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National Program for Sustainable Irrigation & Irrigation Australia Ltd

Future Vision for Irrigation Research Development and Extension

Desktop Review and Consultation Findings

April 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

The National Program for Sustainable Irrigation and Irrigation Australia Limited have engaged GHD to develop recommendations on how irrigation research, development and extension can be improved to achieve the most effective outcomes for end users, providers and investors through developing:

- A vision for irrigation R&D and its adoption; and
- The best **options** for implementation that will enable the irrigation sector to move forward to achieve this vision for RD&E. This will include consideration of the funding model for RD&E to ensure resources are effectively utilised and implemented across industry and government.

This document characterises irrigation RD&E and the key issues, based on a desktop review and consultation with key stakeholders. The next stage of the project involves a workshop with key stakeholders to develop the vision and options for irrigation RD&E.

What's driving the irrigation industry and RD&E?

The study has identified eight drivers which are changing irrigation and RD&E (shown in Table 1.

Table 1: Key drivers and implications

Drivers	Implication
Climate change and variability	Need to produce more with less water and labour
Resource sustainability	Environmental sustainability critical
Water policy reform	Industry structure will continue to change
Population demographics	Demand for irrigated produce will increase
Irrigation investment	There is demand for R&D knowledge
Industry reputation	Irrigation industry needs to improve reputation
RD&E fragmentation	Business as usual RD&E is insufficient
R&D policy review	Policy reviews are catalyst for change

If RD&E is going to meet both the immediate and on-going demand for irrigation knowledge, it requires a framework which engages all RD&E stakeholders to:

- Articulate a vision and strategic priorities for irrigation and RD&E;
- Attract and focus investment on priorities;
- Deliver RD&E to achieve priorities and vision;
- Build and sustain the required capability;
- Demonstrate impact for accountability and improvement; and
- Position irrigation RD&E within the R&D policy reform agenda.

Vision for the irrigation industry and RD&E

There is no agreed vision for the irrigation industry and RD&E. The following visions are suggested, based on the desktop review of industry and government strategies and plans and consultation with stakeholders.

Irrigation Industry Vision

Australia's irrigation industry is not facing a business as usual scenario. Global population growth will increase the demand for irrigated food and fibre. At the same water and labour scarcity, competitive market pressures and the need to sustain its natural resources will continue to drive structural change in the composition and distribution of the industry.

The Australian irrigation industry will meet the demand for its food and fibre and address these challenges by increasing its productivity and sustaining its human and natural capital. By 2020 we will be the recognised global leader in profitable, competitive and sustainable irrigation, contributing to regional, national and global well-being.

Irrigation RD&E Vision

RD&E will substantially contribute to Australia becoming the global leader in profitable, competitive and sustainable irrigation. Industry, government and the research community will work collaboratively to focus on key on and off farm priorities to deliver RD&E that improves productivity, water use efficiency and environmental sustainability, climate change adaptation and irrigation modernisation.

What do we need to achieve?

The study identified nine irrigation industry outcomes and ten RD&E priorities which need to be addressed over the next ten years to achieve this goal. These provide the foundations for industry and RD&E visions.

Table 2: Irrigation industry outcomes and RD&E priorities

Goal	Profitable, competitive and sustainable irrigation industry		
Scale	On-farm irrigation	Off farm irrigation systems	Industry value chain
Industry Outcomes	1. Effective, profitable business systems 2. Productivity gains 3. Water use efficiency 4. Sustainability improvements 5. Climate change adaptation 6. Recapitalisation to improve sustainability of irrigation infrastructure 7. Improved capability and skills of our people		8. Improved industry reputation and value 9. Coordinated industry and RD&E leadership and capability
RD&E Priorities	1. Plant varieties and biotechnology 2. Agronomic practices 3. Irrigation technology and practices 4. Whole farm planning and management	5. Infrastructure modernisation 6. Catchment/water planning and management 7. Enhance ecosystem services	8. Demonstrate sustainability and value of irrigation industry 9. Agreed RD&E framework linked to national system, incorporating M&E and adaptive management 10. Effective and coordinated industry leadership

The study has characterised irrigation RD&E and identified a number of key issues in the RD&E value chain, which need to be addressed to improve performance.

Strategy and Investment

The project and previous industry consultation identified that there is in-principle agreement that a national framework is needed to improve irrigation RD&E strategy and investment, which

- Engages and commits key stakeholders;
- Establishes agreed priorities and focuses coordinated investment which balances time horizons, uncertainty, value chain beneficiaries and emergent innovations;
- Integrates with other RD&E frameworks;
- Avoids duplication and is efficient, effective and flexible; and
- Builds and sustains the required RD&E capability.

RD&E Sourcing and Commissioning and Capability

The two approaches to sourcing and commissioning RD&E are enduring partnerships and competitive bidding, with most investors using a mixture of both.

