# Renewing the Rural RDC model

**Submission to the Productivity Commission Inquiry into Rural R&D Corporations**

**Andrew Campbell, November 2010**

## Introduction and summary

This submission is made on an individual basis, and does not represent the views or position of any organisation.[1] The key points of this submission are that:

- This is a timely review, and a great opportunity to improve the rural R&D model. However we are starting from a strong base, and should not 'throw the baby out with the bathwater'.
- There is a compelling rationale for Commonwealth Government investment in rural R&D.
- The rural R&D model generates a high level of return on levy-payer and tax-payer investment compared with most other public investments, and does a better job at research procurement and management compared with research programs managed internally by policy agencies. It is highly complementary with the Cooperative Research Centre model.
- The RDC model works particularly well for commodity-specific issues. The government-industry partnership at the heart of the model engenders high levels of industry ownership and research relevance, and consequently high levels of adoption and hence return on research investment.
- The Draft Report is correct in concluding that Rural RDCs on the whole are competent research investors, brokers, managers and coordinators, with mature systems and processes that are fit for purpose. It makes sensible recommendations for improvements through data collection, reporting, evaluation, external review and reinstating government-nominated board directors.
- The model as currently configured works less well for cross-commodity issues such as environmental issues: climate, energy, water, irrigation, biodiversity, soils, carbon, pests, weeds and so on. A good case can be made that the biggest challenges and opportunities facing Australian agriculture and natural resource management (NRM) — including climate, water, energy, soils and biosecurity — are **not** commodity-specific. The model tends to under-invest in these issues.
- The abolition of Land & Water Australia in 2009 and the Energy R&D Corporation in 1996, and the budget cuts to RIRDC in 2009, exacerbated these weaknesses in the model. The proposed creation of a new RDC focusing *inter alia* on land, water and energy issues, with an indicative appropriation of $50m per annum, is extremely welcome and would substantially improve the RDC model.
- However I disagree strongly with the Draft Report framing of the funding for a new RDC as a trade-off against public matching funding for the industry RDCs and Industry-Owned Corporations (IOCs); with its implicit assumption that public and private benefits are easily separable; and with its recommended phased reduction in matching funding. As acknowledged by PMSEIC (2010a), we need to be increasing public investment in rural R&D, not reducing it. I doubt very much that any reduction in Commonwealth matching funds would be offset by levy-payers, as the Commission suggests. Moreover, reducing matching funding for the industry bodies would make the job of the proposed Rural Research Australia much more difficult, and could lead to the perverse outcome of an overall reduction in 'public good' research through RDCs.

[1] Relevant experience that informs this submission includes seven years as CEO of a Rural R&D Corporation (Land & Water Australia 2000-2006); membership of the Expert Reference Group of the Commonwealth Environment Research Facilities (CERF) program; three years as Director of a Cooperative Research Centre; Chair of the Terrestrial Ecosystem Research Network funded under the National Collaborative Research Infrastructure Strategy (NCRIS); consultancy work for four RDCs; Chair of the Third Year Review of a CRC; and conduct of the Operational Review of the National Climate Change Adaptation Research Facility (NCCARF). The views expressed in this submission are not necessarily shared by any of the above organisations or initiatives.

- The Draft Report does not differentiate sufficiently between market failure and public good. The market failures that led to the RDC model being developed in 1989 remain as pertinent today. Public good research is essential both within agricultural industries (where industry adoption pathways can ensure relevance and enhance uptake) and across agricultural industries on cross-sectoral issues like climate, water, energy, soils, biodiversity, pests and weeds.
- The drivers for a new cross-sectoral RDC are thus twofold: to improve the ability of the Rural RDC model to invest in and manage cross-sectoral research (for both private and public goods) on big, cross-cutting issues; and to increase investment through the model on public good research that may not deliver immediate direct benefits to levy payers. The level of funding proposed to achieve this (building to a base appropriation of $50m per annum) seems about right, as a starting point.
- The Productivity Commission's comprehensive draft report makes a useful contribution in proposing valuable strategic reforms to rural research funding infrastructure that would enable much better scientific integration (potentially informing much more "joined up" policy) across the big issues facing rural Australia and the nation. But its proposition that this can be achieved with less public investment than we make now seems heroically optimistic.

## Rationale for Commonwealth Government investment in rural R&D

There is a strong public policy case for Commonwealth investment in rural R&D[2]. National and international reviews and evaluations (eg. Pardey & Alston 2010, Mullen 2007, Alston, Beddow & Pardey 2009a and 2009b, Rural RDCs 2008), have found consistently that investment in agricultural research generates high returns on public investment. Alston, Beddow and Pardey (2009a) in an article in *Science*, argued that there are strong linkages between levels of investment in R&D productivity growth in agriculture, and that declining public investment in agricultural R&D is correlated with declining rates of productivity growth — and consequently in food security, economic development and environmental protection. The Prime Minister's Science, Engineering and Innovation Council (PMSEIC 2010a) plots the decline in investment in agricultural research investment in Australia over recent years and argues that this decline needs to be reversed for food security reasons and to deal more effectively with the intersections between climate, energy and water (PMSEIC 2010b).

In terms of natural resource management R&D, the case for public investment is arguably stronger, as the spillover benefits and market failures are even more evident than for productivity-related R&D. Many of the issues cross farm boundaries, often affect more than one commodity, and (such as wildlife habitat, water quality or greenhouse gas emissions) are squarely in the public interest. Again, evaluations of such research have consistently found strong returns on public investment (e.g. Chudleigh et al 2006, Campbell 2006, Schofield et al 2007). Comprehensive evaluation of more than one third of the Land & Water Australia portfolio back to 1990, using conservative assumptions about adoption levels and only quantifiable market benefits, found an average benefit:cost ratio of around five to one on the corporation's investment (Chudleigh, Simpson & Schofield 2006).

