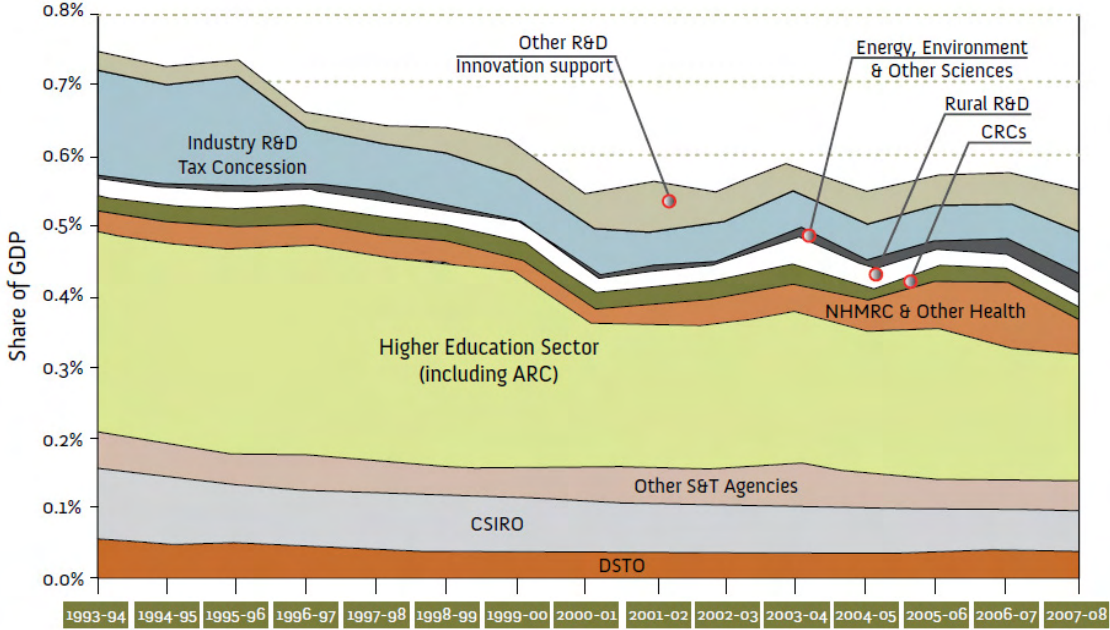
Figure 1. Share of agricultural, veterinary and environmental science R&D by sector



Source: ABS, Catalogue No. 8112.0, 2008.

At the Commonwealth level, aggregate expenditure on science and innovation has fallen, as a proportion of GDP, from 0.74 per cent to 0.58 per cent (see **Figure 2** below). The Commonwealth science and innovation budget was increased from \$6.56 billion in 2007-08 to \$6.88 billion in 2008-09 and to \$8.58 billion in 2009-10. There is substantial out-year growth foreshadowed (see Appendix 1).

Figure 2. Australian Government Expenditure on Science and Innovation, 1993–94 to 2007–08, as a proportion of GDP

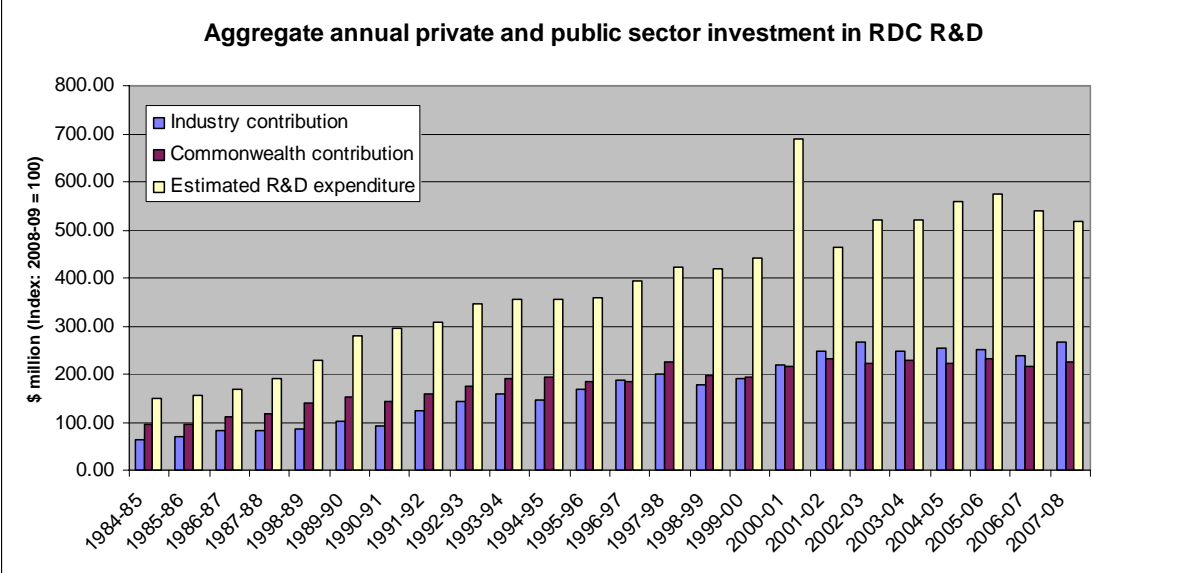


Source: Cutler, T. “A Review of the National Innovation System”, August 2008, p. viii

Commonwealth support to rural research comes from a number of sources. The single most important is the funding going to the 16 Rural R&D Corporations and industry owned companies. But others such as core funding to the Universities and CSIRO and the CRC program are also vital. In 2007-08 the Government contributed over \$200 million in matching eligible R&D expenditure to the RDCs. These funds, matched with industry contributions, mean the combined expenditure by the RDCs is now around \$500 million each year.

Figure 3 below shows the growth in investment (in real dollars) from 1984-85 under the research and development council arrangements through to the current day arrangements under the RDC model which was first implemented in 1990.

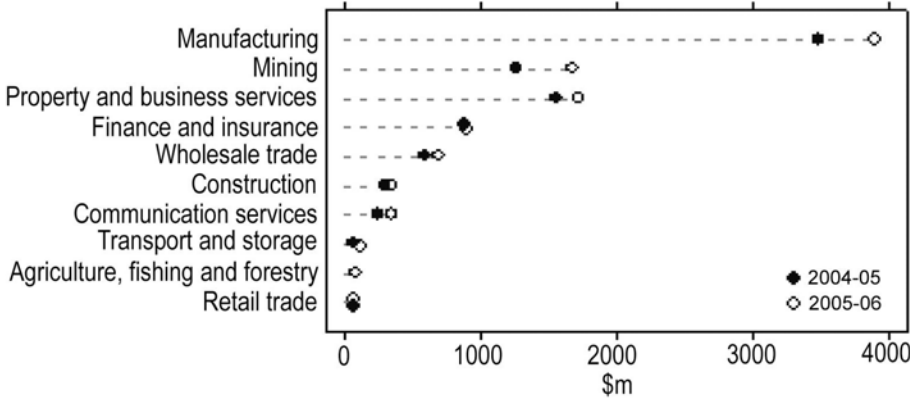
Figure 3. Aggregate annual private and public sector investment in RDC R&D



Source: Australian Government Department of Agriculture, Fisheries and Forestry, 2009

While the ABS data has its weaknesses it is clear that most of the rural research is being done by publicly funded agencies. While business investment in R&D has been increasing strongly by 15 per cent in current price terms from 2006–07 to 2007–08 to \$14,380 million, business R&D investment to the “agriculture, fishing and forestry” sector has been very low - down with the retail trade (see **Figure 4**). Data on gross expenditure by sector (**Table 1**) and trends in business expenditure over the past 20 years are also presented in **Figure 5**.

Figure 4. Business sector expenditure on R&D, selected industries



(a) Classified according to the Australian and New Zealand Standard Industrial Classification (ANZSIC), 1993 EDITION

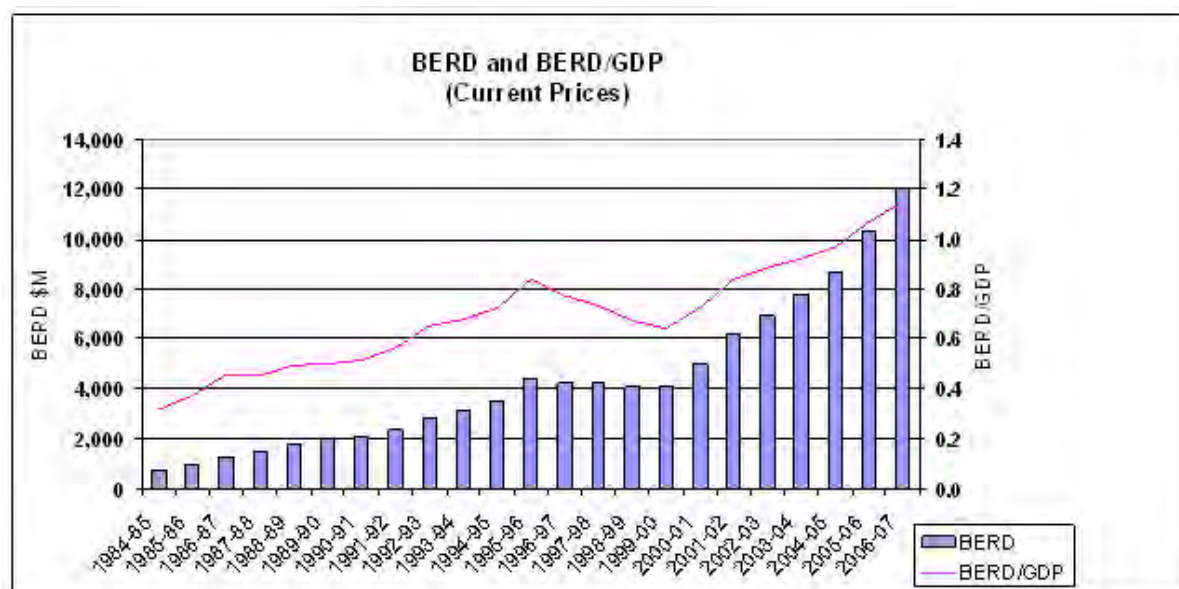
Source: Research and Experimental Development, Businesses, Australia (8104.0)