Competitive bidding fosters innovation and provides investors with a flexible and cost-effective approach to sourcing and commission RD&E. The weakness of competitive bidding is the cost to providers and the risk that capability is not available or sustained for industry benefit. Enduring partnerships distribute sourcing and commissioning costs more equitably between investors and providers and allow them to focus on delivering to agreed priorities. The weakness of enduring partnerships is reduced flexibility, partnership costs and sustaining existing providers at the expense of new entrants.

Irrespective of which approach is used, stakeholders identified sourcing and commissioning as a critical part of ensuring that RD&E is focused on industry outcomes and RD&E priorities and adaptive management.

RD&E providers face continued pressure in building and maintaining capability, which is a key focus of current national reviews. 62% of interviewees indicated capability for irrigation RD&E is inadequate. Potential options to improve capability included:

- Improving the continuity of funding
- Increasing and diversifying the source of funding, including the private sector
- Facilitating specialisation and resource and knowledge sharing; and
- Building the capacity and career paths to retain staff

RD&E Delivery and Use

Delivery of R&D and innovation is complex, non linear and not the responsibility of one organisation. The fragmented nature of irrigation RD&E means that it is delivered through existing industry and provider and/or investment program frameworks.

There are many examples of excellent extension across the irrigation sector, resulting in industry and government using R&D knowledge to improve irrigation at the farm, system and policy scales. Many interviewees believe more extension is needed to facilitate adoption of RD&E. It is apparent that there is no extension leadership or framework for the whole sector, which many interviewees identified as a limitation to the quality and amount of extension needed to foster adoption to improve the industry.

1. Introduction

1.1 Purpose

The National Program for Sustainable Irrigation and Irrigation Australia Limited have engaged GHD to develop recommendations on how irrigation research, development and extension (RD&E) can be improved to achieve the most effective outcomes for end users, investors and providers through developing:

- A **vision** for irrigation research and development and its adoption; and
- The best **options** for implementation that will enable the irrigation sector to move forward to achieve this vision for RD&E. This will include consideration of the funding model for RD&E to ensure resources are effectively utilised and implemented across industry and government.

The outcomes of the project will provide the industry with a sustainable framework which documents the long term priorities and strategic direction for the irrigation industry's RD&E. The project will aid in the forward planning of RD&E delivery across public and private sectors involved and help the irrigation industry and its many diverse organisations with their strategic input into several Commonwealth RD&E Reviews.

1.2 Approach

The project is being implemented in two stages, commencing with a desktop review and stakeholder consultation in order to characterise irrigation RD&E and issues using the analytical framework shown in the figure below[1].

Figure 1 RD&E analytical framework[2]

The second stage of the project involves a workshop with key stakeholders to develop the vision and options for irrigation RD&E. The outcomes of both stages will be incorporated into a final report outlining the vision, options and strategic implementation recommendations.

This document presents the findings from the desktop review and consultation.

[1] See Appendices for documents reviewed, stakeholders consulted and analytical framework description.

[2] There are feedback loops between each step that are not represented in the figure for clarity purposes.

2. Drivers and Insight Findings

This section describes how insights into the future drivers of innovation are shaping the irrigation industry and RD&E.

2.1 Industry Drivers

There are six key drivers which are anticipated to change the irrigation industry and have associated implication for irrigation RD&E (Table 3). The irrigation industry has the opportunity to develop as the demand for food and fibre increases as domestic and global population grows. The degree of irrigation development is potentially constrained by water and labour availability in response to changes in climate, water policy and industry demographics. Irrigated farming systems will need to become more diversified to better cope with variability and manage risk. Sustainable management of the industry's natural resources and improving irrigation's environmental stewardship reputation are also critical.

It is anticipated that these drivers, along with irrigation modernisation investment, will increase the rate of structural change in the industry as on-farm practices, farm businesses and irrigation systems adapt.

This will create both an immediate and on-going demand for R&D knowledge. The immediate demand stems from government and irrigation systems managers to inform water policy reform and irrigation modernisation investments. The on-going demands will include irrigation farmers and industry, as well as government and irrigation systems managers, across all aspects and scales of irrigation.

2.2 RD&E Drivers

The key drivers of irrigation RD&E are fragmentation and the rationale/focus of public investment, which is of concern and a current priority for all rural RD&E (Table 5).

In addition, as farming systems become increasingly dynamic and diverse, irrigation R&D will require a broader strategic approach. As a result, there will be more mixed responsibility and accountability for levy based R&D investment across time, sectors, issues and geography.