John Mullen (2010) points out that the relative difference between government support for agricultural R&D compared with other sectors is significantly less than is suggested in the Draft Report. It is more relevant from a public policy perspective to assess whether levels of R&D investment in other industries are appropriate, and whether they share similar

[2] The term 'rural R&D' throughout this submission refers to both agricultural and natural resource management (NRM) research and development, across the range of issues currently encompassed by the rural R&D corporations, including climate change adaptation and mitigation, and energy management, use and generation in rural Australia.

circumstances to agriculture. If public investment in other sectors is also too low, it is not good policy to bring agriculture down to their level.

As the Draft Report suggests, increasing private investment in R&D is a worthy objective. But reducing the Commonwealth contribution is a very poor way of pursuing this objective, and it may deliver the opposite outcome. People tend to value current losses more than prospects of future benefits. Levy payers will see a reduction in Commonwealth matching funds as a signal that the research is not valued as much by government as previously, and opposition to levies would likely intensify.

The Productivity Commission Draft Report arguments against setting targets for the share of total spending on rural R&D to be met by governments are sound, and the proposed public funding principles are reasonable.

## Appropriateness of current funding levels and arrangements

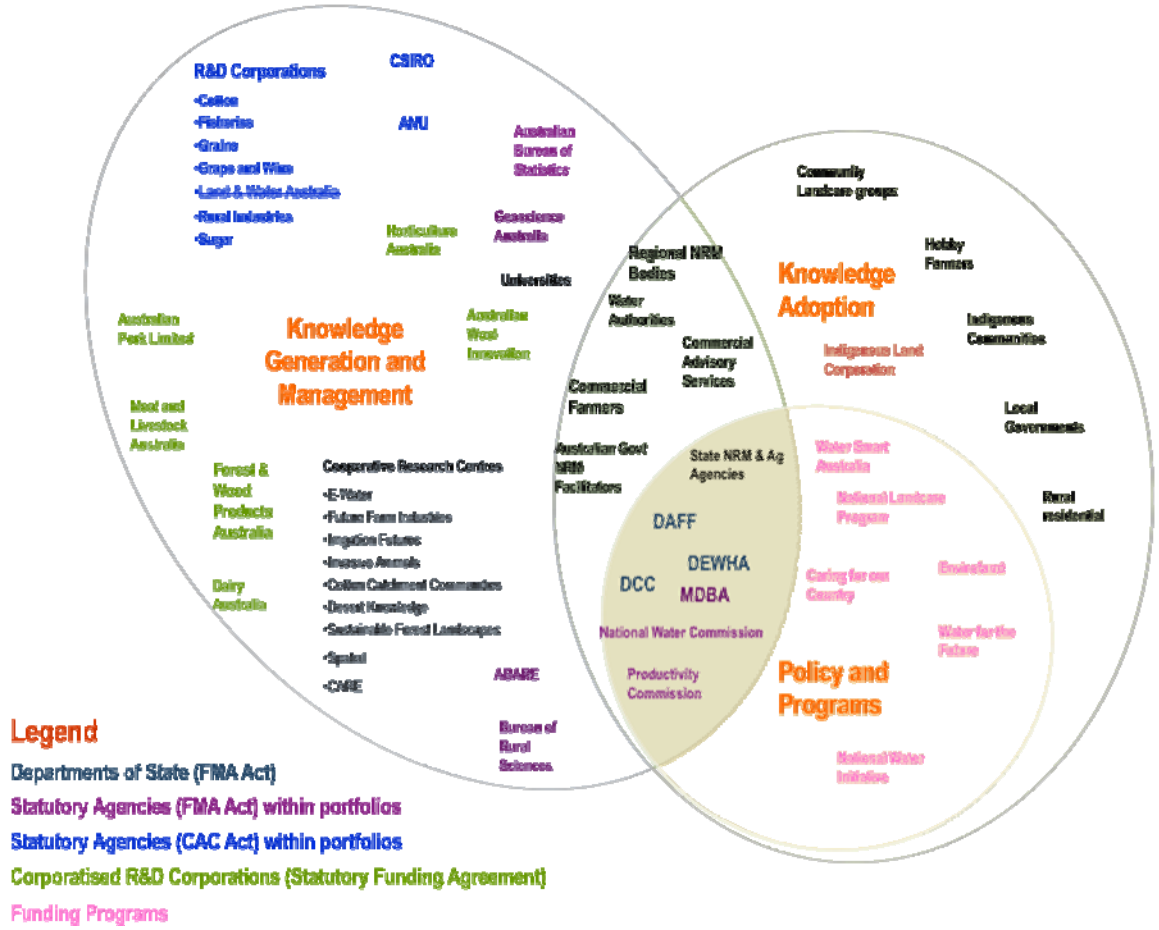
It is difficult to evaluate whether the aggregate investment in rural R&D is appropriate, in part because it is difficult to quantify even total levels of investment across State and Commonwealth agencies, national research institutions, universities, CRCs and RDCs. Campbell (2006), in an analysis of the national NRM knowledge system, observed that it is difficult to improve cohesion or coordination across the system as a whole, if it is impossible to get an overview of who is doing what, where.

Figure 1 below, updated from Campbell (2006) illustrates the complexity of the NRM Knowledge system and the number of research funders, research providers and key users of research outputs, just at the Commonwealth level. This diagram would be impossibly complex to portray if it looked at all agricultural sectors and at the many research players at State and Territory levels. The data and reporting arrangements across these players, just at the Commonwealth level, are very diverse and disparate. The challenge of developing a coherent picture of overall investment across this system, let alone of directing it strategically, is formidable.

Draft Recommendations 5.2 and 5.3 on improving data collection would make a big difference if implemented.

The Commission's finding that total national investment in rural R&D in terms of recurrent expenditure is probably of the order of 1.5 billion dollars annually seems reasonable, although there is likely to be double counting within this figure. The amount of discretionary cash is considerably less than this. A personal opinion is that it would be possible to get a better return on this overall investment if there was better coordination of the system as a whole, and if the competence of research investment and management across the system as a whole could be raised to the level of the rural RDCs.

