National framework for Primary Industries Research, Development and Extension – Economic Considerations

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Executive summary

The organisation and funding of primary industry research, development and extension (RDE) activities has evolved over time, as a function of changes in agriculture policy and practices, agriculture science, and changes in policy towards RDE. On the last front, the past two decades have witnessed a number of policy innovations, notably the separation of funding, purchasing and provision of RDE services, the introduction of contestability, greater involvement of the private sector in financing and undertaking research, and the development of funding partnerships between public authorities and the private sector.

While these innovations are recognised to have enhanced the benefits resulting from RDE activities, there is also a recognition that further action is necessary. The Primary Industries Ministerial Council has thus initiated a process for a national framework for primary industry RDE. The ambition of consolidating RDE capability within and across state jurisdictions, and achieving efficiencies in the supply of RDE, appear to be major points of focus for this process. At the same time, it needs to be recognised that such questions concerning institutional arrangements are part of a set of issues related to the design of pubic policy for primary industry RDE. In particular, it is necessary to consider the structure of incentives embedded in the overall architecture for primary industry RDE, and how this impacts on the efficiency of RDE.

In assessing the architecture for RDE, and the design of public policy in regard to it, it is necessary to begin by articulating what efficiency means in the present context. Allocative efficiency is concerned with maximising the social returns from RDE. The issue of allocative efficiency requires that public policy, and funding rules in particular, address the issue of private appropriability – or otherwise – of returns to RDE. The wedge between private and public benefits can constitute a case for public financing, though by the same token, caution is required to ensure that public funds do not inadvertently subsidise private gains. Given that it is beyond the scope of this exercise to identify which types of RDE investments are socially optimal, our approach will be to assume that the research policy agenda includes those activities where social rates of return are high. Under this approach, assessing whether RDE investments are allocatively efficient amounts to considering whether arrangements are suited to meeting the needs of the current and emerging research agenda. In addition to allocative efficiency, it is useful to consider productive efficiency, which is narrower concept focusing on whether RDE activities are organised and conducted in a manner that reduces the cost of supply, and that enhances innovation. Many of the concerns relating to structural consolidation are primary concerns of productive efficiency.

As already mentioned, reforms to primary industry RDE over the last two decades have generated benefits, which can be articulated in terms of improved allocative and productive efficiency. Nevertheless, the arrangements that have developed do raise a certain number of challenges. In particular:

- Private stakeholders have limited incentives to pursue systemic or cross-cutting research areas, such as food security, biotechnology, natural resource management, and climate change. These issues often require cross-sectoral collaboration, and, because they involve stakeholders beyond producer groups, are liable to generate benefits not appropriable by producers. Existing coordination mechanisms, such as the Chair of Chair process, appear to be insufficient to deal with free-riding problems which can affect cross-sectoral collaboration. Government co-financing of research through RDCS could address issues of private under-investment in areas where some benefits are not appropriable, but only if stronger control is exercised by government representatives on RDC boards on the setting of research priorities.
- The current system of funding is characterised by a number of subsidies to private purchasers of research, with the risk that public resources are likely to be diverted to financing private gains. One such subsidy can arise through the principle of matching co-financing through RDCs, if priorities determined by RDC boards are disproportionately influenced by private sector representatives. Moreover, the development of excludability mechanisms in relation to extension may mean that issues of appropriability are not always as pronounced as might have first appeared . Another source of subsidies is the practice of allocation, by providers, of only the incremental costs of research to the private sector, with overheads and common costs financed through public funds. This can make the calculus of costs and benefits associated with privately beneficial projects more attractive than they should be.
- There appears to be an inefficiently high level of fragmentation in the supply of RDE services, despite the fact that the introduction of contestable funding should, in principle, act as a spur for providers to seek cost savings, through, amongst other things, economies of scale and scope. This in part may reflect the fact that a substantial amount of funding is still disbursed on a block-grant basis; but even where activities are funded by RDCs through producer levies, there appears to little evidence of a push to disburse funds on the basis of revealed competence (as opposed to, say, in a manner that reflects the regional provenance of funds).
- Part of the reason behind persistent fragmentation is the lack of strong incentives for productive efficiency emanating from purchasers and funders. In particular, there is lack of evaluation and monitoring of RDE activities. Where such evaluation has taken place, it has usually been at too high a level, and not done systematically. It is accepted that ex-post evaluation of RDE is complex, and requires a substantial effort over a wide range of activities over

a period of time, if even broad inferences regarding efficient forms of activities are to be drawn. Private stakeholders, in particular, will be more inclined to undertake such effort if they were sufficiently concerned about deriving value for money from their expenditure on RDE. However, such concern is likely to be attenuated if they do not face the true costs of research, owing to the types of subsidy discussed above. It is worth noting that any push towards supply side consolidation is likely to face resistance from entrenched interest groups favouring the status quo. In this context, better evaluation and monitoring, and confronting the private sector with the true cost of activities, have important roles to play as they highlight the costs of the status quo, and thus create constituencies in favour of reform.

The analysis of the current challenges facing primary industry RDE suggests a number of policy levers. One such lever would be to revisit the manner in which public funds are allocated to RDE activities, particular where the degree of appropriability of benefits is high. This entails closer scrutiny of projects to ensure whether they do in fact warrant matching co-financing. It also requires that common costs and overheads be allocated to private purchasers of research. In this context, it is worth considering the merits of divesting or contracting out research functions currently carried out by state governments, which currently undertake a substantial proportion of research commissioned by private producers. Divesting or contracting out would leave cost allocation decisions in private hands, and purchasers are thus more likely to be confronted with the true costs of research.

As we already mentioned, the fact that private producers benefit from various forms of subsidy may attenuate their incentives to ensure value for money by investing in evaluation and monitoring; consequently, we would expect reforms to cost allocations of the manner just discussed to improve incentives for measurement and evaluation. Given the magnitude of publicly financed RDE, particularly on a non-contestable basis, it is clear that substantial efforts need to be undertaken by state governments on the evaluation and monitoring front, particularly in strengthening the linkage between the granting of funds and evaluation results. The extent to which state governments can establish a truly effective and credible performance evaluation mechanism while retaining both funding and provision functions is open to question; this reinforces the rationale for divesting or contracting out provision functions.

As already argued, there are likely to be constituencies of entrenched interests against reform, particularly where reforms entail a relocation of activities across regional lines. While the actions described in the preceding paragraphs can create pro-reform constituencies, it may also prove necessary to encourage reform by meeting some of the costs of adjustment experienced at locations where activities are scale down. This could be done be done through the release of funds, conditional on the implementation of reforms.

It is important to emphasise the inter-linkages between the various challenges we have documented, and the steps that can be taken to address them. It would thus be idle to presume that issues relating to the productive efficiency (e.g. fragmentation in supply) of RDE activities can be addressed in isolation of wider problems relating, for example, to the structure of incentives emanating from current funding processes. It is recognised that public policy in relation to RDE operates in a second best environment, in large part due to the incomplete nature of information associated with RDE. There will always, for example, be complications in evaluating RDE, or in determining the level of private appropriability of the results of research. It is thus unlikely that an optimal set of arrangements, free of deficiencies can be found. However, while there may be no silver bullet, we have argued that there are a series of inter-linked actions which, cumulatively, can generate substantial improvements to the conduct of primary industry RDE.

1 Introduction

1.1 WHAT WE HAVE BEEN ASKED TO DO

A process has been initiated by the Primary Industries Ministerial Council (PMIC) to develop a national framework for primary industries research, development and extension (RDE).

The impetus for the proposed national framework stems from the observation that the current research effort among state departments is generally fragmented, and without a coordinated approach. The current arrangements for the provision of RDE inputs are also considered to be relatively unresponsive to the requirements of the RDE market. These perceived problems, which add to the cost of undertaking RDE, are exacerbated by growing demands for research, including biosecurity, natural resource management and off-farm issues.

The national research agenda seeks to address these problems by rationalising research capability, particularly through consolidation of research units across jurisdictions, into centres of excellence. This would involve, for example, a particular state becoming the centre for excellence for dairy research within Australia. According to the national framework, dairy research resources held within other jurisdictions would either be consolidated within the dairy centre of excellence or would be wound down. Other jurisdictions would have access to all dairy research results at marginal cost. The location of centres of excellence would be based on the location of the relevant industry and the strength and quality of the jurisdiction's existing research programme.

As indicated, the success of this proposal may require a substantial reconfiguration of resources, including the possible relocation of scientists across state borders.

Frontier Economics has been asked to comment on the proposed national framework and to advise on whether the problems of duplication and structural inefficiency are the main problems confronting the RDE system. We are asked to consider whether there are any other problems from an economic perspective.

We are then asked to consider whether the proposed national RDE system will fix these problems and what other things could be tried

1.2 OUR APPROACH

This paper has been approached from two different angles. The first has been to interview a significant number of participants in the RDE sector. These interviews have been relatively informal, but have been designed to elicit each participant's perspective on the performance of the RDE system drawn from their experience. This anecdotal information has been used to inform the second strand of this analysis, which has been to review the current institutional arrangements and industry developments and to develop an economic policy framework for analysis of potential concerns that may arise from the RDE system.

Before developing the analytical framework in greater detail it is worthwhile reflecting on some of the feedback obtained from these informal interviews. One of the consistent responses we obtained was that while there may be some shortcomings with the current arrangements, including the issues outlined above, there was a perception that the model for undertaking RDE in Australia had worked "reasonably well", and that the involvement of the rural industries in determining research priorities had been an important initiative in the delivery of research outcomes for rural Australia.