Table 1. Gross Expenditure on R&D, by Sector

	1996-97	1998-99	2000-01	2002-03	2004-05	2006-07
	\$m	\$m	\$m	\$m	\$m	\$m
Business	4 235	4 095	4 983	6 940	8 676	12 036
Government						
Commonwealth	1 267	1 179	1 405	1 531	1 544	1 893
State/territory	798	864	951	951	942	1 061
Total	2 064	2 043	2 356	2 482	2 486	2 954
Higher education	2 308	2 555	2 790	3 430	4 327	5 404
Private non-profit	186	225	289	360	479	606
Total	8 792	8 918	10 417	13 212	15 969	21 000

Source: ABS, *Research and Experimental Development, All Sectors, Australia (8112.0)*

Figure 5. Trends in Business Expenditure on R&D



Source: ABS, *Research and Experimental Development, Business, Australia, 2006-07(Cat No. 8104.0)*

2. Sketching the Current Framework – A Snapshot

The institutional and structural arrangements through which agricultural research and development is prioritised, funded, performed and delivered are highly complex. An important feature of this system is that while the main structures are governed independently, they are highly inter-dependent in terms of funding, performing and implementing research. As the demand for resources has increased along with the scale of research needed, these relationships have become very complex.

One way of clarifying this complexity is to think about the research framework in terms of those that fund the research (the funders) and those that undertake the research (the doers). While historically dominated by the public sector, this last 20 years has seen a greater degree of separation between the procurement, funding and provision of research services. These definitions are not always mutually exclusive but can help in understanding respective responsibilities of Australia’s complex rural research system as it has evolved up until today. In part this complexity is also driven by our Federal system of government and our history. **Figure 6** seeks to simplify these complexities diagrammatically.

In relative terms, the RDCs are funding between 30-40 per cent of annual rural R&D in Australia and have a major influence on the whole R&D system. While there are exceptions to most generalisations, the majority of the RDC funding today tends to be directed more towards applied research while the more basic or fundamental research tends more to be the province of universities. While it is changing, the universities’ essential role remains the provision of teaching and the generation of high quality, openly disseminated, basic research. CSIRO tends to sit more between the basic and applied ends of the research spectrum. CSIRO expresses itself as being more about key national challenges built on a strong core science capability.

This tendency of the RDCs to fund more applied research is part of a broader trend for the growth in research outlays to be directed more to applied research. According to ABS data, applied research has shown the strongest growth while pure basic research has recorded the lowest.¹

Figure 6. Australia’s Rural Research Framework – A Simplified View

Funders	The Doers	Funders
Core/Institutional Support	By Those Undertaking the Research	Commissioned/Contracted Research - Programs and Projects
Commonwealth	Commonwealth	Commonwealth
<ul style="list-style-type: none"> Department of Innovation, Industry, Science & Research. Department of Education, Employment and Workplace Relations. 	<ul style="list-style-type: none"> CSIRO CRCs Universities 	<ul style="list-style-type: none"> RDCs Commonwealth Depts (e.g. DAFF/CCRP)
States	States	States
<ul style="list-style-type: none"> State Departments. 	<ul style="list-style-type: none"> Research Institutes of State Departments 	<ul style="list-style-type: none"> State Departments
	Private Sector	Private Sector
	There are numerous examples of partnerships/collaboration of agencies listed above.	Some private companies provide funding to either Commonwealth or State agencies to undertake targeted research.

¹ ABS (Cat No. 8112.0)

3. The Current Framework – Its Evolution

As mentioned in the previous section (Section 2) one way of categorising the current rural research system is to do so in terms of those that fund the research and those that do the research.

3.1 By those that do (supply) the Research

The States

All of the States and the Northern Territory have had and continue to have a very substantial investment in rural research facilities and programs. In some cases, the origins of this investment predated Federation. In many cases, the States developed research experiment stations in regions to support local agricultural industries and provide extension/advisory services to farmers.

In aggregate it is the States that have the largest engagement in rural research, whether this is measured by facilities, workforce or program size. It has been a key strength of Australian agriculture but, from a State perspective, also its “achilles’ heel”. Over the past decade, and before that, all States have been under substantial budget pressure to rationalize/cut back on their research investment and today there are three key emerging trends. The **first** is a move towards integration of research facilities with regional universities. The **second** is a recognition that each of the States cannot afford to provide a full suite of research services to industries in each of their States and that agreement is being forged around particular States taking the research leadership for particular industries. And the **third** is that a significant component of the operating costs of State rural research programs is now being funded by the Commonwealth RDCs.

The Commonwealth

The key research agency at the Commonwealth level is the **CSIRO**. It was initiated in 1926 (as CSIR) to respond to national challenges such as pests, weeds and diseases that were affecting agricultural exports. In 1949 it was reconstituted as an independent statutory authority and performs a broad range of functions in accordance with the *Science and Industry Research Act 1949 (as amended)*. In 2008-09, its revenue was around \$1.3 billion of which just over half was core funding from the Commonwealth. The remainder came from external sources (see **Table 2** below).

Table 2. CSIRO's financial performance – Five years at a glance

Revenue by source	2004-05	2005-06	2006-07	2007-08	2008-09
	\$m	\$m	\$m	\$m	\$m
Co-investment, consulting and services					
Australian private sector	63.9	67.6	58.0	68.2	76.3
Australian Governments	89.7	96.5	116.0	119.5	148.3
R&D Corporations	48.0	44.3	43.2	30.2	36.5
Cooperative Research Centres	35.2	35.2	39.8	38.2	40.3
Overseas entities	33.5	36.4	37.2	35.3	61.0
Work in Progress/Deferred Revenue Adjustment	(9.7)	(8.0)	(8.5)	(1.4)	(14.5)
Total co-investment, consulting & services	260.5	272.0	285.8	290.0	347.9
Intellectual property, royalties, etc.	22.0	32.4	30.6	81.7	229.6
Total research and services revenue	282.5	304.4	316.3	371.7	577.5
Other external revenue (including interest)	33.7	43.9	44.5	41.3	40.1
Gain/(Loss) on sale of assets	0.0	15.5	2.7	4.8	17.2
Other fair value gains and reversals	3.1	0.0	0.1	10.8	0.0
Total external revenue	319.3	363.8	363.6	428.6	634.8
Revenue from Government	577.1	593.9	610.1	663.2	668.1
Total revenue	896.4	957.7	973.7	1091.8	1302.9
Less: expenses (excluding value of assets sold)	917.2	947.8	972.7	1044.1	1180.9
Operating result	(20.8)	9.9	1.0	47.7	122.0

Source: CSIRO, Annual Report 2008-09, p iii

Of CSIRO outlays in 2008-09 of near \$1.2 billion, around 40 per cent were directed at rural research if you take the broadest possible definition of “rural” to include all of CSIRO environmental portfolios and all of the agribusiness portfolios except human nutrition, preventative health and transformational biology. On its own, the agribusiness portfolio is around 23 per cent.

In recognition of the scale and scope of some of the challenges Australia is facing, in recent years CSIRO has developed a stronger systems approach through its National Research Flagship program. There are currently ten National Research Flagships which are large-scale multidisciplinary research partnerships that seek to harness world-class expertise to tackle national priorities.

Like the State research agencies, CSIRO has undergone substantial change over the past decade. It is now a much more focused agency. It is placing more emphasis on its “one CSIRO” framework rather than its component parts and is seeking stronger partnerships with other research providers here in Australia and globally. Many of these trends are common with developments in the States.

Another key provider of rural research services at the Commonwealth level is the **Cooperative Research Centres (CRCs)**. The CRC program was established in 1990 primarily to encourage collaboration in research and development between private sector and public sector research bodies and foster research concentration. To date there have been 10 selection rounds resulting in 168 CRCs over the life of the program, with 49 CRCs receiving funding in 2008-09. Of these, more than one third had a rural industries focus.

The CRC program was reviewed in 2008 as part of the National Innovation System Review which found that the program since its inception had delivered significant, identifiable economic and social benefits, particularly through end-user application of research. The CRC program has had a whole-industry impact in CRCs where there is strong drive from an industry intermediary. For example, large numbers of agricultural businesses have benefited from RDC involvement in CRCs. The review suggested that in the future the program encourage more CRCs with impact across broad groupings of end-users and with less commercial focus.

The CRC review also noted that the program had become less attractive to CSIRO, the research-intensive universities, and some significant end-users. The problems centre on the complexity and cost of CRC governance arrangements, such as the high costs of bidding for CRCs, the transaction costs of involvement with them and the lack of flexibility in shaping governance and management to the needs of the partners.