**Figure 1. Components of the Australian NRM Knowledge System (after Campbell 2006)**




There is a flaw in the rural R&D funding model as it concerns both cross-sectoral and public good R&D.

Climate change, water security, irrigation management, energy security, food systems — and environmental issues generally — are difficult to achieve sufficient focus, scale and coordination on through a commodity-based model. The ownership that levy payers feel about research priorities and the research process exerts a considerable gravitational pull towards immediate industry concerns, especially production issues. The danger here is defaulting to short-term, tactical research activities (e.g. weed or disease control) rather than longer-term strategic research activities (e.g. do we have the right farming system for this agro-ecological zone for the climate we are heading into? or what changes would we need to make to this farming system in a world with much higher real prices for energy, water, carbon and food?). The intersections between the big issues of climate, water and energy will create a new set of challenges for Australian agriculture (PMSEIC 2010b) as discussed further below.

To date, public funding for the cross-sectoral and 'public good' RDCs has been a discretionary line in the DAFF budget. In 1990, LWRRDC was the 4th biggest corporation in terms of public funding, with an appropriation of $10.79m. By 2000, with an appropriation of $11.05m, Land & Water Australia was down to 8th of 14 RDCs and IOCs in the level of public appropriation through DAFF. This relative decline continued in the 2000s, but was offset by external revenue from non-appropriation sources as the corporation pursued a collaborative co-investment model, to the point where in 2007-8, LWA total cash investment reached $38.7m, from an appropriation base of $13m (LWA 2008). This was by far the highest level of cash co-investment achieved by any RDC. It reflected a conscious strategy by LWA, the fact that NRM issues are generally cross-sectoral, and the reality that farmers manage about two thirds of the Australian continent and use about 70% of diverted freshwater resources. Consequently, it

makes sense, where appropriate, to use industry adoption pathways to engage producers in NRM research and to promote adoption of NRM research outputs.

**BOX 1. Irrigation**

Irrigation R&D is an interesting case that illustrates the limitations of an industry-based research funding model.

In an 'average' year, irrigation delivers a significant proportion of the profits in Australian agriculture. It has a huge environmental footprint, using more than 70% of diverted freshwater resources in Australia. The success or otherwise of irrigation systems have profound social and economic implications for many regional communities. A study by the Centre for International Economics (CIE) found that rural irrigation (1996-7 figures) contributed $7.4 billion to total exports and around 170,000 employee jobs to the Australian economy (LWA 2008). Billions of dollars are now being spent trying to modernise irrigation systems to deliver more food and fibre using less water, and to return more water to stressed aquatic systems.

Yet irrigation R&D receives only a small proportion[3] of RDC research funding. Farmers tend to think of themselves first as a 'cotton farmer', 'dairy farmer' or 'grape grower' rather than an irrigator, and levies are collected on the farm output or product, not the inputs. There may have been a tendency among industry groups and commodity RDCs to see funding of irrigation research as an LWA responsibility, but this implies an assumption that irrigation systems are a matter for the public purse alone. LWRRDC and LWA ran national irrigation R&D programs and tried to play a coordination role in irrigation R&D (including catalysing and facilitating the bid for an Irrigation CRC), but always struggled to get sufficient co-investment from other RDCs. For example the dairy industry, the biggest water user in Australia, did not see irrigation research as a high priority, and (via DRDC and then Dairy Australia) was not an investing partner in either the National Program for Irrigation R&D (NPIRD) or the National Program for Sustainable Irrigation (NPSI).

It is arguable that there would be better options available to governments and industries now, in terms of the technologies and systems to improve irrigation infrastructure, had there been a better-resourced R&D effort in this sector over the last twenty years. It is also likely that we would now have greater capacity in irrigation R&D, which is sorely lacking in comparison with the scale and seriousness of the challenges facing water management in Australia, especially in the Murray-Darling Basin. The closure of the Irrigation Futures CRC further deepens the capacity hole for irrigation research.

A potential remedy for this situation would be to collect a levy for irrigation research on each megalitre of water diverted for irrigation purposes.

It is difficult to quantify the precise amount of total investment on a given issue due to definitional issues and the fact that many research projects address more than one objective. In 2005, a working group on NRM comprising staff from most RDCs attempted to develop a standardised reporting framework to categorise and quantify investment on NRM issues across the RDCs. Defining NRM very broadly, the group estimated that total RDC investment on NRM in 2004-5 was $78.5m, or slightly more than 20% of total RDC research investment. Of this figure, nearly $9.5m or 12% was invested in collaborations involving two or more RDCs (Rural RDCs 2005).

The Productivity Commission Draft Report asserts that the model tends to under-invest in the public good for the quantum of public funds invested. In my judgement that is probably correct, but difficult to substantiate. The farmer influence on the commodity RDCs will naturally seek to maximise the private return, seen as R&D that delivers immediate production benefits. Recent challenges to GRDC and MLA by prominent growers evidence this. Using the 2004-5 RDC data, if the total environmental investment (including the substantial private good components arising through better resource management such as more efficient water use and more effective tillage systems) was only of the order of 20%, then the social and economic public benefits generated through the balance of RDC investments would need to have been very high (or the definition of public benefit very broad) to approximate the proportion of total public investment through the model. That said, the market failure arguments about the atomistic nature of agriculture and the non exclusivity of much RDC research would still merit a level of public matching funding to ensure a socially optimal level of investment.

The Commission is right to question the overall level of investment in public good and cross-sectoral issues across the RDCs and IOCs. But it is crucial not to conflate these two objectives. The solution proposed in the Draft Report — of linking the establishment of a new cross-

[3] A desktop analysis within LWA in about 2003-4 estimated that irrigation research received less than 5% of total RDC research investment and a broader definition used by the joint RDC NRM working group in 2005 (Rural RDCs 2005) estimated 7%.

sectoral and public good RDC to reduced matching funding for industry RDCs and IOCs focused more narrowly on R&D of direct benefit to levy-payers — is flawed.