There was also a recognition that the provision of RDE takes place in an environment where markets do not work well, and intervention is likely to improve overall outcomes. However, the corollary is that intervention is also likely to be imperfect, and that these imperfections may lead to the problems, such as problems of inefficiency and inflexibility outlined above.

The basic thrust of our approach has been therefore to review the conduct of RDE activities, and to assess whether the manner in which they are organised and funded are consistent with the objectives sought from these activities. We wish to understand sources of market failure, whether these have been adequately met by policy measures, and where the design of policy measures needs to be improved. We see the issue of institutional and organisational arrangements as being anchored in the wider question of how effective public policy for primary industry RDE should be designed.

1.3 STRUCTURE OF THIS REPORT

This report is structured as follows:

- Section 2 examines the functions of the current architecture for RDE services, and the manner in which RDE activities are organised and funded. It sets out the criteria for evaluating primary industry RDE. It then reviews some of the efficiencies generated by current arrangements, and explains some of the challenges it currently faces. A particular focus is the structure of incentives embedded within the architecture for RDE, and whether they are appropriate to meet policy goals set for RDE.
- Section 3 evaluates possible levers for reform, examines how current proposals for a national RDE framework might fit in with the needed reforms, and draws conclusions.

2 Challenges facing the current architecture for primary industry RDE services

2.1 PRINCIPLES FOR ASSESSING THE ARCHITECTURE OF RDE SERVICES

2.1.1 What are RDE services?

The range of activities falling under the RDE umbrella is potentially large. It is customary to distinguish between research and development, on the one hand, and extension services, on the other. The former consists of activities such as the creation of new crop strains, or the design of new farming techniques. Within the research category, it is standard to distinguish between basic and applied research, with the latter geared much more closely to very specific needs of defined groups of users (farmers in this case). By extension services we mean activities "relating to technology transfer, education, attitude change, human resource development, and dissemination and collection of information".[1]

By architecture for primary industry RDE services we mean not just the organisations and agencies involved in procuring and executing RDE, but also the rules and arrangements which govern the behaviour of demanders and suppliers of RDE services. These rules and arrangements may encompass a wide variety of issues, but most importantly the processes by which research priorities are identified and funded, and which ultimately contribute to determining the payoffs from RDE effort.

A detailed survey of current arrangements surrounding the funding and delivery of RDE activities is presented in section 2.2.

2.1.2 How might the architecture for RDE services be assessed?

The policy framework and RDE objectives

The underlying policy agenda for RDE has evolved over time, as a function of changes in agricultural policies, agricultural practices, and in agricultural science. These parameters set priorities for RDE activities, and the broad goals they are meant to meet (e.g. achievement of disease resistant strains, improved resource management).[2] They effectively set the "research agenda" that needs to be met through the implementation of RDE policy. Historically, the basic aim has been

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1 See S.P. Marsh and D. J. Pannell, (2000) "Agricultural extension policy in Australia: the good, the bad, and the misguided", in *The Australian Journal of Agricultural and Resource Economics*, No. 44.4, pp 605-627

2 See J. Alston, P. Pardey, and V. Smith, (1998) "Financing agricultural R&D in rich countries: what's happening and why", *The Australian Journal of Agricultural Resource Economics*, 42.1, pp 51-82.

to foster the productivity and profitability of the agriculture sector as a whole, by investing in the development and dissemination of knowledge and technology. More recently, issues such as the management of natural resources, or the need to handle the linkages between agricultural activities and environmental degradation, have become foci of RDE activities. Indeed, as will be discussed later in the paper, the stakeholders in RDE activities extend beyond the traditional agricultural community.[3]

RDE activities have also been shaped by the evolution of public policy towards RDE, in particular the quest to ensure that RDE activities are carried out and funded in a manner that is efficient from a social perspective, given the public good features and externalities that typically characterise such activities. These are issues that will be a recurrent object of discussion throughout this paper. It suffices, at this juncture, to note that the private appropriability of RDE results has gained increased recognition over the past 25 years, particularly where knowledge generated by RDE services has been of the applied type, specially tailored for specific farm groups. This, in turn, has stimulated a policy trend towards recovering costs associated with RDE from private beneficiaries in the farming sector, with significant implications for the architecture of RDE services. Cost recovery from beneficiaries is intended to free up resources to be devoted to addressing the public good and externality features of research.

Assessment and the concept of efficiency

Against the backdrop of these broad and evolving policy objectives, the key public policy requirement that should be imposed on the organisation of RDE activities is that of efficiency. The concept of efficiency captures a number of different strands. The first such strand is allocative efficiency, which requires that the rules underpinning the funding and conduct of RDE services are consistent with maximising the returns to society from RDE investments. In the context of RDE activities, this requires that funding address issues stemming from the private appropriability – or otherwise – of RDE. In particular, the incidence – to greater or lesser extent – of non-rivalry and non-excludability across most types of RDE activities is liable to drive a wedge between private and public returns from undertaking RDE activities. This can constitute a case for public financing of RDE activities, though, by the same token, careful attention has to be paid to avoid an inadvertent allocation of public funds to subsidise private benefits.

The actual issue of measuring social rates of return to particular types of RDE investments, with a view to identifying which areas of RDE (and within those, what specific types of activities) carry the greatest public benefit, is a complex activity, and one that is beyond the scope of this paper. An alternative approach is to assume that the policy agenda set for RDE captures those activities where social rates of return are likely to be the highest. Under this approach, assessing

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3 See J. Mullen, D. Vernon, and K. Fishpool, (2000) "Agricultural extension policy in Australia: public funding and market failure", in Australian Journal of Agricultural and Resource Economics, 44.4, pp 629-645

the allocative efficiency of RDE investments thus amounts to considering whether current arrangements are suited to meeting the needs of the current and emerging research agenda.

The second strand of efficiency, productive efficiency, relates to the organisation of RDE activities and production of RDE outputs in manner that reduces costs of supply, and enhances innovation. This conception of efficiency is of interest to public and private RDE stakeholders for a number of reasons, including: the increased pressure on public authorities to contain expenditure; the increased challenges faced by producers in agricultural markets stemming from policy liberalisation and the implementation of increasingly restrictive product standards; and the fact that, over a longer time horizon, innovation in RDE can itself affect the overall research agenda. [4]

2.2 OVERVIEW OF CURRENT INSITUTIONAL AND FUNDING ARRANGEMENTS

The RDE delivery system for agriculture in Australia is complex. While historically dominated by the public sector, the last 20 years or so have seen a greater degree of separation between the procurement, funding and provision of RDE services. Separation between procurement and funding has involved, for example, greater latitude given to producers to determine what types of RDE services are needed, with the public sector providing funds to finance the undertaking of these services. Separation between funding and delivery has been introduced through the creation of contestable grants, through which both public and private funds are disbursed to providers through competitive tender.

Of course, the distinctions are not watertight. Public and private co-financing of research means that private procurers of research also provide funding. Rural Development Corporations (RDCs) are a major vehicle through which the private sector procures and funds RDE services in partnership with the state. Many State Departments procure and fund RDE services through contestable and non-contestable mechanisms, but are also important providers of RDE services in their own right. Indeed, State Departments will often compete with other service providers to attract funding from RDCs.

While recognizing the number of ways in which functions and activities of the state, producers, research providers and other representative bodies overlap, the progress towards delineating procurement, funding and provision suggests that we can consider the architecture for RDE as comprising a demand side, where RDE priorities are considered, and funding and procurement organised; and a supply side, which is geared to delivering RDE services.

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[4] It is sometimes customary to identify productive efficiency with cost cutting, and to characterise innovation as "dynamic" efficiency.

2.2.1 Demand side

RDCs

There are 15 Rural Research and Development Corporations and Companies (RDCs). Nine of these organisations were established either under the *Primary Industries and Energy Research and Development Act 1989* while the remaining six are constituted under Corporations Law.[5] The RDC model is one policy response to the observation that the market for RDE "fails" – such that in the absence of Government intervention there would be a significant underinvestment in socially beneficial RDE.[6] When initially established, the RDCs were seen as a means of supplementing the core funding from the public sector, however their prominence has grown, both in terms of their influence on research priorities and on the overall allocation of RDE funds.[7]

In theory, the RDCs are not meant to compete to provide private RDE, but are intended to undertake research activities which would not otherwise be funded. In practice the boundary between public and private good research is not always clear which prevents an absolute demarcation of public and private good research. Moreover RDE outcomes are uncertain, and publicly funded research may yield private outcomes, even if this was not planned at the outset. Finally, the pressure for measurable results and accountability for performance tends to drive RDCs towards the applied end of the RDE spectrum (closer to private good, appropriable research).

The 15 RDC organisations plan and fund, from compulsory and voluntary industry levies, matched by Australian Government contributions, much of the agricultural R&D undertaken in Australia.[8] In 2004-05, the total RDC income was more than $510 million (see Table 1).[9] [10]

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5 A detailed description of the RDC model and the governance arrangements is provided in Centre for International Economics [CIE] (2003) The Rural Research and Development Corporations, prepared for DEST.

6 Other policy responses to market failure in RDE sector include the development of IP rights, and direct provision of research services by government agencies.

7 Brennan and Mullen (2002) "Joint funding of agricultural research by producers and government in Australia", in D. Byerlee and R. Echeverria (eds) *Agricultural Research Policy in an Era of Privatization* refer to the issue of the 'tail wagging the dog' where the D 'tail' wags the public sector 'dog'. We discuss the influence of the RDCs on overall RDE funding later in this report.

8 In addition to funding RDE the RDCs fund, to a greater or lesser extent, off-farm activities including marketing and product development.