The **Universities** are also significant suppliers of research services to the rural sector. In part this has come from the larger number of regional universities. It also arises from significant Commonwealth funding to higher education research. Today this funding accounts for around 30 per cent of total Commonwealth financial support for science and innovation. While much of this research is upstream, the role of the universities in rural research is growing. In terms of RDC funding, the Universities now sit below the States but around the same quantum as CSIRO. In fact, RDC funding to CSIRO declined from \$48 million in 2004-05 to \$36.5 million in 2008-09. This trend is expected to continue as the State agricultural research agencies form stronger business relationships with some of the Universities. This growth in University funding from the RDCs is also probably related to the Universities not being so insistent of full cost recovery. This will change with time.

3.2 By those that fund (demand) the Research

The Rural Research and Development Corporations

There are many agencies that commission/contract research agencies to undertake programs and projects. In an Australian context, the largest single funder is the set of Research and Development Corporations (RDCs). The key to contextualizing these RDCs is their governance which was designed for significant industry input and oversight with around 50 per cent of their funds coming from industry (and around 50 per cent from Government). In 2008-09, aggregate RDC outlays were around \$500 million. In 2007-08 it was \$517 million.

Most of the RDCs were established in 1990-91 as statutory, **single** industry focused RDCs with the intention of improving the performance of the national R&D effort for rural industries. This evolved from the Rural Industry Research Funds system, which had been established under the *Rural Industries Research Act 1985*. Each fund was administered by a council which allocated research funds. Funding was through industry levies and the government contributing matching funding up to 0.5 per cent of the gross value of production for each industry. At that time, R&D corporations were established for the meat and livestock and horticultural industries.

The current RDC model was enacted by the *Primary Industries and Energy Research and Development Act 1989 (PIERD Act)*. It was intended to provide best value for money for the government, industry and broader community in pursuing the objectives of:

- increasing economic, environmental and social benefits
- achieving sustainable use and management of natural resources
- making more effective use of human resources and skills; and improving accountability for expenditure.

The key elements in the current model are:

- the broad scope of rural research activities that may be funded by an RDC
- a more rational and integrated approach to R&D priority setting and a stronger focus on outcomes
- close involvement of industry throughout the whole process of priority setting and reporting
- governance by independent boards that are charged with taking a strategic approach to rural R&D, and
- dual accountability to both industry and the government.

Since the model was introduced, the total number of RDCs has increased to sixteen and a majority (nine) now operates as industry-owned companies under the Corporations Act 2001. In the 2009-10 Budget the decision to abolish Land & Water Australia was announced. The evolution of the model to include industry owned companies was premised on the need to give industry more control over its affairs, as well as rationalisation of existing organisations.

Table 3. Research and Development Corporations and Companies - Funding 2007-08

R&D Corporation	Industry Contribution (\$m)	Commonwealth Contribution(a)(\$m)	Expenditure (Estimate)(b)(\$m)
Cotton RDC	1.95	3.13	10.46
Fisheries RDC	9.58	16.29	21.08
Grains RDC	76.65	37.62	102.50
Grape and Wine RDC	9.88	11.41	23.40
Land and Water Australia	-	13.02	38.70
Rural Industries RDC	2.11	16.10	24.11
Sugar RDC	5.03	6.28	11.09
R&D Companies			
Australian Meat Processor Corp.	11.70	11.70	23.40
Australian Wool Innovation	45.11	12.31	69.19
Australian Pork Ltd	3.71	3.71	7.55
Australian Egg Corporation	1.14	0.83	1.85
Dairy Australia	18.30	18.30	35.10
Forest and Wood Products Australia	5.15	4.28	6.06
Horticulture Australia Ltd	41.53	34.51	72.40
Meat and Livestock Australia	34.51	34.51	69.02
LiveCorp Ltd	0.72	-	0.72
Total	267.06	224.00	516.65

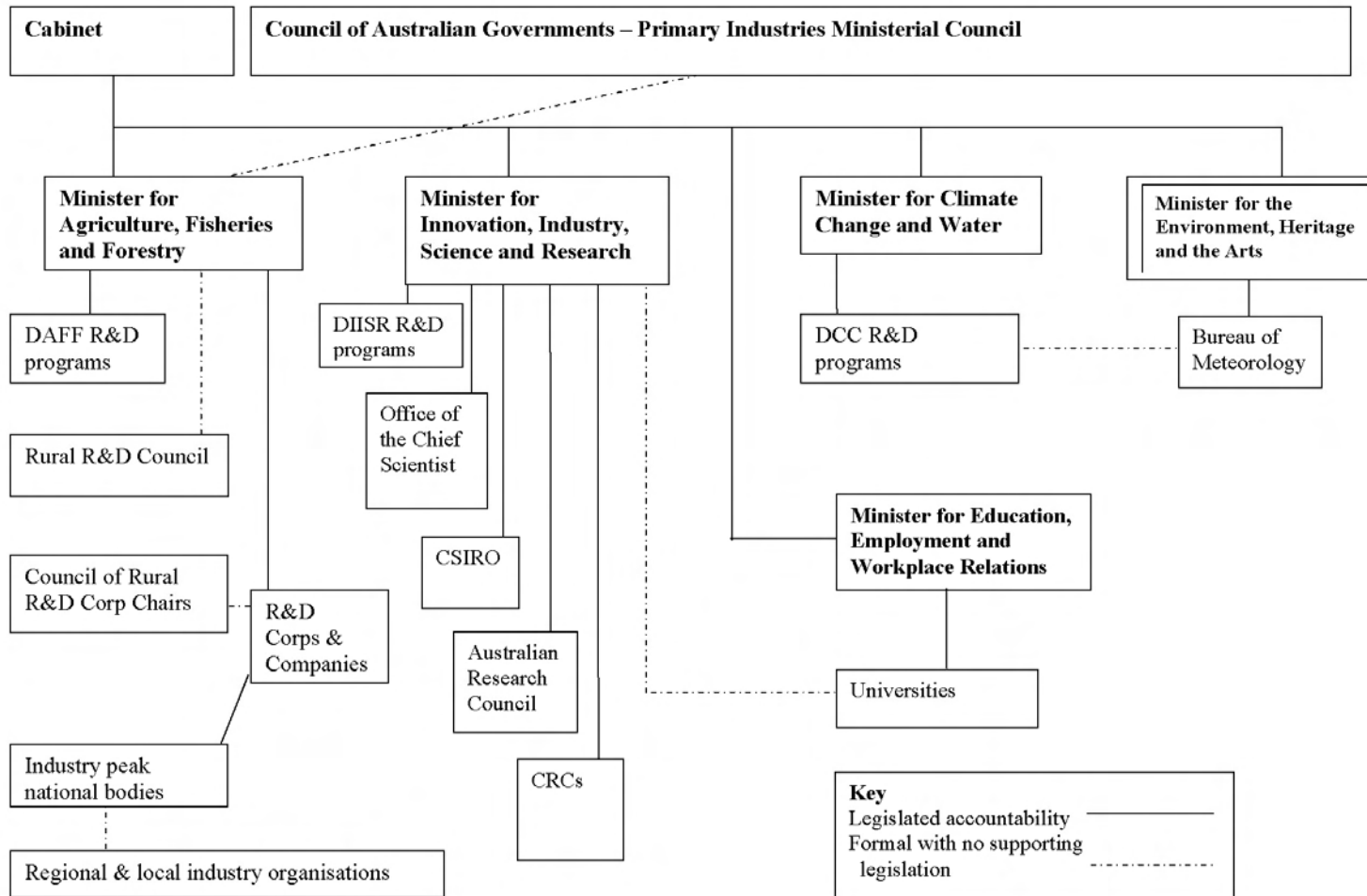
Source: DAFF 2009

- The Commonwealth government's contribution is capped at 0.5% of an industry's GVP as calculated on a three year rolling average. The cap means that for some RDCs the industry contribution will exceed the government contribution. In some cases averaging the Commonwealth contribution means that the government contribution will exceed the industry contribution in any one year.*
- The RDCs have an ability to accumulate reserves or to borrow money. This flexibility allows the RDCs to fund the R&D program even if climatic variability leads to significant year on year variation in levy contributions from industry and government.*

Other Funders of Rural Research

Many State and Commonwealth Departments fund rural research. In 2008-09 the estimated expenditure on rural related R&D was \$1.6 billion of which the RDCs funded around \$500 million. Putting aside the quantum's provided, most of the non RDC funding is either directed towards providing infrastructure and/or core support for the research facility or to fund programs and projects with a broader community focus like climate change. These funds are less likely to be targeted to agencies providing research services with direct industry benefits. This has, in the past, been more the province of the RDCs. The key relationships between rural R&D stakeholders at the national level is presented on the next page.

Key Rural R&D Stakeholders at the National Level



4. The Current Framework – Key Reviews

As you review the rural research agenda over the past decades, there have been a number of key reports and reviews that have reflected on the current framework. Taking twenty years as one reference point, the key starting document is “Research Innovation and Competitiveness: policies for reshaping Australia’s Primary Industries and Energy Portfolio research and development: a Government Statement” released in 1989. Since that time, there have been two Industry Commission/Productivity Reports covering rural research in 1995 and again in 2007 – as well as a key report by the Agriculture and Food Policy Reference Group in 2006. In a broader context there have been several cross sectoral reviews of science based programs that have in nearly all cases led to additional Commonwealth funding. The most recent example is the Review of the National Innovation System conducted by Dr Terry Cutler in 2008.