The Draft Report appears to assume that research projects can be easily put through a drafting gate and labelled either 'public good' or 'private good'. The real world is rarely that simple. Many of the 'best' NRM or other public good research projects are those that also deliver industry or private benefits. A classic example is that of the Cotton BMP program described by Schofield et al (2007), which was a partnership between CRDC, LWRRDC and the Murray Darling Basin Commission (MDBC) that delivered substantial environmental benefits in reducing chemical use, eliminating endosulfan contamination of rivers and consequent fish kills, while also delivering significant production benefits for cotton producers. Using cotton industry extension pathways, this program achieved much higher levels of adoption, and hence return on investment, than could have been achieved by LWRRDC or MDBC on their own.

Many of the comprehensive NRM research evaluation case studies documented by Schofield, Chudleigh and Simpson (2007) illustrate the point that the projects with the highest return on investment are those that deliver a combination of public and private benefits. Of course there are very worthy R&D projects that do not deliver direct private benefits to levy payers — for example around biodiversity, Indigenous NRM, social and institutional research directed at policy makers, decision support tools for catchment management authorities, and so on. Many such projects need to be extended through adoption pathways other than farmers, and will simply not be funded under an exclusively commodity-based model. Other issues like pests, weeds, soil health and irrigation do have important on-farm dimensions and do deliver benefits to producers, but none of these issues are seen as critical core business by the industry RDCs. Absent co-investment from a public-good RDC, they tend to under-invest in these issues — especially their conservation and off-farm dimensions.

### Collaboration

Some submissions suggest that cross-sectoral issues can be dealt with effectively through collaboration between RDCs, and that it is not necessary to (re)establish a new RDC. I disagree.

Industry collaborations managed by Land & Water Australia such as Managing Climate Variability, the National Program for Sustainable Irrigation, Land Water & Wool, Grain & Graze, and Healthy Soils for Sustainable Farms worked very well in the main. But it is important to acknowledge the complementary roles in these collaborations of the industry RDCs and IOCs, and LWA. Industry-specific communication vehicles, extension networks and adoption pathways were of course critical in ensuring research relevance and promoting uptake. But LWA carried most of the administrative costs, it employed the staff, contracted specialist expertise in the relevant scientific disciplines, ran the R&D procurement processes, and then contracted and managed the research projects. The other RDCs and IOCs benefited from LWA's expertise, systems and networks in dealing with NRM issues.

The biggest problem with this model was simply that the LWA budget was far too small, which also exacerbated its political vulnerability in a tight federal budget.

It is arguable that the level of collaboration (only 12% of the total NRM investment) in 2004-5 was also too low, despite the proactive approach to collaboration adopted by LWA in its industry programs. It would be interesting to compare these figures with current data using a consistent reporting framework. Given the increasing importance of climate change mitigation and adaptation, energy and water security and productivity, food security threats and opportunities, and the implications for agriculture and rural lands of demographic pressures and competition with mining, one would expect to see a much higher level of total RDC investment

on NRM, and a much higher level of co-investment through collaborative programs across RDCs today than in 2004-5. This seems unlikely to be the case.

The assertion that, given sufficient direction from government, RDCs and IOCs can meet the need for cross-sectoral R&D through collaboration, to my mind misses two crucial points. Firstly, the transaction costs of collaboration are significantly higher than for programs designed and managed within one RDC (as discussed further below). Secondly and more importantly, the big cross-sectoral issues like climate, energy, water, soils, biodiversity and biosecurity — and the interactions between them — are characterised by considerable technical complexity, multiple diverse stakeholders, and significant social, economic and institutional dimensions along the full spectrum from private to public benefits. They demand research strategy, expertise and systems that are tailored for these issues. This capacity is much more likely to be developed, and to be delivered efficiently, through a dedicated RDC than through part-time managers working to part-time committees whose core business and expertise lies within particular industries, not between them.

As discussed by Campbell and Schofield (2007), collaboration is a means to an end, not at end in itself. The transaction costs of collaborative approaches, especially for the managing agent, are significant. The value proposition — in terms of reduced duplication, greater critical mass, sharing of risk and expertise, making better use of scarce research resources and so on — needs to stack up, and the level of co-investment needs to be significant, to justify the cost in time and money of bringing many partners together in jointly-funded programs. Collaborative programs also carry risks in terms of brand dilution for individual investors, and of defaulting to lowest common denominator approaches. It can be difficult to deliver highly innovative, cutting edge research if all decisions need to be made by committee and consensus.

If the model is such that much greater levels of collaboration are required to deal effectively with the big issues, then it would be more productive to re-examine the model than simply to urge higher levels of collaboration.

The abolition of Land & Water Australia (LWA) in 2009 and to a lesser extent the Energy R&D Corporation (ERDC) in 1996, and the cuts to appropriation funding for LWRRC in 1996 and RIRDC in 1996 and 2009, exacerbated the structural flaws in the RDC funding model, making it much more likely that the model will under-invest in the public good, and in collaborative R&D on cross-cutting issues.

### The Productivity Commission proposal to establish Rural Research Australia (RRA)

Draft Recommendation 6.1 to establish and fund a new $50m RDC under the PIERD Act *'to sponsor non-industry specific R&D intended to promote productive and sustainable resource use by Australia's rural sector'* is, for the most part, very sound.

However, the last two dot points in this recommendation, that other RDCs should then focus primarily on *'R&D of direct benefit to their levy payers'* and that the funding contributions from the Commonwealth to other RDCs (except Fisheries) should then be reduced to half their present levels over ten years, are misconceived.