9 DAFF (2005) Innovating Rural Australia, Research and Development Corporation outcomes.

10 RDC contributions have grown from a total of approximately $155m in 1990-91 ($61m industry funds and $95m government contributions).

R&D Corporation	Industry Contribution ($m)	Commonwealth Contribution ($m) [a]	Expenditure ($m)[b]
Cotton RDC	4.58	4.32	12.62
Fisheries RDC	11.20	16.90	29.06
Forest and Wood Products RDC	3.77	2.97	8.20
Grains RDC	64.19	35.74	119.53
Grape and Wine RDC	9.68	8.10	16.89
Land and Water Australia	-	12.50	26.27
Rural Industries RDC	2.68	14.65	21.09
Sugar RDC	5.13	4.56	8.66
R&D Companies			
Australian Wool Innovation	42.84	13.51	78.49
Australian Pork Ltd	3.80	4.22	7.67
Australian Egg Corporation	0.75	0.76	1.71
Dairy Australia	14.53	14.53	36.11
Horticulture Australia Ltd	31.63	32.91	66.92
Meat and livestock Australia	39.04	39.04	78.08
LiveCorp Ltd[c]	-	-	-
Total	**233.82**	**204.71**	**511.3**

Table 1: RDC Funding 2004-05

Source: DAFF (2005) Innovating Rural Australia, Research and Development Corporation outcomes.

[a] 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.

[b] 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.

[c] LiveCorp came into operation in Jan 1 2005. Full reporting year will be included in the 2005-06 report.

The RDCs have three main roles in supporting the competitiveness and sustainability of Australia's primary industries:

- They set priorities for primary industry RDE reflecting industry identified needs and government priorities;
- The RDCs purchase RDE service from providers such as the state and territory agricultural departments, universities, CSIRO, ABARE, Cooperative Research Centres (CRCs) and the private sector. They may also hold intellectual property (IP), often through joint venture arrangements; and
- They communicate research findings to industry. In particular, they have played an increasingly important role in extension activities, notably by coordinating technology transfer activities, and by ensuring that extension agendas match research priorities.[11]

The industry specific RDCs obtain funds from the relevant industry and therefore tend to focus RDE effort in those areas where the research outcomes are expected to be captured by the industry (industry goods).

However, not all rural research will necessarily lead to appropriable industry benefits. Moreover, some rural industries are not sufficiently organised to manage the functions necessary to support an R & D program, or have elected not to do so (e.g. rice industry). The Rural Industries Research and Development Corporation (RIRDC) aims to support emerging industries, many of which do not have a sufficiently well organised foundation to provide and manage their own production levy, while Land and Water Australia (LWA) tends to focus research effort that cuts across rural industry systems, with a focus on issues of sustainability and resource management. However, the combined expenditure of RIRDC and LWA in 2004-05 was $47M which represents less that 10 % of the total RDC expenditure for this period. The relatively small level of funding that is currently allocated to these two RDCs may be insufficient to accommodate the growing demand for research into environmental and resource management issues.

When research programs offer scope for benefits to be spread across a number of rural industry sectors the RDCs may join forces to fund programs which are anticipated to give rise to wider economic benefits. The Chairs of the various

11 See Marsh and Pannell, *op.cit*

RDCs also meet from time to time under the auspices of the Chair of Chairs to discuss issues of common interest concerning the ongoing evolution of the RDC model, including development of communication strategies and oversight of participation in policy forums.[12] Notwithstanding these developments one issue that we explore in this paper is whether the emergence of a broader R & D agenda presents a challenge to the current industry-based configuration of the RDCs.

Governance of RDCs

The PIERD Act gives the Minister power to give written directions to an RDC in regard to the performance of its statutory functions or the exercise of its statutory powers. RDCs must also submit an annual report to the Minister for tabling in Parliament.

In addition to the nine statutory RDCs established under the PIERD Act, six bodies are industry-owned companies limited by guarantee. The objectives of the industry-owned companies are said to be more focused on commercial development than the RDCs established under the PIERD Act.[13] Directors of the Corporations Laws companies are not subject to Ministerial appointment, nor are their business plans required to be approved by the Minister.

To guide the RDC's investment strategies, industry and other key participants are consulted in the preparation of three to five year Corporate Plans which identify the RDC's research priorities. The industry priorities are also guided by the National Research Priorities determined by the Australian Government for publicly funded research (see Table 2).

The priorities identified through the National Research Priorities process may serve to constrain the activities of the RDCs to those areas of high social payoffs. However, as the table demonstrates, these priorities are set at a sufficiently high level that they offer little restraint on the funding activities of the RDCs.

National Research Priority	**Rural Research Priority**
An environmentally sustainable Australia	• Sustainable resource management
Frontier technologies for building and transforming Australian industries	• Use of Frontier technologies • Creating an innovative culture
Promoting and maintaining good health (though strengthening Australia's social and economic fabric)	• Improving competitiveness through a whole of industry approach • Maintaining and improving

12 CIE *(op cit).*

13 CIE (op cit) p.9.

National Research Priority	Rural Research Priority
	confidence in the integrity of Australian food, fish and forestry products • Improving trade and market access
Safeguarding Australia	• Protecting Australia from invasive diseases and pests

Table 2: National Research Priorities

Source: Backing Australia's Ability

To exercise an effective governance role the Minister must be adequately informed about the performance of the RDCs. Each year the Department of Agriculture Forestry and Fisheries (DAFF) releases a review of RDC outcomes ("Innovating Rural Australia"). This document is intended to provide a review of the achievements of the RDCs and a commentary of areas for future development.

RDCs are also accountable to their industry stakeholders. This is achieved mainly through the development and promulgation of strategic planning documents and the annual reports which provide an overview of performance of the research programs. However, the annual reports generally report performance at a very high level, and generally focus on the alignment of research programs against priorities rather than provide detailed analysis of returns to research across the organisation's research portfolio.

The RDC model is a key element in the development and application of the funder-provider RDE model in Australia. As indicated above one of the key motivations for the establishment of the RDC model was to change the agricultural R&D paradigm from one driven by researchers to one driven by end users. The pool of funds managed by the various RDCs has also provided an element of contestability in the rural research system so that research providers must compete for funds to support their projects. Contestability for funding has been widely endorsed as a mechanism to improve the quality of research and enhancing the responsiveness and accountability of providers for research priorities and research outcomes.[14]

Evaluation of Returns to Research

Evaluation of the returns from the investment in research and development is an inherently difficult but important exercise and is essential to meet accountability requirements and to guide future investment. From time to time some RDCs (e.g. LWA and RIRDC) have undertaken more detailed assessments of the performance of the research programs in order to assess funding performance.

14 Brennan and Mullen *(op cit)*.

For example, LWA attempted to estimate the Return on Investment (ROI) of selected projects within its research portfolio.[15] The study evaluated 25 projects which corresponded to roughly 25% of the LWA research portfolio. The analysis showed significant positive returns to research, however the sample was far from random, with no advice on the remaining 75%. Moreover, the estimation of the expected program benefits was highly subjective, based on a scoring system completed by researchers, and subsequently "verified" by personnel knowledgeable in the field.[16]

Overview of Governance

The governance model which applies to the RDCs may be described as "light-handed". The Commonwealth government appears to exert most of its influence in the determination of high level objectives, which, in turn, determine the broad direction for RDC funding. Once these broad objectives have been set the Commonwealth government appears to leave the funding decisions to the individual RDCs with very little subsequence analysis or scrutiny of RDC performance (either in relative or absolute terms). As indicated previously, the annual review of RDCs undertaken by DAFF does not meet the requirements of a thorough and well-founded review of RDC performance. We conclude that governance of the RDCs is relatively weak and this may have implications for the overall performance of the R & D system. This issue is taken up later in this report.

Range of RDC Investments [17]

Under their enabling legislation the RDCs are empowered to invest in RDE across the production, processing, storage, transport and the marketing chain of primary industries. Recent surveys by AFFA have found that in recent years approximately 25% of the funds were invested in the area of promoting industry competitiveness, 24% in sustainability R&D, 21% in processing, 3% in distribution, storage and transport R&D, 8% in market oriented R&D, 7% in commercialisation and technology transfer activities, 5% in human resource development, with the remaining 6% directed to other R&D, which includes such things as the routine collection of data and some funding of post-graduate scholarships. It is notable that many of the Corporations place more than 50% of their R&D investments in the off-farm area.

The category of R&D invested in is also quite broad: 19% being directed at basic research, 38% on applied research, 14% directed at experimental development, 13% towards demonstration and extension, and 9% for commercialisation; while the remaining 7% of funds was invested in human resources or other R&D.

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15 LWA (2005) Land and Water Australia's Portfolio Return on Investment & Evaluation Case Studies.

16 LWA *(op cit),* p13.

17 www.daff.gov.au/content/output.cfm (5/06/2006).

RDC investments are spread across a diverse range of institutions. RDC funds are spread across CSIRO projects 19%, State Government projects 35%, universities 18%, private sector 18%, and 11% in other institutions.

We have attempted to obtain greater detail on the allocation of funding from individual RDCs. This information is not generally publicly reported and required direct approaches to the relevant RDCs. This information is provided in Appendix 1.