If irrigation RD&E is going to meet both the immediate and long-term demand for R&D knowledge it requires a framework which engages all the RD&E stakeholders to:

- Articulate a vision and strategic priorities for irrigation and RD&E;
- Attract and focus investment on priorities;
- Deliver RD&E to achieve priorities and vision;
- Build and sustain the required capability;
- Demonstrate impact for accountability and improvement; and
- Position irrigation RD&E within the R&D policy reform agenda.

Table 3: Industry Drivers

Driver	Impact	Irrigation RD&E Implications
Climate change – variability	◗ Climate less reliable, more volatile leading to reduced rainfall, higher temperatures and longer, deeper droughts. Reduced irrigation water availability and security; and reduced arable land. ◗ Need for increased water use efficiency and productivity; and adaptable and flexible production systems with advanced risk management. ◗ Structural change of irrigation systems and irrigators: – MDB irrigators more diverse and concentrated – less irrigators, larger businesses and more mixed (dry/irrigated) farms. – Irrigation system modernisation especially in MDB. – Opportunities for growth/relocation in existing and new irrigation areas outside MDB, including Tasmania, Burdekin, Bowen, Northern Australia. – Changes in enterprise mix, e.g. beef and horticulture (Bowen/Burdekin) and bio industries in FNQ.	◗ What are the impacts of climate? ◗ How can irrigation farms and systems become more resilient and adaptive? ◗ How to produce more with less and/or variable water from existing systems? ◗ What water will be available and how can losses be minimized? ◗ What are the alternative farming and irrigation systems?
Resource degradation	◗ Balancing consumptive, environmental and cultural water needs. ◗ Increased need to manage on and off-farm water quality in irrigation (salinity, acidification etc). ◗ Perception that irrigation industry is a poor resource manager.	◗ What is the minimum required to sustain the resource? ◗ How can impacts be managed? ◗ How can the irrigation industry demonstrate its environmental stewardship credentials?

Table 4: Industry Drivers (continued)

Driver	Impact	Irrigation RD&E Implications
Water reform policy	◗ Competition for other water use means reduced water availability and security for irrigators, as well as increased price of water (MDBA bound to give priority to environmental health). ◗ Potential inconsistency and unpredictability of government decisions in relation to water and the environment. ◗ Need for developing and implementing responsible and accountable resource use. Water for the Future has a strong demand for water information and research to support policy, planning, managing and regulatory processes. ◗ Opportunities may arise from the increased focus on water management, nationally, and the development of more consistent policies under the National Water Initiative.	◗ What is the best policy and institutional form for irrigation and water management? ◗ What is the best transparent, responsible and accountable systems for water use and management need to be established and used across the system?
Population demographics	◗ Increased demand for food and fibre - opportunity for the sector to contribute to meeting demand. ◗ Structural change (new irrigators and larger irrigators) as current generation retires and farms not necessarily passed onto children. Challenges in attracting labour.	◗ How can production be increased profitably and sustainably? ◗ How to build best practice capabilities of new irrigators? ◗ How can labour inputs be minimised?
Irrigation investment	◗ Large irrigation modernisation investment by Commonwealth provides opportunities to re-capitalise irrigation systems and on-farm irrigation for industry and environmental benefit. ◗ Investment across Australia, majority focused on MDB.	◗ How to meet the immediate demand for R&D knowledge from: – Government – to inform policy and investment; – Water utilities and private sector – to design modernisation of irrigation systems; and – Irrigators – capture benefit of own or supported recapitalisation of on-farm irrigation.
Poor Reputation	◗ Poor reputation of irrigation sector by government and community limits support and participation.	◗ How does irrigation position and demonstrate itself as a sustainable and responsible industry with a role to play in meeting future food demands.

Table 5: RD&E Drivers

Driver	Impact	Irrigation RD&E Implications
Fragmentation and cross-sectoral R&D	◗ There are many irrigation RD&E stakeholders. There is no framework which sets the vision and strategic direction for irrigation RD&E and integrates all the stakeholders into coordinated and sustained investment and delivery of RD&E. ◗ Greater emphasis on cross sectoral RD&E in response to the importance of significant issues (e.g. climate change and water) and the need to coordinate/collaborate to avoid duplication and maximise benefit. Irrigation RD&E is part of cross-sectoral initiatives, for example: – Climate Change Research Strategy for Primary Industries (Phase 2) – National Program for Sustainable Irrigation (Phase 2) – CRC for Irrigation Futures (ends 2010) ◗ RD&E capability is managed by individual organisations/initiatives rather than for whole irrigation RD&E. The cross cutting RD&E agenda relies on existing RD&E capability and funds, creating pressure on existing resources.	◗ What is the vision for the irrigation sector and its RD&E? ◗ What is the best framework to manage irrigation RD&E, which: – Establishes vision and strategic priorities? – Attracts and focuses investment on priorities? – Delivers RD&E to achieve priorities and vision? – Builds and sustains the required capability? – Demonstrates impact for accountability and improvement?
Rural R&D policy reviews	Relevant policy frameworks include: ◗ COAG Working Group on Climate Change and Water – Developing National Water Knowledge and Research Strategy to support the water reform agenda.	