In my opinion, the last two points would fundamentally undermine and weaken the RDC model in general, and they would 'poison the waterholes' for the proposed RRA in particular. It would be very difficult for RRA to build the goodwill and collaborative spirit that would need in order to access industry adoption pathways (as LWA did) if its establishment had been at the expense of the budgets of the industry RDCs. Moreover, there would be a tendency under this model for any research proposals with a public good component to be flicked to RRA, rather than integrated within the portfolios of industry RDCs and IOCs.

If the establishment of RRA is not linked to reduced matching funding for other RDCs, the model could work well. Building to a base appropriation of $50 million annually deals with the biggest problem with Land & Water Australia — its sub-critical mass in terms of core budget appropriation compared with the scale and scope of its mandate.[4] Assuming that it would be able to develop significant partnerships, the new RDC should have a research portfolio exceeding $100m annually. This would still be a relatively small proportion of the annual $1.5 billion investment in rural R&D, and modest in relation to the size of the climate, water, energy, land, biosecurity and biodiversity issues. The new RDC would still need to be highly targeted and catalytic in its approach.

In my view there are two broad options for the establishment of the new RDC:

i. As proposed in the Draft Report, create a new RDC focused on sustainable NRM issues (climate, land, water, energy, soils, carbon, biodiversity, pests, weeds etc), and leave RIRDC essentially as it is, although bioenergy and agroforestry could potentially come across from RIRDC into the new corporation; or

ii. Substantially overhaul RIRDC to build a new RDC several times larger that would be dominated by its sustainability portfolio, in addition to RIRDC's existing rural issues and small/emerging industries portfolios.

On balance, I prefer the first option. It would be the simplest and easiest to implement, it would more quickly fill the gap created by the abolition of LWA and it would involve minimal disruption to RIRDC. It also means that the new RDC could focus solely on sustainable agriculture and NRM issues in its establishment and recruitment phase. Arguments against creating an additional RDC to avoid administrative overheads in my view are weak. The government has introduced LiveCorp and the Australian Egg Corporation to the model in recent years, and one additional corporation to a group of fifteen is not a huge increase. The climate, energy, water, land, soil, carbon, biodiversity and biosecurity issues are not going to go away, and as the recent PMSEIC reports illustrate, they represent formidable research challenges. The advantages of managing such research investment through the RDC model are considerable, especially in comparison to the alternatives of managing such research within FMA agencies whose core business is policy development and advice, not R&D.

With respect to option (i):

- In my view the proposed name Rural Research Australia is appropriate for Option (ii) but not for Option (i). If it is established separate to RIRDC, then the name is too similar to RIRDC and does not reveal what the new corporation is about. Water Energy and Land R&D Corporation, or Sustainability Research Australia, or Natural Resources Research Australia, would all be better.
- In terms of the scope of the new corporation, I agree with the submission of the Victorian DPI (2010) that it should encompass climate change, soil/water/vegetation/landscape management, biosecurity, energy and bioenergy. However under this option, animal welfare and food safety would better sit with RIRDC. In my view, funding for the cross-sectoral issues managed by RIRDC is also too modest.
- The new RDC should be expected to have a high level of interaction and engagement with industry sectors and their respective RDCs, and a KPI for the new agency would be the quality of its partnerships. If their matching funding is intact, the new RDC should have no trouble facilitating significant collaborations with RDCs on the big cross-sectoral issues, to

[4] An independent international review of Land & Water Australia carried out by Dr Andy Pearce in late 2005 concluded that LWA was an 'exemplary high performing public sector agency' with world class research management and portfolio evaluation, but that it was 'spread too thin'. The Pearce review questioned whether LWA's strategy of industry partnerships leveraging its own funds to attract co-investment had been pushed too far, at the expense of more focused LWA investment on its own highest priorities.

deliver an integrated mix of public and private benefits through industry adoption pathways.

- It should have a strong mandate to be collaborative, not just with the rural RDCs but with other national research funding agencies and with industry, including in the water, energy and carbon sectors. Like LWA, it should also put a lot of effort into the management and custodianship of knowledge assets — not raw data, but value-added synthesis products tailored to the needs of end-users. It would need to have sophisticated search and knowledge management capabilities and extensive links into communication, education and extension networks to ensure that research outputs are easily accessible and prominent.

- The potential for levy streams to this corporation — for example from the irrigation, energy and carbon market sectors would be worth exploring.

With respect to Option (ii):

- If we were rebuilding the RDC model from scratch, knowing what we know now, then this would be the best option.
- It would be an exciting proposition to establish a new Rural Research Australia to deal holistically with all the cross-sectoral challenges in rural Australia, including sustainability issues, social issues, planning and resource allocation issues; and also to take an oversight and coordination role (as the Vic DPI submission suggests) around core national RD&E resource capabilities such as gene banks, national pest and disease collections, research infrastructure and capacity building (including education) and the data issues (knowledge databases, reporting frameworks, evaluation processes, performance review processes etc) correctly identified in the Draft Report.
- This option would in effect create a significantly bigger RDC than the combination of the proposed RRA and the existing RIRDC. It would be a bigger, more expensive, more complicated and more time-consuming job to establish and build such an organisation, compared with just establishing a sustainability-focused RDC. It would be an entity capable of playing a wider leadership role across rural research in Australia. This raises broader questions beyond the agriculture portfolio, as discussed below.

Terry Moran, the Secretary of the Department of Prime Minister and Cabinet, reflecting on the challenges of public sector reform in a speech to the Institute of Public Administration on 15 July 2009, observed that:

> *"By and large, I believe the public service gives good advice on incremental policy improvement. Where we fall down is in long-term, transformational thinking; the big picture stuff. We are still more reactive than proactive; more inward than outward looking. We are allergic to risk, sometimes infected by a culture of timidity….*
>
> *The APS still generates too much policy within single departments and agencies to address challenges that span a range of departments and agencies… We are not good at recruiting creative thinkers."*[5]

Given the need for 'long-term, transformational thinking', the increasing importance of big cross-cutting issues like climate, energy and water, none of which are led by DAFF, and given that the Environment and Water, Climate Change and Energy Efficiency, and Resources and Energy portfolios are also significant research investors on these issues in rural Australia, why should investment in research on these issues be confined solely to the Agriculture, Fisheries and Forestry portfolio?