Each of these major reports referred to above is substantial in its own right but from a rural research perspective, some of the key points to emerge can be summarized as follows:

4.1 Industry Commission Report 1995²

The Industry Commission (IC) concluded research and development was important to economic growth, although it was difficult to quantify, and that for government intervention to be effective it must involve a combination of approaches.

In relation to the RDCs, the IC considered, that notwithstanding the limited experience of the rural research and development corporations at that time, the evidence indicated the financial contribution of farmers for rural research and development had increased and the research and development being done appeared to be carefully assessed and directed to the needs of the sector.

Nevertheless, the IC considered the **1:1** matching funding to be relatively generous and that it would more appropriate for the government to provide matching funding on a 1:2 matching ratio. The government did not accept this recommendation and the 1:1 matching funding has continued to date.

Recognising the State departments of agriculture performed half of rural research and were the largest performers of research contracted by the RDCs at the time, the Commission recommended:

- “State departments should cost all externally commissioned research and price it to recover full costs “ and
- “those State governments, which have not already done so, consider establishing their agricultural research departments as separate corporations or institutes, as well as establishing forums for developing state priorities, and performance indicators to assist in monitoring and evaluating the effectiveness of their research agencies”.

4.2 Productivity Commission Report 2007³

In this report, the Productivity Commission (the successor body to the Industry Commission) argued that while the Australian Government provides matching funding on a 1:1 ratio, the actual subsidy for rural research is considerably higher when combined with explicit and implicit support provided by the groups that actually perform the research and development for the RDCs.

The PC concluded:

“The governance design of the rural R&D Corporation model is inherently sound. Levies that are decided by, and apply to, all beneficiaries of the R&D overcome free-riding and the resultant under-provision of rural research. There are strong grounds for significant public co-

² Industry Commission (IC) 1995, “Research and Development”, Report No. 44, AGPS, Canberra.

³ Productivity Commission (PC) 2007, “*Public Support for Science and Innovation*” Research Report, Canberra.

funding of RDCs that provide spillover benefits beyond industry members where that research would not proceed in the absence of support. But the present substantial co-funding of some industry centred RDCs should be scaled back. The extent to which public funding is reduced should be determined by an independent assessment of the induced spillovers associated with that support. The intention to make changes should be announced well in advance.”

The then government did not respond to the PC review recommendations.

4.3 Report by the Agriculture and Food Policy Reference Group 2006⁴.

This report had a much wider agenda than rural research but, with respect to that item the Report recommendations included the following:

- “the successful partnership funding structures involving farmers (through industry levies), government and RDCs must be maintained
- state governments and CSIRO, as major providers of agricultural research and extension services, must continue to contribute constructively to the efforts of the agriculture and food sector to be more innovative and globally competitive
- the Australian Government should establish a process for major agriculture and food research participants to collaborate in regularly identifying emerging research priorities for the sector
- the research effort, while broadening to reflect new areas of importance, must continue to generate the all-important incremental increases in on-farm productivity that offset the long term decline in farmers’ terms of trade
- the Council of Research and Development Corporation Chairs should take a stronger leadership role, to promote:
 - high priority collaborative initiatives by RDCs on strategic and cross-industry activities
 - more systematic and consistent data collection and financial reporting, and methods of determining research priorities, allocating funds, evaluating results of R&D expenditure and disseminating the findings.”

The Australian Government responded to the Report recommendations on R&D in 2007 and agreed, in the main, with the recommendations. Since then, initiatives such as the Climate Change Research Strategy for Primary Industries, undertaken under the Primary Industries Ministerial Council’s Research Development & Extension Framework, are seeking to focus on multiple agencies including all the RDCs on a single major R&D issue. However, evidence of joint research projects in this area is still limited.

⁴ Corish, P., et al, *Creating our Future: Agriculture and Food Policy for the Next Generation*, 2006.

4.4 The Review of the National Innovation system 2008 by an Expert Panel, chaired by Dr T. Cutler⁵

The final report did not make specific reference to rural research, except in Annex 11, where it proposed that “as a priority the Australian government should develop a national rural innovation strategy to:

- ensure optimal outcomes are gained from public investment in rural R&D including improved delivery of research and development directed at issues of national public concern
- determine where public investment is needed to achieve greater effectiveness and efficiency in agriculture and food supply chains, taking into account the work being done by the Primary Industries Ministerial Council
- reduce the duplication of research activity through institutional consolidation to promote administrative efficiency and critical mass
- review existing research and development levy arrangements and contribution levels, to ensure the effective delivery of research and development to meet the demands of both public and private interests.”

These key reviews over the past 20 years carry a number of messages; some convergent, others not. In terms of consistency of message, the **first** is that the RDC matching funding formula continues to be under question. It is one of DAFF’s major appropriation items but not in a broader outlays context of the Commonwealth. Its validity depends, in some people’s minds, on the extent of the spillover benefits to the broader community. These spillovers are virtually impossible to quantify *ex ante* and will vary depending on the investment objectives of the research being undertaken. The matching dollar-for-dollar funding formula is an *ex ante proxy* which sits uncomfortably with those that seek quantification of spillovers and those that seek to cap/cut budget outlays. The **second** is that these reviews seem much more comfortable with research programs directed at issues of national public concern. While higher on-farm productivity and innovation are acknowledged as keys to building a modern and competitive rural economy, the objective does not resonate as strongly with those not associated directly with rural industries – even when the benefits of this area of research are shown to readily justify the investment. It is as though some policy makers would prefer lower returns from other public domain research – even when the benefits are lower and, in some cases, unlikely to be adopted at least in the short to medium term.

You could go back beyond the past 20 years and the key touchstones that you would dwell on are:

- Harris, S.F., Crawford, J.G., Gruen, F.H., and Honan, N.D. (1974) *The Principles of Rural Policy in Australia: a Discussion Paper*, AGPS, Canberra.
- Balderstone, J.S., Duthie, L.P., Eckersley, D.P., Jarrett, F.G. and McColl, J.C. (1982) *Agricultural Policy: Issues and Options for the 1980s*, AGPS, Canberra.
- Commonwealth of Australia (1986) *Economic and Rural Policy*, AGPS, Canberra.

While the 1974 Green Paper did not attempt a formal set of recommendations, it was a key report by eminent Australians that sought to provide an enduring framework for policy makers at a time of substantial uncertainties about the appropriate direction for economic and industry policy. 1974 was a time when the Tariff Board was being broadened to the Industries Assistance Commission, tariff compensation arguments were being raised and the wide divergence in effective rates of assistance between (and within) the farm and non-farm sectors were being quantified. The Green Paper said this about agricultural research:

⁵ Cutler, T., et al “Report on the Review of the National Innovation System”, 2008.

“5.245. Rural research is a major contributor to efficiency in rural production which needs to be comprehensive and continually updated.

5.246. It is difficult if not impossible to estimate the optimum level of research but the social return to agricultural research is likely to be high.

5.247. The nature of rural research investment is such that, without government intervention, the level of research is likely to fall well below the economically justified level.

5.248. The objective research policy should be to attempt to direct research investments into areas where the likely economic pay-off is highest; institutional arrangements such as single commodity research funds tend to cut across this principle.

5.249. Encouragement should be given to reduce the inflexibility of industry research funds such that research relevant to all farm resources, whole farm systems and economic and social problems are made easier to accommodate from industry fund financing.

5.250. Overall research funding arrangements should ensure that gaps in research needs—such as those in the field of agricultural engineering research—do not develop.

5.251. Research priorities should not be changed in the light of relatively short term changes in the nature of rural problems, but there is a need for a periodic examination of overall rural research policies and long term priorities. There would be advantage in the establishment of an advisory committee for this purpose; it should attempt to stimulate widespread interdisciplinary and multi-institutional public discussion of research needs across the broad categories of research.

5.252. Industry funds should be encouraged to maintain appropriate levels of reserves and to consider other means of increasing stability of research funding.

5.253. Research arrangements should seek to ensure that the maximum feasible use is made of all research resources in government, university or other institutions.

5.254. Encouragement should be given to more multi-disciplinary research projects through greater inter-institution co-operation and collaboration as a means of developing more system oriented rather than discipline oriented research.

5.255. It is difficult to determine a satisfactory basis on which to assess the appropriate level of research funding by industry as distinct from government, partly because benefits from the application of research results are not received only by the producer.

5.256. Some overall research levy would be worthy of consideration, though it would have a number of practical disadvantages; provision of research funding is one way of providing tariff compensation.”

(p. 126).

The so-called Balderstone Report of 1982 followed much of the same ground as the 1974 Green Paper. It affirmed that the Commonwealth should increase its overall funding of rural research and raised the option of a uniform levy on gross income as an alternative to product levies. Nothing came of this option.

In April 1986, the then Prime Minister and Minister for Primary Industry, (the Hon. J. Kerin) issued a Government Policy Statement, ‘Economic and Rural Policy’. It was issued in response to significant unease in the farm sector about policy directions. Commonwealth support for rural research was affirmed. New arrangements for horticulture were proposed. It said this about funding:

- “The value of funding under RIRF arrangements has been increased from \$36 million in 1981–82 to \$70 million this financial year—an increase of around 100 per cent.
- The Government has legislated to increase its matching contributions to RIRFs over five years up to 0.5 per cent of the gross value of production of the industries concerned. Thus future funding will expand in line with industry contributions until the maximum level is reached.”