Table 6: RD&E Drivers (continued)

Driver	Impact	Irrigation RD&E Implications
Rural R&D policy reviews (continued)	◗ National Framework for Primary Industries RD&E. Seeks to align with and leverage off efforts which include: – Creation of national capability in priority areas (National R, regional D and local E) – Shared strategic directions and priorities for national and sector level primary industries, particularly for key areas including climate change adaptation and NRM management – Public research capability integrated, interdependent, specialised, larger critical mass. – Seeking to improve governance, management arrangements and reduce duplication due to increasing pressure for economic and policy rationale for investment in RD&E. – Better M&E to improve accountability ◗ Rural R&D Council Investment Plan – Develop a National Strategic Rural R&D Investment Plan based on an agreed list of national priorities – Establish a performance measurement and reporting framework against national priorities – Advice on enhancing cross-sectoral/disciplinary/jurisdictional and international cooperation and collaboration – Provide advice on improving communication and uptake of new knowledge and technology across all rural industries and at all scales of enterprises – Foster innovation as integral to the culture of rural communities and industries – Foster the building of capacity of the rural R&D sector to ensure that Australia is prepared for challenges ◗ Productivity Commission Review of Rural Research and Development Corporations – Rationale for Commonwealth Government investment in rural research and development – Appropriateness of current funding levels and arrangements – Appropriateness of balance between industry-specific and broader community benefits – Effectiveness in enhancing the competitiveness and productivity of Australia's rural industries – Scope for improvements - and any alternative models that could deliver better outcomes.	◗ What is the best position and associated challenges and opportunities for irrigation RD&E in the current policy reviews?

3. Strategy and Investment Findings

This section identifies the key RD&E stakeholders, how irrigation RD&E strategies and investments occur, and potential improvements.

3.1 Who are the Irrigation RD&E Stakeholders?

The irrigation sector and associated RD&E operates in a fragmented, dynamic and complex institutional environment because it covers multiple jurisdictions, regions and commodities. This creates challenges arising from competition for funds, lack of a cohesive vision, institutional complexity, capability management and demonstrating triple bottom line performance.

The range of key stakeholders in irrigation RD&E is diverse given that irrigation is cross sectoral. Stakeholders can be described as investors, providers and users of irrigation RD&E, and many institutions have multiple roles in investment, provision and use of RD&E. This is captured in the table below.

Table 7: Irrigation RD&E Stakeholders

Investors	Providers	Users
◗ Policy level – AG agencies, State level agencies (e.g. DAFF, state primary industry and natural resource management departments, DIISR, MDBA, NWC) ◗ System level – Water authorities, water supply companies/agencies, regional NRM bodies ◗ Farm level – RDCs, state primary industry departments, Irrigation companies and agribusiness ◗ Peak industry bodies	◗ Universities ◗ State Departments of primary industries, natural resources and water ◗ CSIRO ◗ Private researchers (including private companies) ◗ Private consultants, agronomists ◗ National research facilities (e.g. National Climate Change Research Facility) ◗ CRCs ◗ ACIAR	◗ Irrigators across Australia ◗ Peak industry bodies (IAL, state based bodies i.e. NSW Irrigators Council) ◗ Water suppliers/water companies ◗ Private companies, agribusiness ◗ Rural water supply authorities ◗ Private consultants, agronomists ◗ Commonwealth and state/territory governments

3.2 Irrigation Industry Outcomes and RD&E Priorities

There is no formal and agreed vision, outcomes and associated priorities for the irrigation and RD&E. In a general sense the broad industry and RD&E goal is to improve the profitability, competitiveness and sustainability of the irrigation industry. Nine industry outcomes and 10 RD&E priorities which can contribute to this have been identified through a review of industry and RD&E plans and stakeholder consultation (Table 8).

Table 8: Industry Outcomes and RD&E Priorities

Goal	Profitable, competitive and sustainable irrigation industry		
Scale	On-farm irrigation	Off farm irrigation systems	Industry value chain
Industry Outcomes	1. Effective, profitable business systems 2. Productivity gains 3. Water use efficiency 4. Sustainability improvements 5. Climate change adaptation 6. Recapitalisation to improve sustainability of irrigation infrastructure 7. Improved capability and skills of our people		8. Improved industry reputation and value 9. Coordinated industry and RD&E leadership and capability
RD&E Priorities	1. Plant varieties and biotechnology 2. Agronomic practices 3. Irrigation technology and practices 4. Whole farm planning and management	5. Infrastructure modernisation 6. Catchment/water planning and management 7. Enhance ecosystem services	8. Demonstrate sustainability and value of irrigation industry 9. Agreed RD&E framework linked to national system, incorporating M&E and adaptive management 10. Effective and coordinated industry leadership

The industry outcomes and RD&E priorities operate across three linked scales;

- **On farm** – focuses on irrigation within a farm enterprise
- **Off farm irrigation systems** – focuses on the irrigation schemes and river systems which provide water to irrigation farms; and
- **Industry value chain** – encompasses the upstream value chain, dependent communities, and the industry and RD&E institutional landscape.