Public funding of RDE

The discussion above focuses heavily on the funding role of the RDCs. However, non-RDC funding, which includes substantial funding for agricultural agencies from the Consolidated Fund, remain the dominant source of funds. For example, Queensland DPI reports that external funding contributes approximately 26% of total budget.[18] It is estimated that in NSW RDC levies represent only about 15% of total research expenditure[19] however John Mullen has indicated recently that NSW DPI has significantly increased the proportion of industry funding for R&D – it is now estimated that external funding of R&D is approaching 50% in NSW.[20]

Although the public sector remains an important funder, the real issue is the question of influence on RDE priorities and allocation decisions. As previously discussed, there is evidence that RDC levies have been extremely influential in determining overall research priorities and have been able to leverage expenditure several times their own value. This ability to leverage funding appears to have been exacerbated by the anecdotal evidence (reported in Brennan and Mullen (2003)), that research providers will not undertake some projects unless they receive some level of RDC support.[21]

2.2.2 Supply side

State departments

The existing arrangements in Australia for undertaking agricultural research reflect the dominant role of the public sector organisations. While the Commonwealth Government has one major research provider (CSIRO), and some smaller research organisations (e.g. ANSTO, AIMS), the majority of rural RDE in Australia is still undertaken by the state government Departments of Agriculture or their equivalents.[22] In addition some government agencies that have a natural resource focus also undertake rural RDE, particularly where the

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18 Queensland Government, Ministerial Statement (2006).

19 Brennan and Mullen *(op cit)*.

20 John Mullen *per comm.* (19 Sept 2006).

21 This position has been supported by observations made by other officers in respect of current funding arrangements.

22 Agriculture and Food Policy Reference Group (2006) Creating our Future: Agriculture and food policy for the next generation.

research agenda have extended to emphasise resource protection and sustainable farming practices. However, this level of integration is by no means uniform, with some states still holding agriculture under a different departmental portfolio to either forestry or natural resources.

The activities of state departments have witnessed a substantial degree of regionalisation, which has largely reflected the perceived importance of locating extension services close to clients. That is, in order to provide extension services to rural industries, state departments have operated a geographically dispersed network of institutions. Research activities within departments have also followed this model of decentralisation. Pressures to reduce costs, and the need to pursue a research agenda giving greater emphasis to regional and cross-cutting issues have raised questions as to whether such dispersion is an efficient way of organising research and development (as distinct from extension) capability. Especially where some aspects of the new research agenda draws on very expensive and large research infrastructure, a reduction in the level of fragmentation has its benefits. At the same time, it is recognised that the provision of extension services will tend to favour a greater level of dispersion of state institutions, insofar as services such as adult training and the transfer of technology and proximity to, and knowledge of, local circumstances. Issues relating to fragmentation and rationalisation are discussed in greater detail in section 2.4.3.

Efforts to distinguish between funding and service provision roles have seen the emergence to two types of trend amongst state departments. One is increased recourse to outsourcing RDE tasks to private contractors and agribusiness. But, in parallel with this, state departments have also been active in bidding for RDC funding, and in forming partnerships with industry to ensure that research programmes are best suited to actual needs.

In the area of extension services, industry partnerships have led to changes in the methods of service delivery. There has been a trend towards group-based, as opposed to one-on-one, extension, and the development of branded extension service programmes (such as Target 10, Topcrop, and Prograze). Branded group delivery is in some sense a mechanism for retailing information. It thus constitutes a mechanism through which to address the non-excludable nature of research, and raises further questions as to the rationale and extent of government intervention in RDE.

Universities and Cooperative Research Centres

Rural research is also being undertaken within Universities, within a number of private research agencies, and Cooperative Research Centres (CRCs - discussed below). These organisations all compete with the state agencies for funding from the RDCs through the award of competitive grants. In some cases, the Universities and other agencies will form alliances with the state agricultural agencies to bid for research funding. In this way the various research organisations may at any one time be a competitor or complementor.

In 1990, the Australian Government began to establish Cooperative Research Centres (CRCs). CRCs are joint agreements between different research providers

to undertake R&D into particular areas. The CRCs were created to enhance the links between industry and the public research institutions. There are approximately 24 CRCs related to agriculture (out of a total of approximately 62 CRCs).

The objective of the CRC programme is "…to enhance Australia's industrial, commercial and economic growth through the development of sustained, user-driven, cooperative public-private research centres that achieve high levels of outcomes in adoption and commercialisation".

CRCs often receive in-kind contributions from the public sector research institutions, in addition to the funding provided by the Australian Government and industry. The Australian Government funding is limited to 50% of total funding of a centre's total budget. Funding is generally limited to a maximum of 7 years, after which funding ceases unless the CRCs are successful in a subsequent competitive bidding round.

CRCs are primarily focused on research, but their activities also include an extension component. Traditionally, the CRCs have relied on state departments for the dissemination of research knowledge, particularly through technology transfer activities. The changing focus of state departments on extension has prompted CRCS to explore other mechanisms for dissemination, notably through industry groups.

Since the commencement of the CRC Programme, all parties have committed more than $11 billion (cash and in-kind) to CRCs. This includes more than $2.6 billion from the CRC Programme, $2.8 billion from universities, $2.1 billion from industry and more than $1.1 billion from CSIRO. These figures include commitments made in the 2004 selection round. The amount of funding provided to new CRC's, or those developing from existing CRC's, in the last selection round (2004) ranged from $20 million to $40.25 million over seven years.

CRC governance

The Minister appoints an advisory committee, the Cooperative Research Centres (CRC) Committee. The CRC committee is tasked with advising on the selection and evaluation of Centres, and on determining what criteria should be associated with the disbursement of funds under the Programme. However, the Minister does not directly review the operations and performance of specific CRCs. Instead evaluation of CRC performance is delegated to an advisory committee which determines whether to extend the funding of an existing CRC beyond the existing term.

A review of the CRC Programme was completed in July 2003. The evaluation included an examination of the appropriateness of the programme's objectives in the light of policy on research and innovation, including the national research priorities.

The evaluation also considered the effectiveness of the programme in enhancing collaboration among public and private sector researchers, and between public sector researchers and commercial or community interests.

The evaluation found that "the currently operating CRCs fit well within the Research priorities. In particular, the emphasis of the Programme in agriculture and the environment has a very strong orientation towards sustainability."

Efforts have been undertaken to strengthen the programme's accountability arrangements. The 2003 review recognised this limitation and commented accordingly:

> The evaluation considered the effectiveness of the programme's accountability arrangements, including performance monitoring and reviews, and recommended a review of the CRC performance management framework…"
>
> Consequently, the Department is seeking to achieve a performance assessment approach that is consistent with the requirement of all research and research-funding bodies to enable a cross-portfolio assessment of the impact of research on achieving the NRP goals.
>
> The Department is currently revising the CRC performance management framework and in this context will consider key performance indicators for assessing and managing the performance of individual CRCs and the CRC Programme.[23]

It appears that the evaluation of CRC performance will be assessed in accordance with the implementation of the "research quality framework (RFQ)".[24] This framework is designed to provide a consistent and rigorous basis for assessment of the quality and impact of public funded research. The process of development of the RFQ began in May 2004 and is expected to be introduced in 2007.

This following sub-sections will assess some of the advantages of the current RDE architecture, and analyse some of it potential shortcomings.

2.3 EFFICIENCIES UNDER CURRENT ARRANGEMENTS

The evolution of the RDE architecture over the last two decades is recognised as having created efficiencies through a number of channels.

2.3.1 Efficiencies in the execution of RDE activities

The introduction of contestable processes and the establishment of better linkages between provider and industry have given the RDE agenda a greater demand driven focus, as opposed to one determined primarily by the requirements of researchers. To the extent that that the demands of RDE users are liable to more accurately reflect actual industry needs, the greater demand focus generates higher rates of return than would have been the case under a supply driven agenda.[25] A challenge remains in verifying that this is actually the case. The lack of comprehensive and detailed analysis of returns to research

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23 http://www.dest.gov.au/NR/rdonlyres/5796C8BA-7FC5-4EDA-8BD7-60955E966572/7269/CRCrevisedNRPs04.rtf

24 http://www.dest.gov.au/sectors/research_sector/audience_segments/for_crc.htm

25 CIE *(op cit)*.

represents a significant stumbling block in drawing firm conclusions regarding the link between institutional arrangements and research outcomes. We shall consider this issue in greater detail in section 2.4

More generally, the introduction of contestability in the allocation of funds to providers – whether through RDCs, or by governments through grants (for example, in allocation of funds to Universities) – has the potential to create efficiencies to the extent that it enables funds to be allocated to the provider best suited for a particular activity, and who will deliver the best value for money. Moreover, the expectation that funds will be allocated on a contestable basis should create incentives for RDE providers to seek ways of improving the efficiency of their operations – for example, by identifying areas of specialisation, or seeking economies of scope by avoiding duplication or fragmentation of facilities. The extent to which contestability does create incentives for efficiency, and in particular the extent to which it is effective in stimulating efficiency-seeking behaviour from RDE providers is a matter for empirical evaluation. We shall consider this in greater detail below and in section 2.4

In relation to extension activities specifically, the expansion of group-based delivery methods is seen as broadly positive. The trend reflects the increased involvement of industry in determining priorities, and thus is consistent with a move towards a demand-pull rather than science-push agenda. In particular, the development of groups carrying brand names has fostered greater control over the content and delivery of information in extension programmes. Brand named groups are credited with mobilizing industry support, while control over membership has allowed some control over who benefits from the knowledge disseminated.[26] Moreover, group-based extension activities are able to prompt change in relation to complex farm management issues (e.g. rotation farming, natural resource and catchment management, and understanding business viability) where the main constraints to action have largely been the result of a lack of shared understanding of problems, rather than a lack of awareness about what science has to say on these issues. [27]

2.3.2 Allocative efficiencies

The public-private co-financing model is, in principle, a source of efficiencies given that:

- To the extent that the results of RDE activities are *not wholly* appropriable - either owing to the fact that they are non-excludable, or because of externalities – the provision of public funding mitigates the risk of under-investment which would otherwise arise if the financing of RDCs activities were left wholly to private sources; and
- The results of RDE activities are to *some extent* appropriable. For example, the results may translate into higher sales revenues, and it may be possible to limit

[26] Marsh and Pennel, *op.cit*

[27] Marsh and Pannell *op.cit*

the extent to which the results are disseminated beyond the private contributors to the RDC by devising exclusionary mechanisms. If this is the case, requiring private contributors to bear some of the costs of research will limit the extent to which public funds subsidise private returns. [28]

It is, of course, an empirical question as to whether the potential for efficiencies attributable to public-private financing translates in practice into efficiencies on the ground. As we shall discuss in section 2.4, this depends on the extent to which RDE results are appropriable. For instance, if the results are indeed wholly or largely appropriable by private entities, then the practice of public co-financing may well lead to a misallocation of funds, given that it would entail the subsidisation of private gains.