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5 http://www.dpmc.gov.au/media/speech_2009_07_15.cfm

The big challenges to agriculture tend not to be commodity-specific, nor specific to the agriculture portfolio. Pretty et al (2010), in a large multinational, collaborative project, attempt to define the 100 most important research questions for global agriculture. As global research priorities, they inevitably tend to be generic, there is a considerable focus on developing country issues, and there is no attempt to quantify or prioritise these questions. It is nevertheless interesting to note the broad breakdown of the 100 priorities: 7 on climate, watersheds, water resources and aquatic systems; 7 on soil nutrition, erosion and use of fertiliser; 8 on biodiversity, ecosystem services and conservation; 11 on energy, climate change and resilience; 8 on crop production systems and technologies; 5 on crop genetic improvement; 6 on pest and disease management; 6 on livestock; 5 on social capital, gender and extension; 9 on development and livelihoods; 6 on governance, economic investment, power and policy making; 9 on food supply chains; 7 on prices, markets and trade; and 6 on consumption patterns and health. While many of these issues are researchable within the context of particular agricultural industries, it is notable that only about one quarter of these questions would best be explored through commodity-specific R&D and less than half through on-farm R&D.

## Water

**Figure 2 Water use in Australia, 2004-05 (AWR 2005)**

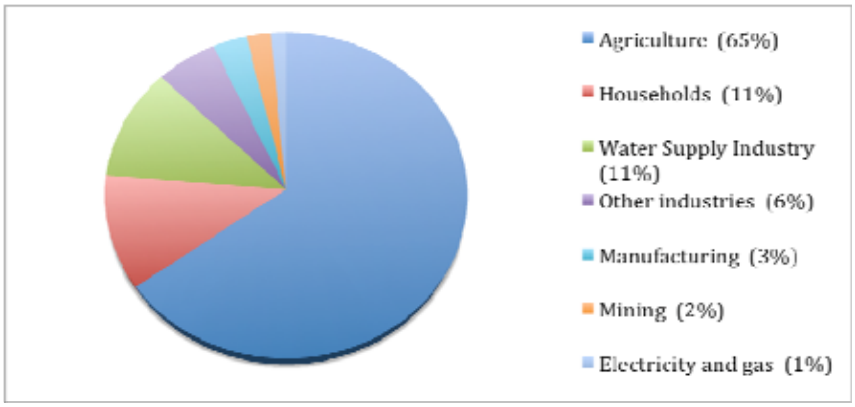



Figure 2 illustrates the enormous water footprint of Australian agriculture. The significance of water alone would justify a dedicated RDC to deal with it effectively. Australia's population is projected to grow by over 65% to 35 million people by 2049, with demographic trends towards further concentration in south-eastern Australia and along the southern half of the eastern seaboard. This would put existing water supply and management systems under enormous strain, even in the absence of extended drought or climate change. Population growth is compounded by growing per capita consumption, which increased by 25% in real terms from 1995-6 to 2003-4 (Beeton et al 2006). The water supply, drainage, sewage and waste management systems of the three biggest cities, which already house one in every two Australians, were and are simply not designed to cope with an extra seven million people over the next forty years, irrespective of any change in prevailing climatic conditions.

> *"Are Australia's natural resource endowments, including water, capable of sustaining a population of 35 million? What are the implications for environmental amenity of this sort of population growth? Must it mean an even greater loss of biodiversity…?*
>
> *…with a population of 22 million people, we haven't managed to find accommodation with our environment. Our record has been poor and in my view we are not well placed to deal effectively with the environmental challenges posed by a population of 35 million."*

This is not the familiar lament of the green movement or the sustainable population lobby, but an excerpt from a speech by Dr Ken Henry,[6] Secretary of the Commonwealth Treasury, to business leaders on *Long run forces affecting the Australian economy*. The first two among

[6] Speech by Dr Ken Henry at the QUT Business Leaders' Forum, 22.10.09, http://www.treasury.gov.au/contentitem.asp?NavId=008&ContentID=1643 accessed 22.11.09

Ken Henry's group of four big forces confronting the Australian economy were the ageing population and population growth, and climate change adaptation & mitigation.[7]

When the projected warming and drying of south-eastern Australia — and the predicted increase in the frequency and intensity of extreme events such as storms, floods, heatwaves and bushfires — is overlaid on this demographic momentum, then it is clear that Australian governments, industries and communities have an enormous amount of work to do to avoid major water security crises. Ken Henry again:

> *"…substantial additional investment, in both private and public infrastructure, economic and social, will be required to support our larger human population. … quite sophisticated infrastructure planning is going to be required…"*

Such sophisticated infrastructure planning will be knowledge-intensive. It will demand a significant commitment to long-term research programs and institutions to tackle some of the deep knowledge gaps that characterise this challenge. The infrastructure, policies and plans needed in the future are likely to differ from the models of the past. It will no longer be sufficient (or even feasible in many places) to rely on building big dams in the hills to supply centralised water distribution systems for the irrigation districts and/or cities below.

Widespread innovation and technological development will be required across a range of relevant sectors, to assist industries and communities to anticipate and to adapt to changing water management needs, and to provide new options.

Many water management challenges are urban and peri-urban, and it could be argued that these are not relevant to the Rural RDC model funded and managed within the Agriculture, Fisheries and Forestry portfolio. However the lines between urban water and rural water are blurring, and as water markets mature this trend will continue. Agriculture will need to maintain a sophisticated research management capacity in water if it is to continue to justify its share of diverted freshwater resources in the face of much higher value uses in, for example, the urban and mining sectors.