(p. 46)

5. The Current Framework – Priorities and Governance

5.1 Priorities

Priorities matter because there are never enough resources to fund the research agenda. Nor should there be because not all research proposals will be worthwhile investments over either the short or longer terms. Given our federal governance framework and multiple agencies each with their own governance it has been inevitable that there has been a plurality of competing priorities around rural research. Looked at over time it has been inevitable that research priorities have differed between the Commonwealth and the States and between the States themselves.

Over the past twenty years, in terms of the *PIERD Act 1989*, the Commonwealth has had a forward planning framework for its RDCs. The problem has been that these plans have usually been framed in very general terms, developed at different time periods by each RDC. There is little coherence in the scope of the plans and even less in the priorities as reflected in the indicative resource allocations.

While there are strengths in this plurality, it also has its weaknesses. Most rural research is funded publically and the business and political case for continuing and increasing this support requires a relatively coherent and concise set of articulated priorities. In part because of these pressures, it was in 2002 that the then Government issued a first set of national research priorities. The rural research priorities were consequently required to complement this.

National Research Priorities (2002)	Rural Research Priorities (2003)
An environmentally sustainable Australia	<ul style="list-style-type: none"> – Sustainable resource management
Frontier technologies for building and transforming Australian industries	<ul style="list-style-type: none"> – Using frontier technologies – Creating an innovative culture
	<ul style="list-style-type: none"> – Improving competitiveness through a whole-of-industry approach – Maintaining and improving confidence in the integrity of agricultural, food, fish and forestry products – Improving trade and market access
Safeguarding Australia	<ul style="list-style-type: none"> – Protecting from invasive diseases and pests

In 2007, the rural R&D priorities were again revised, following national consultation. These revised priorities again complemented the national research priorities, which had remained unchanged.

National Research Priorities (2002)	Rural Research and Development Priorities (2007)
Promoting and maintaining good health (strengthening Australia's social and economic fabric)	Productivity and Adding Value <i>Improve the productivity and profitability of existing industries and support the development of viable new industries</i>
	Supply Chain and Markets <i>Better understand and respond to domestic and international market and consumer requirements and improve the flow of such information through the whole of the supply chain, including to consumers</i>
An environmentally sustainable Australia	Natural Resource Management <i>Support effective management of Australia's natural resources to ensure primary industries are both economically and environmentally sustainable</i>
	Climate Variability and Climate Change <i>Build resilience to climate variability and adapt to and mitigate climate change.</i>
Safeguarding Australia	Biosecurity <i>Protect Australia's community, primary industries and environment from biosecurity threats.</i>
Supporting the Rural Research and Development Priorities	
Frontier technologies for building and transforming Australian industries	<i>Improve the skills to undertake research and apply its findings.</i>
	<i>Promote the development of new and existing technologies.</i>

When introduced, the National Research Priorities were intended to guide Commonwealth research agencies. In more recent years Commonwealth research agencies have been required to report annually to the Chief Scientist on how they have responded to the national priorities. The RDCs have been required to take into account both sets of priorities in their planning.

In its 2007 Report, the Productivity Commission said this about the guidance role of the National Research Priorities:

“The Commission supports the retention of the priorities in the present level of detail as these usually provide sufficiently meaningful signals of areas for research. Any marked loosening or tightening of the priorities would be problematic. Central government control would lack the flexibility and information to prescribe more precise research agendas. Any broader level of prioritisation would no longer usefully guide research at all.” (p. xxx-xxxii)

This prioritisation agenda was taken one step further by CSIRO when it introduced its Flagships in 2001. The Flagships have sought to focus concentrated scientific effort on problems of national significance based on partnerships and thinking outside the customary disciplinary and institutional confines. There are now ten CSIRO Flagship Programs and, in terms of rural industries, they include the Food Futures Flagship; the Sustainable Agriculture Flagship; the Water for a Healthy Country Flagship; and the Climate Adaptation Flagship.

This increasing focus on partnerships and priorities is also being undertaken by other jurisdictions and agencies because of a growing recognition that, if Australian rural industries are to improve their productivity and sustainability, they cannot afford a fragmented and duplicative research system. Within the Commonwealth-State Primary Industries Ministerial Council there is now a real intent to finalise an overarching inter-governmental agreement which will see nominated jurisdictions taking a lead national role. Underpinning this agreement will be fourteen sectoral and seven cross sectoral industry strategies.

- Primary industry sectors: beef, cotton, dairy, fisheries and aquaculture, forests, grains, horticulture, pork, poultry, sheepmeat, sugar, wine, wool, and new and emerging industries.
- Cross-industry sectors: animal biosecurity, animal welfare, biofuels and bioenergy, climate change and variability, food and nutrition, plant biosecurity and water use in agriculture.

When the Framework is fully implemented, it is expected:

- research capability will become more collaborative, specialised, have larger critical mass and will be less fragmented.
- agencies will collaborate with others to provide for a more comprehensive national research capability.
- the national research capability will be an integral component of a wider innovation agenda.

If these sector specific and cross sectoral plans are to move beyond the generalisation to the specific they need quantifiable performance benchmarks. An example is the CSIRO Flagship for Sustainable Agriculture that has a goal of increasing productivity by 50 per cent and reducing net carbon emissions per unit of food and fibre by at least 50 per cent between now and 2030 through a mix of productivity growth, emissions reductions and carbon storage in soil and vegetation.

5.2 Governance

Like prioritization and focus, governance matters in rural research. The first concerted attempt at formulating an overarching and common governance framework for research was the *PIERD Act 1989*. More than anything else this legislation provided a prescribed common framework for how research funders (RDCs) would operate; setting out the rules to avoid conflict of interests, to define the respective responsibilities of the Minister and of the funding agencies, to formally engage the end user industry in priority setting and to appoint expertise based Boards, not representational Boards. To the maximum extent possible, related party transactions between the funding agency and research contracting partners were to be avoided. A strong accountability framework to industry and government was legislated. As noted by the Productivity Commission in 2007, the ..."Corporation model is inherently sound." While the majority of the RDCs are now operating as industry-owned companies under the *Corporations Act 2001*, their governance requirements are codified not only by the requirements of the *Corporations Act* but also by their company specific Articles of Association. These Articles reflect the key provisions of the *PIERD Act 1989*.

6. Monitoring, Evaluation and Impact Assessment

The concepts of monitoring, evaluation and impact assessment are different and distinct dimensions of performance management. Where rural research is contracted by funders for the delivery of a research service these contracts and agreements have their own in-built mechanisms for monitoring and evaluation. The monitoring and evaluation processes for core and institutional research support are much more opaque. While these are examples of *ex ante* impact assessment, most of the published casework is *ex poste* of funded projects and programs that have been completed for several years. This makes sense if adoption rates and impacts are being actually measured and not just assumed.

Over the past twenty years or so, there has been a very substantial upgrading in monitoring, evaluation and impact assessments of rural research investments. In part this has come from the greater degree of separation between the “funders” and the “doers”. It has also come from the advent of the RDCs who are essentially accountable to the funders - Government and industry – for “value for money”.

The transparency of these monitoring and evaluation processes is now being facilitated by continuing advances in information technologies which are permitting data aggregation and broader public domain access to the results of these processes. The growth of the internet has made it possible to lower to zero the marginal costs of disseminating scientific information.

With respect to impact assessments, there has been a substantial upgrading in impact assessments as a professional tool. Its application to rural research has dominated these advances. When aggregated, these assessments have shown that rural research is an investment with high returns. But those close to these impact assessments recognise their sensitivities to the assumptions used and the difficulty in pricing environmental services. Because of this sensitivity to assumptions and different approaches, the RDCs now have a rolling program of evaluating their investments, using a consistent methodology across all RDCs. Their first report from this evaluation program was released in December 2008 and showed, from a sample of randomly selected projects across the RDCs, an expected return of \$11 for each dollar invested. This RDC conclusion that research pays is reflected in many studies. To quote the Productivity Commission in its 2007 report:

“The Commission examined many strands of evidence – industry analyses, qualitative assessments, international cross-sectional time series studies and case studies relating specifically to R&D undertaken in universities and public sector agencies. Overall, these also suggested good returns. In some instances, such as R&D for many environmental purposes, the net gains are mostly not measurable as short-run changes of GDP, but are nonetheless worthwhile.”

While there have been very substantial advances over the past twenty years in performance measurement of rural research, there are gaps when put in the context of approximately \$1.6 billion being spent each year on rural related R&D.

- How effective is the core and institutional funding to research agencies?
- How effective are the RDCs in their monitoring and evaluation responsibilities? When was the last time that the RDCs, as a set of institutions, were reviewed? It certainly hasn't been routine, transparent and independent.

7. Looking Back – Some Reflections

Our rural research efforts are one of the key underpinnings of Australia's rural industries. This is recognised widely. Most also conclude that the way we organise our research efforts is complex. This should come as no surprise. We are a Federation, our rural sector covers a very diverse set of agro-ecological zones and industries and, like nearly any current public policy program, its structure has been built on previous – in this case longstanding – initiatives by the States and the Commonwealth.

This complexity has its costs and weaknesses but also its strengths. Part of the complexity comes from its active engagement with stakeholders and it is these built-in feedback mechanisms which are helping to ensure that research programs are focussing on higher priority areas and that outputs are being translated into outcomes. This engagement is also helping to maintain support for industry and taxpayer funding.

Like any system our rural research system has its entrenched interests which challenge change. This is not surprising. But the research system is changing, primarily because the external incentives on the system are changing. It is now subject to sustained pressure and challenge. The framework is actually more vulnerable than it looks.