2.4 CHALLENGES RELATING TO CURRENT ARRANGEMENTS

Notwithstanding the potential for efficiencies highlighted above, reviews and analyses of the present RDE architecture, supported by discussions with participants in the RDE industry (for example senior Departmental officers, RDC staff, members of CRCs) have noted several challenges and issues that need to be addressed. We review these briefly here, before assessing the factors underlying these challenges and issues in a more systematic manner in the next section.

2.4.1 Are the incentives faced by funders, purchasers and providers aligned with the emerging research agenda?

RDCs appear to operate with a strong focus on their particular sector (e.g. grains, wool, livestock). This focus reflects the funding basis of the industry-based RDCs and the consequent desire to focus RDE effort in areas directly relevant to the industry stakeholders. As already discussed above, this move to a "demand-pull" model can, and has, generated benefits.

However, this "vertical" approach is thought to hinder the ability of RDCs to support RDE activities which address research issues of a more cross-sectoral nature. These issues may be of a regional nature, or systemic issues which impact on agriculture more generally. These are also issues in which non-farm groups may have a significant interest. Issues of this type include: food security, biotechnology, natural resource management, climate change, and developments in international trade conditions (for example, changes in sanitary and phyto-sanitary legislation in trading partners).[29]

It may be argued that these cross-cutting issues can be effectively dealt with through the collaborative arrangements which exist between the RDCs, or via the

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28 See C. Pray, "The growing role of the private sector in agricultural research", in D. Byerlee and R. Echeverria (eds), *Agricultural Research Policy in an Era of Privatization.*

29 For example, community concerns regarding land degradation, salinity or water supply impact on agriculture and farming systems.

role of more general funding bodies such as the RIRDC and LWA. After all, collaboration between RDCs is possible and there are fora through which this may be pursued (for example, coordination via the Chair of Chairs). Granted that there are institutional arrangements that would facilitate collaboration to some extent at least, we need to consider whether there are other factors which may act as a disincentive for collaboration.

One possible factor is that the systemic nature of these issues means that there are gains from collaboration; but that this collaboration may be impeded by free-riding. That is, to the extent that results of RDE are applicable across sectors, and are not excludable, any specific individual sector may face incentives to try and reap the benefits of research without contributing to costs. Where such free riding problems arise, the existence of a process such as the Chair of Chairs, may be useful in identifying the systemic issues on the agenda, but may not be sufficient to ensure that the incentives exist for RDCs to pool resources to fund and implement such an agenda.

The importance of "systemic issues" to non-farm groups, and the consequent implications for identifying research priorities, raises the question as to whether the current arrangements may lead to a discrepancy between the benefits of research accruing to producers, and the wider benefits of such research to society. The possibility that such externalities may exist raises the possibility that producer funded models of RDE may lead to a sub-optimally low level of investment in systemic issues. Of course, the simple fact that research priorities may be influenced by non-farm groups does not, in itself, guarantee that such externalities will arise – there may be some mechanism by which the benefits to non-farm groups may be internalised by producers. For example, where there are concerns about food safety issues, we would expect consumers to have a higher willingness to pay for products which satisfy food safety requirements. Thus, while investments in improving food safety will confer a benefit to consumer groups, producers may be able to appropriate some of these benefits because of its impact on consumer willingness to pay.

Where there is no market-based mechanism through which the interest of non-stakeholders can be internalised in RDC priorities, an alternative option is to broaden the composition of RDC boards to representatives of non-producer interest groups. However, this again raises issues of free-riding. While it is relatively straightforward to identify producers who stand to gain from research and to recover research costs through a system of levies, following a similar approach with more diffuse non-farm interest groups may pose intractable problems.

Nevertheless, to the extent that the research priorities extend to issues which may not align with the interests of rural industries, then the RDC model may not be well suited to funding this new research agenda. One obvious alternative is for government to ensure that it funds RDE services which are focused on systemic issues. Another option is for government as funder, on behalf of the broader community, to exert a stronger influence on research priorities within the RDC framework itself. This might make sense when systemic issues also have

significant associated private benefits, thus justifying the allocation of costs to the private sector.

2.4.2 Are public funds for RDE allocated in a socially optimal way?

Applied versus basic research

A trend towards increased investment in applied research raises the question as to whether basic research is being neglected, and if so whether this implies a misallocation of public funds and a distortion of research priorities.

The observed increase in investments in applied research is not, in and of itself, a bad thing, nor is it surprising given the role played by private funds in supporting RDC's activities. The issue of whether this comes at the expense of basic research reflects two related concerns. The first is that market failure stemming from externalities and public good characteristics (non rivalry and non excludability) are typically stronger in basic research. Hence, there are concerns that the diversion of public resources away from such research is inefficient. This diversion can occur even if projects have a substantial degree of private funding. This arises owing to the fact that when public institutions engage in applied research, they allocate some public funds to the activity even if private funding is involved. This is because private funding typically covers the incremental costs associated with a particular project, while fixed and common costs such as overheads are typically met from public funds.

Second, to the extent that the results of applied research have fewer externalities and are excludable to some extent, the use of public resources – whether they be the general funds financing public institutions, or the publicly co-financed element of RDC spending – could in some cases amount to subsidizing largely private benefits. This situation could arise if, for example, government representatives on RDC boards exert insufficient control on the establishment of priorities, with the result that projects identified are ones in which benefits are mainly private and appropriable.

Public funding of extension services

Extension services are primarily funded from public sources. As pointed out earlier, the increased involvement of the private sector has been mainly in the delivery of such services through sub-contracting. Though historically RDCs had tended to neglect extension in favour of research and development, they have in the last 10-15 years have been instrumental in the promotion of group-based methods of extension and the development of branded extension programmes. These mechanisms have the property of reducing the non-excludable nature of extension by more clearly delineating beneficiaries. The increasing role of RDCs in coordinating extension and "wholesaling" information through branded programmes has been a significant development. Funding bodies have increased the extent to which their allocations match RDC priorities. Likewise, as indicated

before, state governments have increasingly sought to develop industry partnerships to ensure that their services are demand driven.[30]

Taken together, these trends raise several issues. First, it appears that the historical disconnect between RDC involvement in research and development, on one hand, and their involvement in extension, on the other, has been progressively reduced.

Second, the continued dominance of public funding for extension, even with the development of excludability mechanisms, raises the possibility that public funds are directed towards supporting private returns. The logical corollary of mechanisms such as branded extension groups should be a greater investment of private resources in extension. This would free up public funds to support extension in domains where the development of excludability mechanisms is less feasible – notably applied, cross-cutting and systemic issues.

Impact of funding processes on efficiency of resource allocation

Under current arrangements, private contributors are matched by government funding; and the combined funds disbursed by RDCs typically cover the incremental costs incurred by public providers.[31] This combination of factors potentially gives rise to a number of complications.[32]

- While the system of matching private contributions with government grants is intended to compensate for market failures, it only makes sense if the actual projects selected are characterised by market failures to such an extent that co-financing of this magnitude is warranted. If this is not the case – for example if RDC boards are disproportionately influenced by producer representatives in project selection – we may well see a diversion of public resources to meet private benefits.
- In facing only the incremental costs of research, RDC funded projects received an extra hidden subsidy, amounting to the proportion of common costs (e.g. overhead relating to staff and facilities) incurred by providers, which are not allocated to the RDC funded project. Projects funded by RDCs thus appear more attractive than they ought, from the point of view of allocating funds efficiently. To the extent that budgets for overheads and other operating expenses of research providers are met by public funds, the non-allocation of common costs acts as a further public subsidy which could well go to funding private gains.

We have already pointed to factors that make the funding of basic research issues and cross-cutting research issues unattractive from a private point of view, relative to the overall collective benefits they generate. The cumulative effect of

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[30] See Marsh and Pennel, *op.cit*

[31] We note that Victoria has introduced a policy of costs recovery which includes a contribution forcommon costs. Other jurisdictions appear to be moving toward full costs recovery, but have not as yet implemented this policy.

[32] See Brennan and Mullen *op.cit* and Mullen *et. al op.cit.*

the explicit and hidden subsidies is to reinforce the tendency for RDCs to invest in privately beneficial activities, at the expense of cross-cutting activities, by making the cost to benefit calculus of privately appropriable research all the more attractive. Given this situation, it is unsurprising that formal coordination mechanisms such as the Chair of Chairs have had limited success in encouraging a pursuit of cross-cutting issues. Coordination is more a matter of aligning incentives correctly, and less an issue of exchanging ideas. If the attractiveness of privately appropriable RDE activities remains artificially enhanced by various hidden and explicit subsidies, RDCs will have little incentive to pursue wider goals.