The same industry outcomes have been used at the on and off-farm scales, because while the RD&E, actions and responsible parties may vary, the headline outcomes are the same. The rationales behind the outcomes are explained below:

- **Effective business systems** – key decisions on adoption of R&D and optimisation are made at a business level which R&D needs to feed into. Enterprise level decision making is also an area of R&D and essential for effective extension.
- **Productivity gains** – essential to profitability and competitiveness.
- **Water use efficiency** – a key component of productivity and also priority given water scarcity.
- **Sustainability improvements** – encompasses ecosystem services, pollution management, welfare, food and fibre safety and associated efficiency dividends.
- **Climate change adaptation** – advanced risk management to improve resilience.
- **Recapitalisation** to improve sustainability of irrigation infrastructure – there is an immediate demand for RD&E knowledge to inform government and industry modernisation investment. Capital constraints may also limit on-farm adoption.
- **Improved industry reputation and value** – essential to secure on-going community and government support and labour market participation.
- Coordinated industry and RD&E **leadership and capability** – required to ensure industry focuses on priorities and sustains the required capability.

The on and off-farm scale RD&E priorities are based on areas of research, most of which potentially contribute to more than one industry outcome. The industry value chain RD&E priorities focus on demonstrating value and effective industry leadership. Research is needed to establish the framework to demonstrate industry and RD&E value. After which focus needs to shift towards on-going monitoring and communication of the value provided. Similarly, establishing an agreed irrigation RD&E framework and ensuring effective industry leadership is more of an institutional design than a RD&E priority.

Industry Outcomes

When the industry outcomes are compared against the major investors (Table 9 overleaf) it is apparent that on-farm irrigation outcomes are of higher importance to the industry and government. The lower rating for grains and rice are due to specific industry factors. For grains irrigation is secondary issue because it only represents are small proportion of the industry. For rice the emphasis on productivity gains and water use efficiency stems from the contraction in RD&E funds resulting from the drought.

The lower rating for on-farm outcomes by irrigation companies reflects that their core business focuses on the off-farm irrigation system, where the ratings are higher. The lower rating for irrigation companies on the climate change adaptation outcome is based on their publically available strategies and seems anomalous.

Table 9: Irrigation Industry Outcomes by Investor[3]

Scale	On-farm						Irrigation system (off-farm)						Value chain	
Institution	Effective business systems	Productivity gains	Water use efficiencies	Sustainability improvements	Climate change adaptation	Recapitalisation to improve infra. sustainability	Effective business systems	Productivity gains	Water use efficiencies	Sustainability improvements	Climate change adaptation	Recapitalisation to improve infra. sustainability	Improved industry value and reputation	Coordinated industry & RD&E l'ship & capability
Irr. Companies	M	M	M	M	L	M	H	H	H	H	L	H	M	L
Commonwealth	L	H	H	H	H	M	L	M	H	H	H	H	M	H
State Depts.	L	H	H	H	H	M	L	L	M	M	H	H	M	M
Horticulture	L	H	H	H	M	?	L	L	L	L	L	L	H	H
Dairy	H	H	H	H	H	H	L	L	L	L	M	L	H	L
Cotton	H	H	H	H	H	H	M	M	M	M	M	M	H	H
Grains	L	M	M	L	M	L	L	L	L	L	L	L	H	M
Rice	L	H	H	M	M	?	L	L	L	L	L	L	H	L
IAL	H	M	H	H	L	M	H	M	H	H	L	M	H	H
NPSI	H	H	H	H	H	H	M	M	H	H	M	H	M	H
CRC IF	H	H	H	M	L	M	M	M	H	M	L	M	L	M
CSIRO	M	H	H	H	H	H	M	H	H	H	H	H	M	H

[3] The ratings are based the consultation and strategic plans available from investor web sites. The ratings aim to show the relative importance of irrigation industry outcomes for each investor type and between each investor types. Industry ratings are based on the rural RDC strategic plans. Commonwealth ratings are based on DEWHA, DAFF priorities. State departments are based on the respective Departments of Primary Industries. Irrigation companies are the organisations who manage irrigation systems. CSIRO based on the Sustainable Agriculture and Water for a Healthy Country Flagships.