7.1 Funding Support at the State Level

Most State budgets are under pressure and many State based research institutes are seeking greater external funding, principally from the RDCs. Higher cost recovery levels are being sought and there is now substantive engagement to rationalise the coverage of some of these institutes. In addition there are now numerous examples of State research institutes working much more closely with Universities. The nature of these changing relationships varies but it is clear that the primary incentive for this change is budget pressures. And, on balance, these changes are moving rural research in the right direction. While it has its challenges, greater focus, less overlapping mandates, and stronger institutions will be good for research quality and direction in the longer term. It also has the potential to be more secure in a budgetary sense.

Part of this reform process to achieve efficiencies in the supply of research services is the development – with key funders – of an agreed Research Framework covering the major industry sectors and key cross sectoral issues. In theory this should help to ensure that funding decisions are mutually supportive of the structural supply changes. The reality is that these reform directions will probably be slowed by entrenched interests but are unlikely to be derailed. Embedded in these changes is a stronger set of financial incentives (pressures) that will support the change process.

7.2 Funding Support at the Commonwealth Level

Over the past twenty years, the RDCs have emerged as a major long term funding source. The matching funding formula is legislated and can only be changed by amendment – either to the principal legislation or the subordinate regulations. In that sense the policy has some security. In terms of vulnerability it is relevant to note the 2009-10 Commonwealth Budget decision to abolish Land and Water Australia and to cut RIRDC funding – both areas which are outside the matching arrangements.

In the early 1980's aggregate industry levy revenue as a percentage of GDP was less than 0.2 per cent. It is now around 0.5 percent with some industries significantly above it. Clearly the growth in RDC outlays will now slow unless there is substantive GDP growth or industries agree to forego the matching arrangements and support levies above the 0.5 per cent GDP ceiling.

Equally while it would be difficult to reduce the funding formula incentive without broad based political agreement, it is clear that key agencies such as the Productivity Commission will continue to

argue that “... the present co-funding of some industry-centred RDCs should be scaled back.” But in the context of the new 45 per cent refundable tax credit for Australian owned firms turning over up to \$20 million a year, announced in the 2009-10 Budget, the pressures to change the matching funding formula for rural research should be reduced somewhat. But it won’t stop the continuing debate and uncertainty. It is unfinished business that is likely to continue to be revisited in the annual budget context.

7.3 Program Priorities and Directions

While there is general agreement that rural research programs should encompass economic, social and environmental components – the so-called triple bottom line – the reality is that the predominant objective is productivity enhancing industry development. When you have single industry funding mechanisms as with the RDCs, it is inevitable that cross sectoral research budgets (for agencies such as climate change and variability, water use efficiency) will be stretched.

This focus on industry development will continue to be questioned by some, particularly those who argue that spill-over benefits beyond industry members are the predominant justification for public funding. In this questioning what is really put at risk are the research related on-farm productivity gains. In the Australian context, multifactor productivity growth has counted for the entire increase in agricultural output over the past 30 years (2.3 per cent in trend terms). This is considerably stronger than achieved in Australia’s market sector (1 per cent in trend terms). Unless funding quantum are increased, it seems clear that industry specific research related productivity gains could be forsaken for other broader cross sectoral priorities. As this debate unfolds, it will not just be a question of listing priorities – embedded in the same question is the funding that should be allocated to each priority.

But the weakness in the funding of the cross sectoral agenda is a weakness in the current arrangements. It is solvable by adjusting the funding formula without challenging the matching principle. But it would be a difficult assignment to achieve without going backwards on the current arrangements. On balance it is probably too risky an assignment if done in isolation. The development of a new National Strategic Rural R&D Investment Plan would provide the contextual opportunity to revisit the funding formula and the underpinning governance instruments for implementing the Plan.

7.4 The Balance of the Research Portfolio

It is not possible to be definitive about the appropriate balance of research resources that should go to basic research⁶. But we do know that maintaining a strong core science capability to acquire new knowledge without a special application in view is vital. In the Australian context, more than \$2.5 billion is provided annually in research block and competitive grants through the Commonwealth Education, Science and Training Portfolio to Universities, primarily for basic research. As the rural research framework has evolved, it will be vital that the importance of the more basic research is not overlooked with an excessive focus on the commercialisation stages of innovation. One real advantage of the State Departments forging stronger linkages with the universities will be access to these complementarities.

⁶ According to the ABS definitions:

Pure basic research is experimental and theoretical work undertaken to acquire new knowledge without looking for long term benefits other than the advancement of knowledge.

Applied research is original work undertaken primarily to acquire new knowledge with a specific application in view. It is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving some specific and predetermined objectives.

But over time it will come with a price tag as publicly-funded research infrastructure is priced for revenue enhancement and to cover maintenance costs. It all adds up to fuller cost recovery that will need to be picked up by the RDCs. It is a trend that will be debated but it will be inevitable.

7.5 Workforce Issues – Running Down the Human Capital

The research system needs a strong and committed scientific workforce. It has this today but it has been stronger in the past. The workforce is ageing and our agricultural programs at Universities have been in far better shape in the past. Agricultural science is no longer seen a preferred program with high entry standards. Elite students are doing other programs. In addition there are issues in job satisfaction in areas such as career pathways, contract employment and the non-research workload.

These are crucial issues for Australia's rural research system. Additional funding would help but the issues are more complex than just money. What is clear is that the research funders, like the RDCs, will need to recognize and support the scientific cohort in ways that foster its attractiveness as an occupation. Greater trust and respect need to underpin the partnership of funders and doers. The cost of rural research will rise but, without a dynamic and committed scientific workforce, we will end up with a research framework/program without quality, without as much impact.

8. Some Specific Issues

In commissioning this paper, the Rural R&D Council asked specifically that the work explore and discuss:

8.1 The role and contribution of public institutions, including universities, and the private sector in rural research

To the extent that the data permit, sections 2 and 3 of the paper sketch the vital role and contribution of public institutions be they as research funders or providers. While it is true that rural research in Australia is primarily a public sector business, it would be wrong to conclude that the private sector is not important. It is. Many significant research advances are embedded in commercial farm inputs built around privately owned technologies most with IP protection. These are making a vital contribution but do not show up in our ABS data. Perhaps it reflects the global nature of some of the important agribusiness seed, chemical and machinery companies. Or perhaps it reflects problems of data aggregation and definition. Whatever the reason, private sector research is very important and has been built, in part, on public domain research outputs both here in Australia and globally.

As set out in the paper, change has been endemic to the way that rural research is funded, conducted and delivered. Most of the change has been good for Australian agriculture. One key development over the past twenty years has been the advent of universities with particular regional and programmatic mandates. In nearly all States, there are closer synergies developing with Universities and, given the growth in Commonwealth funding to the university sector and pressures on State Budgets, this trend is likely to consolidate and probably expand into broader centres of excellence with research, education and some outreach responsibilities. These aggregated centres will be good for Australian agriculture provided their programs remain focussed on industry needs, both short and long term. There is a risk that their research programs could shift upstream but that will really depend on RDC funding priorities and availability.

8.2 Common research themes and collaborative efforts in the rural sector over time

Section 5 goes into some detail about the common research themes built around the National Research Priorities and the more recent work of the Commonwealth-States Primary Industries Ministerial Council in this area. The only additional point that should be stressed here is that funding should not be diverted from farm productivity enhancement. Over the past fifteen years there has been a much stronger focus on environmental issues with less prominence, in a relative sense, given to farm productivity enhancement. Perhaps the following quote captures the risks we are facing if we get our priorities wrong:

“Agricultural R&D is at a crossroads. The close of the 20th century marked changes in policy contexts, fundamental shifts in the scientific basis for agricultural R&D, and shifting funding patterns for agricultural R&D in developed countries. Even though rates of return to agricultural research are demonstrably very high, we have seen a slowdown in spending growth and a diversion of funds away from farm productivity enhancement. Together these trends spell a slowdown in farm productivity growth at a time when the market has begun to signal the beginning of the end of a half-century and more of global agricultural abundance. It is a crucial time for rethinking national policies and revitalizing multinational approaches for financing and conducting agricultural research. At a time when much of the world’s attention is drawn to other global public goods – those associated with peace, security, communicable diseases, and climate change – we should not continue to neglect agricultural R&D.”⁷

⁷ James, J. Pardey, P. and Alston, J., “*Agricultural R and D Policy: A Tragedy of the International Commons*”, Staff Paper P08-08, University of Minnesota, September, 2008, p.1.

8.3 Funding trends and funding models in Australian rural R&D

Funding trends are discussed in section 2 of the paper. Over time, it is clear that the source of funding for rural research has shifted from the States to the Commonwealth and that the Commonwealth RDCs are now the largest single funders of applied rural research in Australia. The Commonwealth is also significantly expanding its support to Universities for research infrastructure and the more strategic and fundamental research areas. Underpinned by Commonwealth tax incentives, business expenditure on R and D is also expanding sharply. The delivery of rural research is primarily done by public sector agencies – the State departments responsible for agriculture, fisheries and forestry, CSIRO, Universities and CRCs. In part due to funding pressures a number of the States have or are developing explicit partnerships with Universities for the delivery of research programs.