Even if these hidden subsidies were removed, it may still be the case that systemic issues are difficult to pursue owing to the fact that appropriability issues may constrain cooperation between RDCs. In particular, there may no mechanism through which the constituents of a particular RDC are able to internalise the benefits accruing to other RDCs by a particular project. This suggests that the locus of funding may need to be revisited. That is, governments may need to start redirecting at least a proportion of their co-financing to a higher level body that coordinates RDC actions regarding systemic issues, rather than to individual RDCs.

Finally, the pursuit of systemic issues may be hampered by the fact that the largely publicly funded extension services are to some extent at least subsidizing private gains, for reasons discussed previously. The development of excludability mechanisms in extension services suggests that there is a greater scope for introducing private funding of extension, thus freeing up public funds to support activities where appropriability is more of an issue.

Summing up

The availability of public co-financing has raised the concern that, rather than helping to address market failures, it may actually exacerbate them. As suggested before, if government representatives on RDC boards exercise insufficient control, the addition of public funds to private ones will simply increase the attractiveness to the private sector of projects which generate appropriable, and therefore largely private, benefits. Dominance of public funding of extension services in connection with the development of excludability mechanisms further amplifies the potential for public funds to be allocated in a manner that subsidises private returns. The practice of allocating incremental costs, but not necessarily overheads, to RDC funded projects may further increase the private profitability of RDC projects.

Taken together, the concerns documented here raise the question as to whether the extent to which public resources are implicated in applied research is commensurate with the strength of public good characteristics and market failure in applied research. [33] In particular, we are concerned as to whether the process for disbursing public funds accurately addresses sources of market failure, or

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33 Brennan and Mullen, *op.cit.*

whether they in fact blur the extent to which private decision makers taken into account the social costs and benefits of their decisions.

2.4.3 Fragmentation and duplication in RDE activities

Fragmentation and duplication have persisted despite the introduction of contestability and private funding

"Fragmentation" refers to the geographic dispersion of RDE capability. Duplication of activities is one possible consequence of fragmentation. Whether or not fragmentation, and consequent duplication, is costly depends to an extent on whether we are focusing on research and development activities, or extension activities. The non rival nature of research and development entails, by definition, that the cost of providing an extra unit of a "knowledge good" is zero, or close to zero, and hence that there are likely to be substantial economies of scale. This suggests that a consolidation of research and development facilities would, other things being equal, be efficient.

However, there may be other factors that act against consolidation. An obvious one is the specificity of local conditions and knowledge. Such specificities mean that while inputs into the RDE processes may be similar across regions, they are not identical, and hence we would expect to see similar types of activities undertaken across regions. Moreover, funders may be willing to fund a number of similar projects, in the hope that at least one such project will yield results. Given the inherently unpredictable nature of research activities, this may be viewed as a means through which funders can manage the risks associated with such uncertainty.

In addition to economies of scale, economies of scope may arise, and are likely to be a possible driver for co-location. This may take the form of benefits of co-location of a critical mass of researchers, in the form of collaboration and resilience of the research organisation to changes in key staff.

The incidence of non-rivalry in the provision of extension services is more limited – in both group delivery and one-on-one delivery contexts, the cost of providing services to an extra farmer will begin to rise beyond a certain point. There is thus less of an in-built driver for consolidation. Moreover, to the extent that local knowledge and contact are important factors in the successful delivery of extension services, the decentralisation of provision is liable to enhance the effectiveness of extension services.

Overall, the extent to which consolidation is optimal is an empirical question. It is difficult to determine, *a priori*, absent a detailed model of the different cost inputs into RDE and the influence of local factors, what the optimal level of consolidation is. On balance, we would expect to see a system characterised by research hubs, which support a dispersed delivery of extension services. Developments in recent years conform to some extent to this principle. One particular example is that crop breeding research in Eastern Australia has been consolidated in South Australia, but the outcomes of this research are made available to other jurisdictions (such as Victoria). However, this type of

rationalisation has not been widespread; the view remains that research effort is by and large fragmented across jurisdictional boundaries.

The persistence of what appears to be inefficient arrangements is a puzzle, given that we would have expected that the introduction of contestability in the allocation of research funds would promote incentives for efficiency in the conduct of research. Granted, to some extent the introduction of competition will generate some duplication, as potential providers endow themselves with the facilities to compete for certain types of project. It is also possible that RDCs have an interest in fragmentation in order to enhance their bargaining power. This is largely speculation, however, and in any case an interest in maintaining bargaining power is not *prima facie* inconsistent with the achievement of efficiencies. In a number of industries where repeated tendering is common, weaning out inefficient providers through rigorous evaluation is not incompatible with the existence of a set of efficient providers.

On the whole, therefore, contestability (along with the use of private funds) could be expected to create incentives to monitor and evaluate the results of research, with a view to identifying the best and most cost-effective RDE providers. Given that contestable funding procedures are repeated games this, in turn, could be expected to strengthen the incentives that providers have to improve the efficiency of RDE activities through, amongst other things, streamlining and rationalisation of activities and facilities.

The reality suggests that contestability has not had a pronounced effect on incentives for provider efficiency. Many participants interviewed identified the duplication and fragmentation of research facilities as a major problem, particularly as budgets are shrinking and the research task is expanding. Moreover there appears to be little evidence on the demand side of a push for such efficiency. For example, producers who contribute to RDC funding through levies seem to expect that RDC funds will be disbursed in a manner that reflects the regional provenance of these funds, rather than on the basis of the revealed capabilities of providers.[34] Clearly, it is necessary to consider in greater detail why the introduction of contestability has not generated effective efficiency incentives.

Does the demand side for RDE generate sufficiently strong incentives for provider efficiency?

RDCs

As already discussed, the fact that the RDCs constitute a vehicle through which private producers bear some of the costs of research should create incentives for evaluating and monitoring the activities of RDE service providers, with a view to holding them accountable for the quality of output. Monitoring and evaluation

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34 Another issue identified in discussions with stakeholders was a concern that program managers in RDCs were too involved in the determination of a provider's proposed methodology. This active role of the program manager in commissioning R&D runs the risk of blurring the respective roles of purchaser and provider, and makes it difficult to effectively manage and enforce project outcomes. This raises the question – under what circumstances can poor management practices persist?

are thus mechanisms which could impose a level of discipline on service providers and cause them to seek efficiencies. As already observed, this in-principle argument contrasts with the observed penchant to disburse funds on perceptions of fairness e.g. on regional basis in line with regional contributions, rather than on efficiency grounds.

Moreover, it seems that there is very little in the way of rigorous evaluation of results. The annual DAFF review of RDC outcomes appear to represent public relations exercises to "demonstrate the value of RDCs to their shareholders" rather than a vehicle for effective RDC governance.[35] In particular, the DAFF reports provide no advice on estimates of returns to research and instead focus on reporting RDC performance on a range of qualitative measures – such as timeliness in meeting reporting deadlines. These annual reviews fall short of the standard necessary to ensure that RDCs are held accountable to the Minister.

While RDCs are accountable to industry stakeholders, the level of scrutiny exercised by the latter is, as we noted in subsection 2.2.1, of a fairly high level nature, and where more detailed assessments have been made, the level of methodological rigour has been open to question. Given that industry stakeholders have an obvious interest in ensuring value for money, the lack of scrutiny is somewhat surprising.

There may be a number of reasons for this, beginning with a simple lack of understanding of the importance of evaluation, particularly if there is a perception among private producers that research is primarily provider driven. It has also to be recognised that various factors make ex-post evaluation a complicated endeavour. In particular, it may be difficult to assign defined benefits to particular projects, and inferences drawn may well require a certain level of judgement. The appropriate response to these, however, would be to ensure that evaluation is conducted on a large scale, over a sufficient period of time, and over a wide range of projects. Even if this does not provide a sufficient level of information to make fine-grained decisions, it could at least provide a body of evidence that allows general propositions to be made about the forms of research, which may then be used to guide allocation decisions.

The main point to be drawn here is that effective evaluation will require a substantial investment over time. Consequently, when confronted with evidence of a lack of effort in relation to evaluation, it is necessary to examine whether RDCs and their stakeholders have the incentives to undertake the level of necessary investments to ensure adequate evaluation. We would suggest that some of these incentives are weakened by the structure of RDE funding. We have discussed previously the fact that private producers benefit from a variety of RDE subsidies, both hidden and explicit. In addition to the incentive effects described elsewhere, such subsidies may dilute the incentives faced by producers to invest in evaluation. Put simply, if producers faced more of the true cost of RDE activities relative to benefits, they may be more willing to ensure that they received value for money. Granted, this would not, in and of itself, address fully

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35 DAFF (2002) Innovating Rural Australia, p iv.

the complexities associated with ex-post evaluation. However, it would be an important step in ensuring that RDCs have incentives to address these complexities in order to engage in more systematic evaluation.

Governments

Despite the fact that public funds account for the bulk of RDE financing, the extent of formal evaluation of RDE activities carried out by governments is limited, particularly when compared to practices in overseas jurisdictions. For example, the use of block grants (still the single largest source of funding for research providers) is not subject to specific formal assessment mechanisms, with reviews generally carried out at a national level. This contrasts with practice in the UK, where university departments are subject to periodic assessments based on a detailed scoring system, with funding linked to the scores obtained.

The question remains, given the substantial investment by the public sector in RDE, why the relevant governments have not invested greater effort in monitoring and evaluation. Clearly, evaluation and monitoring creates costs to both the evaluator and the institution subject to evaluation. However these must be set against the gains arising from the creation of long-term disciplines and incentives for research providers to seek efficiencies.