Demonstrating the value and improving reputation is more important for industry. However the importance of coordinated industry and RD&E leadership and capability is more distributed. This reflects the degree of self sufficiency and that investors are organised according along industry and jurisdictional rather than irrigation lines.

RD&E Priorities

On-farm irrigation RD&E is more important to industry, state government, CSIRO, NPSI and the CRC IF (Table 10 overleaf). Rice focuses on plant varieties due to resource constraints, while the lower importance for grains is due the small proportion of grain that is irrigated. The lower emphasis on whole farm planning is because much RD&E focuses on components of the system. Whole farm is increasing in significance since it is a key factor influencing adoption of practice and technology which has been specifically identified by dairy and cotton.

Investors responsible for water/catchment planning and management have a greater emphasis on irrigation system RD&E priorities than industries, with government and irrigation companies having a particular emphasis on irrigation modernisation.

Demonstrating the value and sustainability of the irrigation industry is of moderate importance to all investors. This reflects the greater emphasis placed on RD&E rather than monitoring and reporting on the irrigation industry by most investors. Investors recognise the need for an agreed irrigation RD&E framework, apart from rice (resource constraints) and grains (small proportion of whole grain industry).

Effective and coordinated industry leadership is most important to industry and NPSI, CRCIF and CSIRO who have a sectoral leadership role. It is relatively less important for government, since leadership needs to be industry led, with government support.

3.3 Irrigation RD&E Investment

Investment in irrigation RD&E is distributed across the stakeholders in Table 9 above and is generally not reported as a discrete investment unless it is an irrigation specific entity or initiative. Appendix D summarises stakeholders' RD&E investments and irrigation RD&E investment where it is reported. The key trends in comparing the historical and future focus of investment are:

- Increased focus on irrigation system infrastructure, water use efficiency, productivity and improving industry value and reputation; and
- Lower emphasis on sustainability improvements.

Table 10: Irrigation RD&E Priorities by Investor[4]

Scale	On-farm				Irrigation system (off-farm)			Value Chain		
Institution	Plant varieties & biotechnology	Agronomic practices	Irrigation technology & practice	Whole farm planning & management	Infrastructure modernisation	Catchmen/water planning & management	Enhance ecosystem services	Demonstrate industry value & sustainability	Agreed irrigation RD&E framework linked to national system	Effective and coordinated irrigation industry leadership
Irr. Companies	L	L	H	M	H	H	H	M	M	L
Commonwealth	L	L	M	L	H	H	H	M	H	M
State Depts.	H	H	H	M	M	H	H	M	H	M
Horticulture	H	H	H	M	L	L	H	M	H	H
Dairy	M	H	H	H	M	M	H	M	H	M
Cotton	H	H	H	H	H	H	H	M	H	H
Grains	M	L	L	L	L	L	L	M	L	M
Rice	H	L	L	L	L	L	L	M	L	M
IAL	L	L	H	L	H	H	H	M	H	H
NPSI	L	H	H	M	M	M	H	M	H	H
CRC IF	L	M	H	H	H	H	H	M	H	H
CSIRO	H	H	H	M	M	H	H	M	H	H

[4] The ratings are based the consultation and strategic plans available from investor web sites. The ratings aim to show the relative importance of irrigation industry outcomes for each investor type and between each investor types. Industry ratings are based on the rural RDC strategic plans. Commonwealth ratings are based on DEWHA and DAFF strategic plans/initiatives. State departments are based on the respective Departments of Primary Industries. Irrigation companies are the organisations who manage irrigation systems. CSIRO based on the Sustainable Agriculture and Water for a Healthy Country Flagships.

3.4 Irrigation RD&E Strategy and Investment Coordination

3.4.1 Current Situation

Irrigation RD&E is mostly embedded in a wide range of industry, jurisdictional, national and rural and water sector strategy and investment processes, including:

- Rural RDCs – develop strategic plans in consultation with industry, government and RD&E organisations for the investment of combined industry levy and Australian government funds for specific commodities. RIRDC and the now defunct Land and Water Australia develop strategic plans with a whole of rural sector focus. Irrigation RD&E is embedded within the strategic plans and can include specific initiatives focused on water/irrigation (such as the Horticulture Water Initiative).
- Irrigation companies - undertake investment in RD&E, often overseen by specific RD&E programs, committees or regional councils. Funding is sourced through levies from members/landholders and urban ratepayers (Murrumbidgee Irrigation); (Harvey Water), e.g. MI - R&D committee. Some organisations provide strategic direction setting for regions and are farmer based, non-profit arrangements. Levy payments are leveraged to obtain additional research support from others including RDCs, state and federal government.
- Irrigation RD&E Initiatives – Investors and providers identify common needs and form an alliance/partnerships to implement projects, programs or centres. Examples include Northern Australia project, NPSI and the CRC IF.
- State Government – collectively are the largest investor in rural RD&E. They also invest in irrigation RD&E through their water agencies. Priorities are established through state wide agriculture and water policies/strategies and the strategies of individual departments.
- Australian Government – is a key investor through DAFF's contribution to the RDCs, CRCs, specific initiatives (e.g. Caring for our Country and previously NHT), and portfolio agencies (e.g. National Water Commission, MDBA, BOM, DEWHA).
- CSIRO – have two flagships which include irrigation RD&E, Sustainable Agriculture and Water for a Healthy Country, involving Land and Water, Plant Industries and Sustainable Ecosystems divisions. CSIRO is both a provider and investor, working with RDCs, government, industry and universities.
- National RD&E Coordination – there are also a range of initiatives and reviews underway aimed at improving rural and water RD&E, including:
  - National Innovation Strategy – sets strategic directions for innovation in all sectors across Australia.
  - National Primary Industries RD&E Framework – operates under the Primary Industry Standing Committee. Currently developing 10 commodity and 8 cross sectoral strategies, including Water Use in Agriculture.
  - Council of RDCs – aims to improve coordination and collaboration between RDCs

- National Water Knowledge and Research Strategy – COAG Working Group on Climate Change and Water developing strategy to support water reform
- Productivity Review of RDCs – looking a rationale for Commonwealth investment, funding levels, portfolio balance and improvements to RDC model
- Council of Rural R&D – developing national R&D investment plan.

The wide range of processes creates challenges in both defining and coordinating irrigation RD&E. The largest challenge is the lack of a national framework which engages the key stakeholders to establish agreed irrigation RD&E priorities and coordinate focused investment. NPSI and the CRC IF have partially fulfilled this role over the past ten years, although largely limited to the stakeholders who invested in them. The CRC IF ends in the middle of 2010.

3.4.2 Potential Improvements

The project and previous consultation with government and industry identified that there is in-principle agreement that a national framework is needed to improve irrigation RD&E strategy and investment, which

- Engages and commits key stakeholders;
- Establishes agreed priorities and focuses coordinated investment which balances time horizons, uncertainty, value chain beneficiaries and emergent innovations;
- Integrates with other RD&E frameworks;
- Avoids duplication and is efficient, effective and flexible; and
- Builds and sustains the required RD&E capability.

The consultation identified a range of issues, considerations and ideas which inform the design of the national irrigation RD&E framework which are outlined below.

Vision

A vision is needed for both the irrigation industry and irrigation RD&E. The visions are not regarded as contentious, but they need to be articulated and agreed. Draft visions for both are suggested below.

Irrigation Industry Vision

Australia's irrigation industry is not facing a business as usual scenario. Global population growth will increase the demand for irrigated food and fibre. At the same water and labour scarcity, competitive market pressures and the need to sustain its natural resources will continue to drive structural change in the composition and distribution of the industry.

The Australian irrigation industry will meet the demand for its food and fibre and address these challenges by increasing its productivity and sustaining its human and natural capital. By 2020 we will be the recognised global leader in profitable, competitive and sustainable irrigation, contributing to regional, national and global well-being.

Irrigation RD&E Vision

RD&E will substantially contribute to Australia becoming the global leader in profitable, competitive and sustainable irrigation. Industry, government and the research community will work collaboratively to focus on key on and off farm priorities to deliver RD&E that improves productivity, water use efficiency and environmental sustainability, climate change adaptation and irrigation modernisation.

Who has input into strategy and investment?

Everyone agreed that the investors and users of RD&E need to be involved in strategy and investment to ensure it focuses on need, priorities and delivers the required benefit. A significant proportion agreed that RD&E providers should be involved since they have detailed knowledge and what RD&E can deliver and relationships with users. Users were identified as irrigators (farm level), irrigation system managers, government and consultants/service providers.

Focus of strategy and investment

The key difference between strategy and investment is that the former is about identifying what needs and could be done to deliver on industry outcomes, while the latter is about allocating the available resources to achieve them.

A strategy needs to determine priority setting needs to be done over three horizons (e.g. short to long term; applied to blue sky etc) and involve all key stakeholders (investors, users and providers). It should be a guide to:

- Determine what needs to be achieved over ten years to deliver on industry outcomes;
- Attract and coordinate investment; and
- Monitor progress.

Investment should allocate available funds and resources towards the strategic priorities within funding cycles. Investors, users and providers who are involved in specific area of investment need to be part of the decision making process.

Investment

The quantity, continuity, coordination of investment were the most important issues identified. The quantity and continuity of investment are linked. The diversity of investors, discipline of funding cycles, long-term nature of RD&E and lack of an agreed strategic plan create challenges in maintaining RD&E in priority areas and sustaining capability. The lack of a strategic plan limits the ability to understand if investment is sufficient. Similarly irrigation RD&E investment is a mixture of funds and capability distributed amongst a range of organisations, making it difficult to coordinate and allocate investment to strategic priorities.