On the question of funding models, there is no single right answer. You could approach the question as the Productivity Commission has and seek to equalise the incentive frameworks for farm and non-farm research. On this basis it is true that the matching formula for rural research is more generous than the tax concession for business research. But this comparison is built on a very narrow canvas. Much of the business research is not in the public domain, limiting the scope for spillovers and wider community benefits. And there are very substantial public research investments paid exclusively by the tax payer where the benefits are flowing directly to non-farm industry. It is not an easy area to quantify but the current matching formula is probably one of the key foundations for the productivity performance of Australian agriculture. But the current funding formula can be questioned in certain respects. There is no real rationale for the 0.5 per cent GVP ceiling other than as a mechanism to limit budget outlays. The new R&D tax credit is not subject to any expenditure cap. And the industry specific attribution of the research levy revenue is posing real limits on the scope for the important cross sectoral research agenda. This is a design fault that should be fixed. The details would need to be worked out but one could envisage that, based on an overarching national R&D investment plan, Government may be prepared to consider abolishing (or lifting) the 0.5 per cent GVP funding ceiling provided a proportion of the aggregate funding was earmarked to broader cross sectoral research programs.

8.4 The changing nature of extension

“A smart society is not just one that has excellent science. It is one that can best distribute and adopt excellent science. Unfortunately, for several decades Australia has fallen into the trap of assuming research quality alone is sufficient. Dissemination of scientific findings is one of the lowest priorities on the agenda, as is perfectly evident in the budgets of the Commonwealth or practically any of its agencies and universities. As the Government inquires into the universities, the co-operative research centres and eventually all the other arms of the knowledge machine in its quest to make them better, the adequacy of their knowledge transmission systems needs to come under glaring scrutiny. Skills are low, resources pathetic and barriers to knowledge transfer high.” (Cribb, April 2008)

If you reflect back on the publicly funded State based agricultural extension services of past decades, it is clear that those services are no more. Nor is the Commonwealth Extension Services Grant that was abolished in 1981. The remnants of services remain but radical change has occurred. Public extension has shifted from one-on-one to group approaches and from a production/economic focus to a broader platform involving environmental and social concerns.

The private sector continues to expand and, as well as providing individual services, also operates in the same sphere as public extension. The RDCs have, to an extent, filled the space as have ICTs, agribusiness and farmer groups like Kondinin and Birchip. Many of these farmer groups are supported by the RDCs. Whether this substantial change in public sector agricultural extension services represents a problem or an opportunity is uncertain. Clearly the RDC research programs are now much more holistic in their structure and partnerships with inbuilt feedback processes. It is one of the significant strengths of an industry specific RDC with its inbuilt accountability mechanisms for performance.

What is also true is that there is an inseparability between agricultural education and extension as components of one activity. Clearly both have changed radically as has Australian agriculture. Farming is now much more a business where more than 70 per cent of output is produced by less than 30 per cent of farmers. This key farmer cohort is (probably) well positioned with the competencies to apply relevant research knowledge to enterprise specific circumstances. In the main, this group is better educated, prepared to pay for advice and more open to new ideas. Working with this cohort should ensure that relevant research remains a profitable investment. There is a dualistic character in Australian agriculture where a small number of large scale commercial farms produce the majority of agricultural output and the plurality of extension mechanisms reflects this fact.

8.5 Changes to the positioning of rural R&D within the national innovation system as a whole across portfolios

The term National Innovation System (NIS) is one of those that is well used but hard to define. Everyone knows that innovation and governance are particularly important for economic development but the debate normally moves quickly to a focus on R&D expenditures. According to Cutler:

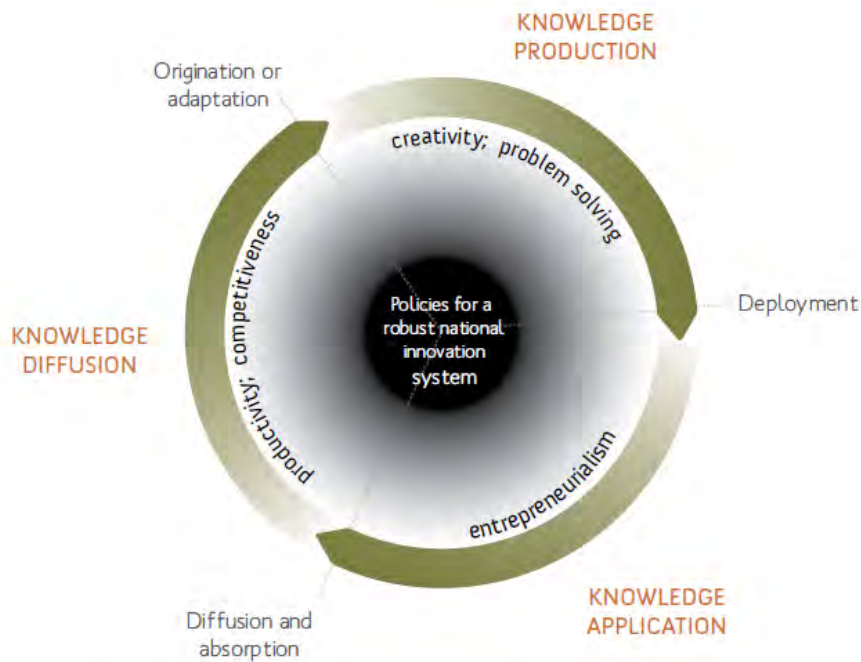
“... innovation is not the same as invention and innovation policy is more than just science and technology policy.”

From Cutler’s perspective, there are three interdependent functions within an innovation system:

- “- the origination of new knowledge and ideas:
knowledge production;
- the deployment of ideas within a real world context:
entrepreneurial knowledge application; and
- the diffusion and adoption of this applied knowledge and its
adaptation in use: **knowledge diffusion and absorption.**

Cutler’s thinking about operationalising this NIS is to do so in terms of investing in the capabilities of each of the three elements as well as the linkages and flows between them.

Figure 7. Elements of a National Innovation System



Source: Terry Cutler (2008)

Source: Cutler, T., et al, “Report on the Review of the National Innovation System”, 2008. p. 17

The Government responded to the Cutler NIS Review in its 2009-10 Commonwealth Budget by a significant expansion in funding particularly for Australia’s publicly-funded research capabilities and introducing stronger tax incentives for business R&D, particularly for the SMEs. It did much more than this in its response but these were two of its key pillars. And we now have an extensive list of well funded public sector schemes and programs (see Appendix 1 for some details) seeking to address the next few years of innovation economy wide.

The reality is that rural R&D never figured prominently in the most recent NIS review or the Government response to it. Annex 11 of the NIS Review dealt with Rural R&D in two pages and concluded that a national innovation strategy should be developed. A Tropical Innovation Council and a Tropical Innovation Precinct was also proposed. But this is not necessarily a reason for concern. The reality is that, at the Commonwealth level, primary responsibility for innovation and science rests with the Innovation, Industry, Science and Research Portfolio. Where higher education is involved, it is done by jointly administered programs with the Education, Employment and Workplace Relations Portfolio. While recognising the important work of its two Bureaux, the Agricultural, Fisheries and Forestry Portfolio essentially has a research funding responsibility and it now has the opportunity to take advantage of the significant expansion in research capabilities that are being funded over the next decade.

Whether it will is an open question. In the context of substantially increased resources, the rural research agenda could well be subsumed by other better funded priorities. The only substantial way of countering this is to ensure continued growth of rural research funding and to ensure that the interfaces to economy wide programs such as those listed at Appendix 1 are strengthened. Today, there is not much evidence that the RDCs are cognizant of these emerging opportunities – and challenges. But it is early days.

8.6 Key legislative and structural reforms that have impacted on this positioning

In one sense, positioning rural R&D within a NIS is about timing. Looking back, the 1980s were about the internationalisation of the Australian economy. The 1990s were about microeconomic reform. The Agriculture, Fisheries and Forestry Portfolio played its part in both reforms and argued that competitiveness and productivity could only be sustained with an expanded R&D investment and strong end user interfaces. The 1989 Government R&D Policy Statement and subsequent *PIERD Act 1989* need to be seen in that context. So does the May 1988 Government Statement by Ministers Kerin and Cook ‘Policies for Growth’. There were some parts of the policy architecture that should have been removed like input subsidies and some marketing schemes - and they were there – and there were others that needed to be strengthened to meet the new global realities. Rural R&D was one of these.

Fast forward to 2009 and it is a very different and in some ways a more complex challenge – not made easier by the rural innovation agenda being outside the broader May 2009 national policy statement “Powering Ideas: An Innovation Agenda for the 21st Century.” The mandate of the Agriculture, Fisheries and Forestry Portfolio is now much more circumscribed than in the 1980s/early 1990s or in the following period (1996-2007) when the agenda was more protected for specific political reasons. It is not too late but it is equally clear that rural industries no longer hold centre stage. Responsibility for water and climate change is held in another Portfolio. The structure of the Australian economy has changed and so have the national R&D priorities. And so has the capacity of rural industries to attract political attention.

8.7 Australia’s involvement in international rural R&D

While Australia contributes approximately 3 per cent of the world’s new knowledge⁸, the counterpoint is that 97 per cent of scientific discoveries are made overseas – and it is vital that Australian rural industries/and rural researchers move more strongly to position themselves in that international innovation network. It is obvious but, in fact, the business case based on spillovers etc. is even stronger internationally than it is nationally. It makes sense because, globally, there was more than \$US30 billion spent annually on agricultural research (see Table 3) in 2000. According to the 2008 International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD):

“Among the rich countries, just two, the USA and Japan, accounted for 54% of public spending in 2000, and three developing countries, China, India and Brazil, accounted for 47% of the developing world’s public agricultural research expenditures.”