From Table 1 below it is clear that Australia's agricultural water research capacity is actually declining, both in terms of specialist research funding agencies and research providers. This is counter-intuitive given Australia's water challenges. In meeting the research and innovation needs inherent in these challenges, there is an urgent need for the sorts of specialist research planning, funding, management, brokering and knowledge translation services that an appropriately mandated R&D Corporation could provide. This issue alone, especially given the projected collapse in capacity illustrated below, would justify the establishment of a $50m per year RDC.

**Table 1 Concluding Water Research and Knowledge programs and organisations**

| Year / Organisation or program | 1982 - 1989 | 1990-1992 | 1993-2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raising National Water Standards (NWC) | | | | | | | | | | | | | | |
| eWater CRC (& predecessors) | | | | | | | | | | | | | | |
| CRC for Irrigation Futures | | | | | | | | | | | | | | |
| National Program | | | | | | | | | | | | | | |

[7] The others were the ICT revolution; and the re-emergence of China and India.

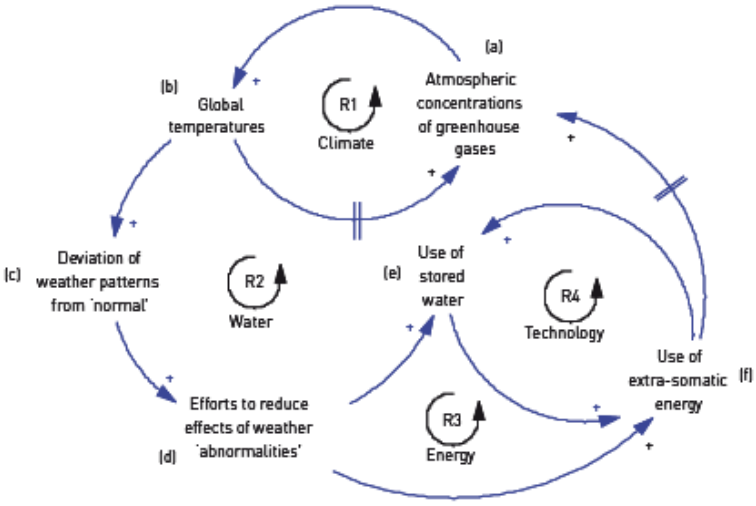
| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| for Sustainable Irrigation (NPSI & predecessors) | | | | | | | | | | | | | | |
| Murray Darling Freshwater Research Centre | | | | | | | | | | | | | | |
| Land & Water Australia | | | | | | | | | | | | | | |

## The convergence of climate, water, energy and food

Steep increases in the real price of energy over the next decade are likely, primarily due to the depletion of global oil reserves (IEA 2010, UKERC 2009), but also through the advent of a carbon price. Every megalitre of water weighs one thousand tonnes, so water management and energy consumption are tightly coupled. Water is needed to produce energy, and energy is needed to produce water. Many water-saving measures such as piping and pressurising open channels, desalination plants and inter-basin transfers increase energy consumption. Energy production is water intensive, and measures to reduce emissions from energy production such as Carbon Capture and Storage and nuclear power generation are even more water intensive than conventional coal-fired power stations. Increasing consumption of fossil fuel energy increases greenhouse gas emissions, resulting in responses to shift to renewable energy sources and to offset emissions. However, biosequestration projects can also have a significant water footprint, as can biomass energy and biofuel projects driven by energy security concerns. At a higher system level again, global climate change resulting from increasing atmospheric concentrations of greenhouse gases affects both water resources and energy consumption.

**Figure 3. Generic structure of the climate-energy-water system** (Proust et al 2007)

Figure 3 at right, from a study commissioned by LWA in 2005, portrays the generic feedback loops between climate, water and energy. These and other feedback loops between water, energy and carbon mean that it is increasingly untenable to consider water in isolation.




The coupling of water and energy is particularly obvious in irrigation and in urban water supply contexts, which both involve transporting large amounts of water.

The connection with food is less obvious in Australia at this stage, but already acute in other countries. We are accustomed to seeing pie charts like Figure 2 that indicate that agriculture is by far the biggest water user and households only use about 10% of water diverted. This is misleading however, in that most irrigation water is used for food production. The biggest component of the water footprint of the average household is through food consumption, not flushing toilets, watering gardens or long showers.

The world needs to increase food production by at least 70% over the next forty years (FAO 2009). Over 3 billion people now rely on food grown elsewhere and transported to cities, and with urbanisation, this is likely to grow to around 7 billion by 2050. One result of the urbanising trend is that global trade in basic food commodities will rise (Clark 2009).
The traditional means of increasing food production have been through expanding the footprint of agriculture — clearing more land, cultivating more land, and irrigating more land — and

through better varieties, intensification, mechanisation and greater use of fertilisers. These options are now narrowing due to climate change, rising prices for energy and nutrients, energy security concerns, the degradation of arable lands (FAO 2008), and the fact that all the world's major irrigated food bowls have either fully- or over-committed their groundwater and surface water resources (IWMI 2007). Some water-scarce countries such as India have already committed a significant proportion of their water resources to biofuel production as a hedge against rising oil prices and the depletion of easily accessible world oil reserves.

One implication for Australia of global food, water and energy security concerns is that world demand for food will increase steadily, while supply will be increasingly volatile, leading to food price volatility but probable long-term real increases in food prices and major opportunities for food exporting countries like Australia (Campbell 2009). Australia produces about 1% of the world's food and 3% of food exports (Clark 2009). Food should remain a significant and potentially growing export earner for Australia, provided we can maintain or increase food production capabilities in the face of climate change, domestic population growth, rising real energy and nutrient costs, and suburban expansion.

There is a looming resource allocation and integration challenge, in Australia as in many other countries: how to optimise the allocation of land and water resources to food and energy production, in ways that mitigate net greenhouse gas emissions, in the face of increasing population and urbanisation, which is often occurring on some of the most productive agricultural soils. Peri-urban regions are estimated to produce one quarter of Australia's total gross value of agricultural production (Houston 2005), yet there is no national mechanism in Australia for monitoring the loss of agricultural lands to urban expansion and its impacts. If global oil prices do increase rapidly in real terms over the next decade, as predicted by the International Energy Agency (IEA 2010) and the UK Energy Research Centre (UKERC 2009), then areas with good soils, reliable water and rail proximity will become increasingly important for intensive food production.