There are some signs that indicate that the Commonwealth government has become aware of the importance of obtaining a better grasp of performance of the research sector. Following the UK lead, the Australian government has embarked on the development of a Research Quality Framework (RFQ). In December 2005, an Expert Advisory Group (EAG) commissioned by the Minister for Education, Science and Training released its final advice on the preferred RQF model. The genesis of this study arose from the observation that there is currently no system-wide and expert way to measure the quality and impact of research conducted in universities and Public Financed Research Agencies (PFRAs) and the benefits of research to the wider community. This assessment framework represents a positive initiative to provide consistent measures of performance across a broad range of research providers. [36] [37]

Consequences of underdeveloped evaluation and monitoring systems

The evidence suggests that mechanisms for RDE evaluation and monitoring are lacking. The absence of any systematic evaluation by both private producers and government dilutes any incentives for efficiency that may have been created by the introduction of contestability. This, in turn, acts as a brake on any substantial reform of the infrastructure for the provision of RDE services, particularly when

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36 We note that the policy body responsible for oversight of the implementation of R&D in New Zealand is currently undertaking a review of FoRST (the R&D Funder). This review will be used to provide recommendations to the Minister on the performance of FoRST and whether any changes are necessary to the institutional arrangements to ensure the government's overall R&D objectives are achieved. We are not aware of any rigorous review of funder performance in Australia.

37 http://www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/research_quality_framework/

we take into account the difficulties inherent to institutional rationalisation given the influence of interest groups who stand to lose from such rationalisation.

Private producers in principle form a constituency that should have an interest in monitoring and evaluation, and in leveraging this to drive institutional reform. However, as we argued before, the hidden and explicit subsidies from which private producers benefit dilute their incentives to invest in evaluation and monitoring, and this translates into a dilution of interest in pressuring providers to reform.

To be sure, regardless of the strength of incentives on the demand side, the rationalisation of service provision is likely to confront various impediments. One such impediment is that fragmentation, while a source of inefficiencies, yields benefits to certain groups through employment and associated effects in certain rural areas. A second possible impediment is resource immobility – in the short run, experts and researchers may be hostile to relocation, and are likely to lobby against change. Both these factors create constituencies that favour the status quo, independently of the incentives for rationalisation on the demand side. With these factors in mind, the importance of stronger demand side incentives for rationalisation is reinforced; in particular, these incentives need to be strong enough to outweigh the influence of supply side forces which favour inertia.

2.4.4 Summary of underlying factors affecting the current architecture for RDE

The analysis in the previous subsections suggests that the current architecture for RDE faces a number of challenges:

- There are limits to the extent to which current arrangements facilitate the pursuit of new research agenda issues, notably in regard to systemic and cross-cutting issues. This is partly due to the sector –focus of RDCs, the weak influence of government representatives on RDC boards, and the possibility that cross-sectoral collaboration is hindered by free-riding. These factors are possibly compounded by the hidden and explicit subsidies emanating from current arrangements.
- The hidden and explicit subsidies for research and development received by providers, and particularly the fact that private producers face only the incremental costs of research undertaken by RDCs, result in a socially inefficient allocation of resources, insofar as public funds are diverted to financing private benefits.
- The fact that RDCs and private producers receive these subsidies dilutes the incentives they face to monitor the cost effectiveness of RDE providers. In particular, RDCs have weakened incentives to monitor overheads and operating costs since they are not allocated these costs when procuring research.
- The prevalence of public funding for extension services, even when excludability mechanisms have been put in place, is likely to lead to the subsidisation of private returns at the expense of activities where

appropriability is an issue and in which public funds could be more efficiently invested.

- In the absence of a systematic process undertaken by government to evaluate research providers and make funding conditional on such evaluations, there is little impetus for long-term reform of the type that would lead to efficiencies in RDE provision. For reasons explained above, RDCs do not face strong incentives to pressure providers; while there will be interest groups within service providers who will be inherently hostile to changes.

3 Levers for reform and proposals for a national RDE framework

3.1 THE PROPOSALS FOR A NATIONAL RDE MODEL AS A RESPONSE TO CURRENT CHALLENGES

In the previous sections, we examined the salient features of the architecture for RDE services, and the structure of incentives embedded within them. Our analysis suggests areas in which reforms are necessary. In sum, the challenges identified above raise questions as to whether the incentives embedded in the current arrangements are both appropriate and strong enough to deliver RDE outcomes that meet key policy requirements relating to efficiency.

The development of a national framework for primary industry RDE is presented as a response to these problems. We take this to mean that research administrators within the state agencies in Australia believe that the current delivery mechanism for providing RDE inputs within the state-based system is inefficient and costly. The proposed national model seeks to lower the costs of provision by rationalising research capability, if necessary across state boundaries. According to the proponents of the national model, R&D activity does not necessarily have to be located close the industry that is the ultimate recipient of the research results. On the other hand the proponents of the national RDE model believe that extension services must be located close to rural communities that they serve.

The proposed national model reflects an "administrative" solution to a perceived problem. That is, the proposal calls for a coordinated approach among the state agencies to pursue opportunities to rationalise research capability along lines of perceived comparative advantage. It is, however, only a partial solution for several reasons. First, it is couched primarily in the language of rationalisation, whereas the challenges facing the architecture for RDE services extend beyond this to encompass issues such as the alignment of research funding and activities to the emerging national research agenda. More fundamentally, the call for institutional restructuring embodied by the national framework proposal does not address, in and of itself, the underlying factors which have limited the extent to which the current funder-provider model has driven efficiencies in RDE provision.

The analysis we have undertaken suggests that the problems of fragmentation and dispersion of service provision are related to more fundamental inefficiencies that stem from the pattern of incentives embedded in the current architecture for RDE services. We have paid particular attention to the processes of funding, and have argued that hidden and explicit subsidies received by RDCs can represent a distortion in the allocation of resources, which can discourage the pursuit of a cross-cutting research agenda. It also weakens incentives private producers have to pressure providers into seeking efficiencies. The latter problem is aggravated by the lack of effective monitoring of public funds.

We approach the proposals for a national framework against this backdrop. Institutional restructuring is to be seen as an end-point of a reform process that addresses the underlying structure of incentives. The extent of rationalisation should thus, in our view, be endogenous to reforms, rather than a constraint imposed on the reform process. Moreover, even if one adopts a narrow approach focusing solely on the need for institutional rationalisation as an end in itself, our analysis suggests that reform of the underlying structure of incentives is still needed as only this is likely to create the sufficient momentum to overcome vested interest that would be hostile to rationalisation.

With that in mind, we turn our attention to what policy levers are available to address the issues we have discussed in the previous section.

3.2 POLICY LEVERS FOR REFORM

Our assessment of the policy levers draws on the analysis conducted in the previous section.

3.2.1 Reforms to the mechanisms for allocating public funds

Allocation of public funds to RDCs

A first task is to ensure that the true cost of research funded by RDCs to private producers. This involves ensuring that:

- RDCs are allocated a proportion of common costs incurred by providers; and
- Government representatives on RDC boards need to evaluate whether research projects are of a nature such that appropriability issues warrant matching public co-financing.

Allocating the true cost of research to RDCs will lead to more efficient allocation of funds, and avoid problems related to the subsidisation of private benefits. By targeting public funds more closely to projects which suffer from appropriability issues, governments can reduce the bias RDCs have towards applied research, and help the pursuit of a systemic agenda.

Allocating the true costs of research to RDCs will create incentives for the latter to invest in monitoring and evaluating research providers, thus creating a constituency that favours rationalisation. Granted, this would not in and of itself address fully the complexities associated with ex-post evaluation. However, it would be an important step in ensuring that RDCs have incentives to address these complexities in order to engage in more systematic evaluation. If stronger evaluation puts RDCs in a better position to appreciate the drivers for efficiency and innovation in the conduct of research, they may be in a better position to discriminate between alternative service providers. This in turn would act as a spur to reforms on the supply side.

Moreover, this reform should free up funds for allocation to activities where appropriability is more of an issue, and thus where there is a greater case for public funds playing a co-financing role. At the same time, policymakers should give close consideration to the extent to which RDCs constitute appropriate

vehicles for pursuing cross-cutting and systemic agenda issues. Given that it is likely that some the gains from such research are likely to be privately appropriable, the principle of combined public and private funding is worth continuing (though not necessarily on a uniform 50:50 basis). However, this does not necessarily mean that a public-private approach should be housed within the current RDC structure. As pointed out previously, the nature of cross-cutting and systemic issues requires collaboration across sectors, and sector specific RDCs may limit the extent of their collaboration owing to the incentives to free-ride. Consequently, it would make sense to direct the publicly financed element of co-financed private/ public activities at a higher level than individual RDCs – perhaps an RDC coordination mechanism under the control of the Chair of Chairs.

The implementation of this option will face challenges, not least because RDCs will not welcome an increase in costs. However, states need to make the case that the onus is on RDCs to monitor costs, and to ensure that private producers' efforts in this respect are backed up by a commitment by governments to improve evaluation and reform (see below). In order to implement cost recovery along the lines suggested, governments will have to ensure that guidelines for recovering common costs are followed consistently by service providers. A piecemeal approach is likely to lead to a situation where funding is diverted to institutions which continue to allocate only incremental costs. It has, for example, been pointed out that the Victorian DPI is currently disadvantaged in competition for RDC funding by its policy of costs recovery (including a contribution to common costs). One initiative that could usefully be adopted by the PMIC officials is to agree a costing framework to be consistently applied across all jurisdictions.

Allocation of public funds for extension

We have noted that public sources dominate funding for extension services, even though mechanisms have been established to give greater control over who benefits from these services, which in turn diminishes the market failure/non-excludability rationale for public spending. Private beneficiaries should be called upon to share a greater part of the cost of extension services, and the state governments' presence on RDC boards could be one mechanism by which this could be implemented.