Today, these linkages to the key countries are built around our strong participation in international conferences, ACIAR programs and Australia’s involvement in the international agricultural research centres of the CG System. Of the RDCs, the Grains Research and Development Corporation is probably the only example where explicit action has been taken to forge substantive relations with two of the CG Centres (ICARDA and CIMMYT). ACIAR has also catalysed much of this but much more is possible if Australia is to tap access to, for example, superior crop germplasm both in the CG Centres and other global facilities.

⁸ Thomson Reuters Web of Science.

To put our efforts on rural research in a broader context, Australia has had a specific *International Science Linkages* program in the Innovation, Industry, Science and Research Portfolio that is seeking to facilitate Australia's access to global science and to foster collaboration with international partners. In the 2009-10 Budget, the Government announced that it will not proceed with funding for a 2009 Competitive Grants round under the International Science Linkages program.

Likewise, CSIRO has moved strongly in recent years to foster international linkages across a number of areas. CSIRO's involvement in the Global Research Alliance is an example. Another is the increasing engagement of some Australian universities with overseas counterparts.

Building a stronger international interface for Australia's rural R&D requires two catalysts. The first is that we need to convince ourselves that it is a priority and the second is to fund it. Modern ICT is part of it but these mechanisms need to be built around face-to-face networks. To do this, the RDCs need to explicitly recognize an international dimension to their programs and to fund it – something that is not common today.

Table 4. Agricultural Research Expenditures by region, 1981 and 2000

	Expenditures				Shares			
	Public	Private		Total	Public	Private		Total
	1981	2000	2000	2000	1981	2000	2000	2000
	<i>(million 2000 international dollars)</i>				<i>(percentage)</i>			
Asia & Pacific (18)	2,236	5,089	499	5,588	15.7	25.1	3.7	16.6
China	587	1,763	--	--	4.1	8.7	--	--
India	332	1,160	--	--	2.3	5.7	--	--
Latin America & Caribbean (27)	1,821	2,341	116	2,457	12.8	11.5	0.9	7.3
Brazil	628	929	--		4.4	4.6	--	--
Sub-Saharan Africa (44)	1,054	1,194	21	1,214	7.4	5.9	0.2	3.6
South Africa	200	243	--	--	1.4	1.2	--	--
West Africa and North Africa (18)	792	1,407	51	1,458	5.6	6.9	0.4	4.3
Sub-total, Developing Countries (107)	5,903	10,031	687	10,717	41.4	49.4	5.1	31.8
High-Income Countries (22)	8,340	10,268	12,682	22,950	58.6	50.6	94.9	68.2
Japan	1,821	1,646	--	--	12.8	8.1	--	--
U.S.	2,569	3,882	--	--	18.0	19.1	--	--
Total (129)	14,243	20,298	13,369	33,667	100.0	100.0	100.0	100.0

Source: James, J., Pardey, P., and Alston, J., "Agricultural R and D Policy: A Tragedy of the International Commons", Staff Paper P08-08, University of Minnesota, September 2008, p.34.

9. Some Conclusions

This report aims to provide a brief history of rural research in Australia, the roles of the many stakeholders in research and development (R&D) of Australia's primary industries and outline the continual evolution of the methods for rural R&D in Australia.

Rural research and development has a long history in Australia. It stems from the necessity of European settlers to establish a viable agricultural industry to support the growing colony throughout the 19th century. Early agricultural research was conducted by the states and territories at many research stations across the country to support the local agricultural industries. The states continue to be major research providers and funders in a complex rural R&D system.

The need for a national approach to the challenges facing not only primary industries, but many other sectors, was recognised early by our leaders. This led to the forerunner of what is now the Commonwealth Scientific and Industrial Research Organisation (CSIRO) shortly after World War I.

The formation of the Research and Development Corporations (RDCs) and Cooperative research Centres (CRCs) in the 1990s was a major advancement in the Commonwealth's and Industry's involvement in rural R&D. With industry and government contributions the RDCs invest approximately \$500 million annually into R&D now. This represents between thirty to forty per cent of total R&D spending nationally. The RDCs have had a major influence on the whole R&D system, with the model evolving to include industry owned companies that can provide marketing, promotion and industry representation and to give industry more control over its affairs.

History shows that rural R&D has been driven by industry and the needs of each particular sector. The shifting proportion of public funding that goes into rural R&D, compared to other sectors, also reflects the position of the agriculture, fisheries and forestry sector in the Australian economy and the importance of it.

The continual evolution and the need for continual adaptation of Australia's primary industries to market conditions, the environment and community expectations has seen many policy changes and shifts in research priorities across primary industries over the years. There is continuing need for government policy to support and keep Australia's primary industries at the forefront of a competitive international market.

Across the system policy changes now are being driven by reduced budgets for research and development, the need for greater efficiency throughout rural R&D system, and major cross sectoral challenges that require multi-disciplinary research responses. Collaboration between agencies is now a major theme in many research projects.

A number of new initiatives are aimed at ensuring rural R&D is conducted collaboratively between agencies and industry sectors to effectively and efficiently use resources. The National Research, Development and Extension (RD&E) framework is one such initiative which, when implemented, establish a strong culture of collaboration and strengthen national research capability to address cross sectoral and sectoral issues better.

Advanced communication technology has helped considerably in encouraging researchers to work together across agencies and given end-users much easier access to research findings and facilitating adoption.

While the private sector has not been a significant investor in rural R&D, outside of the levy system, this is changing as private consultants provide extension services and research is commercialised using intellectual property rights.

The challenges facing our primary industries are many and continued investment is a necessary measure to help Australia's agri-food industries adapt to these challenges. If our primary industries are to compete in an ever changing global market, investment in rural R&D is essential. Australia's ability to compete with other nations will ultimately come from the ability of our primary industries to adapt to and manage the challenges that may be faced in the future.

Appendices

Appendix 1. National Innovation Strategy – May 2009

Examples of New Programs and Funding (\$m)

SCHEME	KEY OBJECTIVES	2008-09	2009-10	2010-11	2011-12
Australian Post Graduate Awards Scheme	<ul style="list-style-type: none"> To support postgraduate research training in the higher education sector; and To provide financial support to domestic postgraduate students of exceptional research promise who undertake their degree by research at an eligible Australian higher education provider. 	101	151	183	218
Research Training Scheme	<ul style="list-style-type: none"> To enhance the quality of research training provision in Australia; To improve the responsiveness of Higher Education Providers (HEPs) to the needs of their research students; To encourage HEPs to develop their own research training profiles; To ensure the relevance of research degree programmes to labour market requirements; and To improve the efficiency and effectiveness of research training. 	592	604	615	631
Joint Research Engagement Program	<ul style="list-style-type: none"> To support capital maintenance (not purchases) by HEPs; and To support infrastructure upgrades. 	-	159	324	333
Super Science Initiative	<ul style="list-style-type: none"> To boost critical areas of scientific endeavour, including space science and astronomy, climate change, marine and life sciences, biotechnology and nanotechnology. 	\$1.1 billion over four years.			
		-	Space and Astronomy		\$160m
		-	Marine & Climate		\$388m
		-	Biotechnology, Nanotechnology and ITC		\$504m
		-	Fellowships		\$27m
Commonwealth Commercialisation Institute	<ul style="list-style-type: none"> To support research commercialisation and early stage company development by small and medium enterprises. 	21.9	38	59	78
Research and Development Tax Credit	<ul style="list-style-type: none"> 40% non-refundable tax credit and a 45% refundable tax credit for firms with turnover of \$20m or less. No expenditure cap. The definition of R&D will be tightened. To start 1 July 2010. Expected to be revenue neutral because it is replacing the existing R&D Tax Concessions. 				

Appendix 2. Selected bibliography

- A Government Statement by the Hon. J. Kerin, Minister for Primary Industries and Energy and Sen. the Hon. Peter Cook, Minister for Resources, “*Policies for Growth*”, May, 1988.
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- IAASTD, “*Agriculture at a Crossroads*”, Synthesis Report, 2008.

Appendix 3. Consultant's brief

Project objectives and deliverables

The Council wishes to examine rural R&D policy over the past century in order to inform discussion with and among stakeholders regarding the next phase of system development and to inform the National Strategic Rural R&D Investment Plan, which the council is tasked with.

The council is seeking a consultant to use desktop research already undertaken by the department as a basis for preparing a retrospective analysis of rural R&D policy in Australia.

This work will explore and discuss:

- *the role and contribution of public institutions, including universities, and the private sector in rural research*
- *common research themes and collaborative efforts in the rural sector over time*
- *funding trends and funding models in Australian rural R&D*
- *the changing nature of extension*
- *changes to the positioning of rural R&D within the national innovation system as whole over this period, across portfolios*
- *key legislative and structural reforms that have impacted on this positioning, and*
- *Australia's involvement in international rural R&D.*

Some reference to case studies and thematic developments could be included, at the discretion of the consultant in order to demonstrate the diversity of the system in delivering research across the various structural components in fields such as plant breeding, animal health, food quality and standards, irrigation efficiency, land management, farm machinery and manufacturing, rural sociology, behaviour and change management and environmental sustainability.

Timing and methodology

A draft of this paper should be available by 26 October 2009 with the document to be completed by 9 November 2009.

A Retrospective on Rural R&D in Australia