Another implication of the tightening global food supply context is that Australian know-how in sustaining food production in a variable climate, and in managing water scarcity and declining water resource security, will become increasingly valuable and in demand. Knowledge is the world's most valuable traded commodity. Water knowledge could become a major export earner for Australia, just as knowledge exports already earn more than $3 billion for the Australian minerals sector (Cribb 2008). The strong international dimension of the climate-energy-water nexus, and the knowledge commercialisation opportunities it represents are also acknowledged by PMSEIC (2010b).

The climate-water-energy-carbon-food nexus is not unique to Australia. However, given the extreme variability of our run-off, the size of the continent and the density and distribution of our major population centres, Australia is at the sharp end of the tensions between water security, energy security, food security and reducing carbon pollution. This presents a formidable knowledge and research challenge. Any solutions developed in Australia will be of intense international interest and commercial significance. This was illustrated by the Climate Energy Water Nexus Forum held at the ANU on 2-3 December 2010, as part of a collaboration between the Crawford and Fenner Schools of the ANU and the US Studies Centre at Sydney University. There is considerable interest, funding and involvement from the United States through its Dow Sustainability Program for a research initiative called the Australia-United States Climate, Energy and Water Nexus (AUSCEW) Project. It was very apparent at this forum that the US (especially in the south and west) and Australia share very similar challenges in trying to reduce the water, energy and carbon intensities of their economies in the face of water scarcity.

There is a case for considering research funding models that cross portfolios, especially around water, energy, carbon, biodiversity, biosecurity and climate change.
The RDC model with dedicated corporate bodies operating under the CAC Act is the best vehicle we have yet developed for funding and managing rural research. It may be outside the Terms of Reference for this inquiry, but it would be worth exploring more systematically how a Rural Research Australia could be used by other Commonwealth portfolios (e.g. Water, Climate Change, Energy and Regional Development) for purchasing their rural research.

## Enhancing competitiveness and productivity of rural industries

The great strength of Australia's rural R&D model is the partnership between government and industry that is hard-wired into the model, and is the envy of many of Australia's agricultural competitors internationally. The ownership that levy-payers feel towards research outputs has been a key contributor to high adoption rates for research results, that have in turn contributed to a doubling of productivity in Australian agriculture over the last 25 years — considerably higher productivity increases than the economy as a whole (Mullen 2007). This ownership also feeds into extensive end-user input into research priorities, which means that research outputs tend to be relevant and adoptable. The model engenders high levels of collaboration between researchers and end-users, and also a degree of national coordination of research activity within each sector.

Stakeholder ownership of the research agenda, and end-user input into research priorities and research delivery are important but not sufficient conditions for a high quality applied research portfolio. Appropriate governance and competence in research procurement and management processes and systems are equally important (Campbell and Schofield 2007). In the main, rural RDCs are well-governed and well-run, with competent people, processes and systems that are fit for purpose. Funding and managing applied R&D to meet industry needs is core business for RDCs, and on the whole they do it well — especially in comparison to research programs managed within policy departments.

### Governance

The loss of government directors from RDC Boards since the Uhrig review of CAC Act bodies has been an unfortunate retrograde step to the detriment of both DAFF and the RDCs. It has removed a crucial early warning system for both government and industry, an important development opportunity for DAFF senior executives has been lost, and the perceived conflict of interest that this move was intended to 'fix' was always illusory.
The PC recommendations to provide for consensual appointment of a government director and to improve evaluation, reporting and performance review processes across the whole RDC model would improve it. I do not see a good case for lessening Ministerial involvement in approving Strategic R&D Plans however, especially if matching funding is not reduced.

### Competence

The RDCs are dedicated research purchasers, managers, brokers and coordinators. They recruit and train staff with skills in these areas and they have systems designed for these purposes. Procuring and managing research, and communicating the outputs of that research, is their core business. Their staff tend to remain with the corporations for longer than tends to be the case in policy agencies and many have both deep technical knowledge of, and broad networks within, their particular industry or sector.

In considering the merits of any particular model, it is important to consider the alternatives. One alternative is for DAFF to simply attempt to procure and manage research services itself,

as it did with the Climate Change Research Program, and as the Environment Portfolio did with the $100m Commonwealth Environment Research Facilities (CERF) program.

As a general observation, research management tends to be more competently delivered by organisations or agencies established, staffed, equipped and dedicated for that purpose than it is by policy Departments. Policy Departments operating under the FMA Act generally suffer from a number of constraints in delivering research management services, including that they:

- perform a wide range of roles other than research management, many of which impose more urgent daily requirements and deadlines;
- are subject to the FMA Act, which (compared with the CAC Act) places restrictions on the management of multi-year funding and partnering with commercial organisations;
- have a high level of staff turnover (compared with most research providers and dedicated research funding organisations) which undermines continuity, cohesion, credibility and corporate memory;
- find it difficult to train and retain sufficient staff in research or knowledge management roles;
- lack specialised project and contract management systems designed for managing research activities (e.g. with on-line application processes and sophisticated measures for keeping registers of and managing intellectual property);
- tend to use generic professional services contracts to procure research (rather than contracts designed specifically for the purpose of research investment);
- lack dedicated outreach systems to communicate and promote research outputs (beyond passive communication mechanisms such as press releases), and have difficulties with publishing findings that are inconsistent with the policies and priorities of the government of the day; and
- find it difficult to manage knowledge legacy issues, especially after the funding period for the relevant project or program has ended. Departments often can't even find project or consultancy outputs funded five years ago, let alone ten or twenty years ago. Their evaluation processes tend to be oriented to accountability within particular programs, rather than adaptive learning across a whole portfolio through time.

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