At the same time, extension services which relate to cross-cutting and systemic issues may still be characterised by issues of excludability. Resources that could be freed up as a consequence of greater RDC involvement in extension could be directed to these other areas.

Allocation of public funds and the role of state departments

A key question relates to the extent to which state departments should be involved in the actual provision of RDE services. As already indicated, the line between funder and provider is blurred by the fact that state departments both fund and bid for research. We have already noted that one facet of service provision was the incomplete allocation of costs to private beneficiaries, and that

this created hidden and distorting subsidies. Given that state governments are among the main actors involved in research, one way of ensuring that public funds are not (mis)allocated in such a manner would be to completely divest the state government's provision function. This could be done either through privatisation or through concessions. As already noted, the contracting out of extension activities has made significant progress over the last two decades, both in Australia and in jurisdictions overseas.

The potential advantages of such an approach are twofold. First, it would facilitate a better allocation of costs to beneficiaries, given that these decisions are likely to be left in private hands (though the extent to which this is true depends in part on the way in which any subsidies from state departments are granted). Secondly, granting the control of services provision and assets to private operators is likely to encourage decisions regarding the location and number of research facilities to be made on a more strictly economic basis, rather than on the basis of patronage or other extraneous influences. We would expect private operators, faced with a hard budget constraint, to seek out the advantages offered by economies of scope and scale that are usually associated with research activities.

3.2.2 Contestability and performance evaluation

Procedures for evaluation and monitoring

The need to provide RDCs with incentives to invest in evaluation tools was discussed above in section 3.2.1

Given that the bulk of RDE funding still stems from public sources, the implementation of evaluation and monitoring systems by governments is critical in order to generate sufficient incentives for institutions to seek efficiencies. Governments need to ensure that public funds disbursed through RDCs are directed to projects where appropriability is a problem, and need to ensure that block grants are made conditional on a satisfactory track record by research institutions. The establishment of a more rigorous evaluation and monitoring process is also a signal to private producers that governments intend to genuinely increase pressure on providers to seek efficiencies and cost savings.

The question of performance monitoring and evaluation intersects with the issue of state departments carrying out research provision. It is open to question as to whether a truly effective and credible performance monitoring mechanism can be established as long as state departments combine both funding and provision. Contracting out service provision would, by contrast, increase the rationale and rewards to state departments from investing in performance monitoring and evaluation.

Notwithstanding these difficulties we consider that it is important to enhance the level of scrutiny of RDC performance. This scrutiny should be directed towards obtaining the clearest possible assessment of RDCs, on both an absolute and relative scale. This analysis requires a significant investment in evaluation of returns to research across a wide portfolio of projects, not only those success stories hand picked for assessment. This evaluation should be undertaken by an

agency independent of the RDCs, possibly an organisation such as the Productivity Commission.

3.2.3 Issues of coordination and collaboration

Effective collaboration requires the development of policies to internalise spillovers that may be associated with systemic research issues.

We suggest that this extends beyond forums of sharing ideas and may require the development of a new organisational and funding model which extends beyond the current industry by industry framework. The RIRDC and LWA models represent possible models, but their current funding may be insufficient to accommodate the new RDE priorities.

Coordination in the reform of service provision

We argued that incentives for rationalisation of research service functions could be generated through a number of channels, such as allocating costs more appropriately, by developing performance and evaluation procedures, and by contracting out functions carried by the state departments. In order to be effective, rationalisation is likely to require a reallocation of research provision functions and assets across state boundaries. If, for example, Victoria has a comparative advantage in dairy research it makes sense for other jurisdictions to shift research functions in that area to Victoria. This assumes, however, that the other states have embarked on the type of reforms which would encourage the pursuit of efficiencies through trans-jurisdictional rationalisation. We recall that there are in-built vested interests that are hostile to reform, and in the absence of any strong constituency for reform in any jurisdiction, there is bound to be hostility towards any rationalisation, let alone rationalisation that transfers activities across borders. Consequently, there are gains from jurisdictions pursuing reforms simultaneously. At the same time, the influence of vested interest means that no one jurisdiction is likely to engage in reforms without an assurance the others will be doing likewise, owing to the political costs of doing so. This creates a collective action problem.

One mechanism through which this may be addressed is by the Commonwealth supporting reforms through the release of funds conditional on the pursuit of reform, in the manner of the national competition policy reforms. The funds provided could be directed towards meeting the adjustment costs of reforms, notably the costs borne by those regions which may suffer as a result of the closure of facilities. They could also be directed towards facilitating the mobility of human assets.

3.3 CONCLUSIONS

The manner in which the architecture for RDE services has developed over the last 20 years or so has generated a number of benefits, in particular through the introduction of contestability, the increased distinction between funding, purchasing and provision, and the involvement of industry partners. There are, nevertheless, a number of issues which, if addressed, could lead to substantial

improvements in the performance of the overall architecture for RDE, as measured against the different concepts of efficiency discussed in this paper. Rather than a complete restructuring of the way in which RDE activities are conducted, what appears to be needed is a series of reforms within the overall framework as it currently exists.

One such area of action we have identified consists in reforming funding processes to ensure that private purchasers of RDE services do not receive hidden or explicit subsidies, which end up financing private returns. Current arrangements fall short on this count, leading to inefficient resource allocation, in that resources are diverted away from areas which have been identified as carrying significant social benefits (such as systemic and cross-cutting issues which constitute a significant part of the research agenda). Moreover, it is likely that current arrangements dilute the incentives private stakeholders have to invest in the development of evaluation and diagnostic tools that could provide a better handle on measuring the performance of activities undertaken by portfolios. We accept that ex-post evaluation is a complex process, and one which is likely to require substantial effort over a period of time – but this is precisely why it is important to ensure that the correct incentives to undertake evaluation are there in the first place.

We noted that the lack of sufficient evaluative effort is also a feature of public funders and purchasers of RDE. Given that a sizeable proportion of state department funding is delivered through non-contestable grants, it is incumbent on state departments to implement an evaluation framework that is considerably more substantial than the high-level, and largely piecemeal, approach that exists at present. There is also scope for states to initiate an across the board review of RDC performance. The extent to which public authorities can pursue a more rigorous approach to evaluation could be strengthened, inter alia, through a greater separation between state involvement in funding, on one hand, and the actual provision of RDE activities on the other.

While proposals for a national RDE framework tend to be couched primarily in terms of institutional rationalisation and the reduction of fragmentation, we have argued that the actual institutional configuration should be the end point of a process that addresses the deeper structure of incentives embedded in the present architecture for RDE. A key point we have made is that of contestability, and the tying of funding to an improved evaluation framework, should generate incentives for providers to seek out supply side efficiencies, which is likely to involve consolidation. The fact that supply side rationalisation is likely to face opposition from entrenched interests favouring the status quo further reinforces the importance of creating strong constituencies in favour of reform, for example, by ensuring that private stakeholders face the true costs of research and thus have incentives to demand value for money.

It is worthwhile emphasising the close inter-linkages between the different areas of policy action we have discussed. For example, revisiting the manner in which costs are allocated to private funders and purchasers of research is a necessary step in ensuring that private gains are not financed through public resources, and that public resources are freed to promote systemic and cross-cutting issues. At

the same time, this type of action is liable to create stronger incentives for evaluation, which itself will contribute to efforts to ensure efficiencies on the supply side.

It is recognised that public policy in relation to RDE operates in a second best environment, in large part due to the incomplete nature of information associated with RDE. There will always, for example, be complications in evaluating RDE, or in determining the level of private appropriability of the results of research. It is thus unlikely that an optimal set of arrangements, free of deficiencies, can be found. However, while there may be no silver bullet, we have argued that there are a series of inter-linked actions which, cumulatively, can generate substantial improvements to the conduct of primary industry RDE.

Appendix 1: Allocation of R&D funding to providers

We have obtained information regarding the allocation of funding from AWI and the GRDC. The tables below indicate the diverse range of providers supported by the RDCs and show that although state agencies remain an important provider of RDE services, other providers, that include private providers and universities, are also important players in this market.

Australian Wool Innovation Ltd

Appendices in the 2004/05 Annual Report provide a comprehensive list of all current projects funded by AWI including identification of the provider. On the basis of this information it is possible to determine the following overall allocation.

The data illustrates the wide variety of possible providers and the relative importance of each (in terms of their level of financial support). However, the data does not indicate the total level of R&D activity undertaken by each provider, since the data does not include the financial support and resources provided by the provider.

Provider	Contract Value ($'000)	Percent total funds
CRC	1851	1.1
CSIRO	27624	17
Federal Govt agency	1010	.6
Industry	20486	12.7
Private	35942	22.2
RDC (eg LWA)	27736	17.2
State Agency	18910	11.7
TAFE	312	.2
University	25329	15.7
Various	2506	1.5
TOTAL	161706	100

Table 3: Breakdown of AWI project funding

Source: Annual Report 2004/05

GRDC

The allocation of GRCD funds in 2005/06 is outlined in the table below.

Provider	Contract Value ($'000)	Percent total
CRC	2,865	2.44
CSIRO	16,052	13.67
Commonwealth Gov (includes other RDCs)	2,457	2.09
GRDC (misc.)	12,460	10.61
International	1,361	1.16
Other	25,695	21.88
State Government	36,046	30.70
University	20,475	17.44
Total	**117,413**	**100**

Source: Grains Research and Development Corporation (2006)

Table 4: GRDC Funding by provider 2005-06

The allocation of funding illustrates the importance of state government as a provider of grains R&D (accounting for over 30% of total GRDC allocation), but also shows the diversity of providers.

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