Governance

Stakeholders agree that better governance is needed at national and regional levels to improve irrigation RD&E. A national approach is needed to establish strategic priorities and coordinate investment. This requires a specific national entity with the mandate to:

- Establishing a collaborative approach to develop shared priorities and attract/coordinate investment accordingly; and
- Pooling funds to reinforce the collaborative approach and invest in strategic priorities and capabilities.

An additional option is to expand the mandate to a "National Irrigation RD&E Institute" who leads the collaborative approach, manages pooled funds and undertakes RD&E.

Better regional governance is also needed to guide strategy, investment and delivery of RD&E. Stakeholders felt that a flexible rather than a uniform approach is needed to ensure regional governance suits the specific stakeholders and needs.

4. Sourcing and Commissioning Findings

This section describes how sourcing and commissioning criteria shape RD&E provider responses and contribute to effective and efficient capability development.

4.1 Who are the irrigation providers and what are their priorities and focus (types of research)?

Traditionally, key providers have been CSIRO, Universities, DPIs, CRCs and the private sector consultants. Others have included irrigation companies who partner with key providers on projects.

State departments have tried to foster strong government and community partnership in regional program delivery, e.g. in Victoria, such as partnership arrangement facilitates community ownership of land and water management plans and their outcomes, and, through cost-sharing arrangements, community investment in agreed works. The programs also have implementation partners to develop coordinate and implement regional programs (e.g. including CMAs and implementation committees, other government departments, rural water authorities and irrigators).

Within irrigation RD&E, NPSI and the CRC IF focused on providing RD&E through commissioning and managing research in irrigation RD&E and undertaking knowledge management. The CRC IF also undertook RD&E. Essentially CRCs are created to coordinate and deliver collaborative RD&E from pre-agreed programs using the investments drawn from others (and the in-kind from participants), plus any new external investment.

4.1.1 Consultation results

Interviewees were asked about who they considered to be the most important RD&E providers for irrigation. Overall, the view was that there is a role for traditional providers in future RD&E efforts but the mix and focus will vary and is unclear.

Most respondents cited DPIs, CSIRO and universities as the most important providers. RDCs, overseas and private industry providers were also mentioned. Specific comments regarding the role and capacity of these providers were:

- CSIRO: have traditionally performed well, and are generally aligned with industry needs however some interviewees were uncertain on their future role.
- State departments – interviewees noted that there has been a decline in commitment and leverage from state departments, although they continue play a significant role.
- Private companies – contribution increasing. Problems are that they don't share outcomes widely. Have different drivers for RD&E, therefore may not be aligned with broad industry needs.
- Universities – are general technically sound. However they are not always not well connected with industry's RD&E priorities.

Comments regarding future role of providers included:

- It is important that providers have a degree of neutrality, independence and objectivity;
- Providers should be selected on merit;
- Good evaluation needs to accompany RD&E provision;
- Need close relationship between providers and industry (which will improve goal alignment which is currently poor). This is currently done well by RDCs however irrigation/water needs to be a core priority;
- Need provider who can blend science with practice; and
- It is the people not the organisation that matters.

4.2 How do investors and providers source and commission irrigation RD&E?

The two approaches to sourcing and commissioning are enduring partnerships and competitive bidding, with most investors using a mixture of both.

Competitive bidding fosters innovation and provides investors with a flexible and cost-effective approach to sourcing and commission RD&E. The weakness of competitive bidding is the cost to providers and the risk that capability is not available or sustained for industry benefit. Enduring partnerships distribute sourcing and commissioning costs more equitably between investors and providers and allow them to focus on delivering to agreed priorities. The weakness of enduring partnerships is reduced flexibility, partnership costs and sustaining existing providers at the expense of new entrants.

Irrespective of which approach is used, stakeholders identified sourcing and commissioning as a critical part of ensuring that RD&E is focused on industry outcomes and RD&E priorities and adaptive management.

4.3 Do providers have the required capability?

Organisations who commission RD&E individually tend to select and prioritise investment using a decision framework that considers key criteria such as alignment with investment priorities, expected outcomes, value for money and whether there is capability to undertake the work. Consequently providers have the capability when the work is contracted.

There have been changes in the distribution of capability amongst providers. State government agencies hold research and technical capability in the areas of natural resource management and agricultural productivity. Their capability in extension has reduced over time. As a result, extension lacks a governance, and perhaps more critically, an intelligence gathering and delivery focussing framework following departure of state government primary industry lead in this space. Also, state government RD&E capability and infrastructure has remained largely unchanged for

some time, and aging facilities have not kept pace with the changing nature and needs of industry.

RD&E providers face continued pressure in building and maintaining capability, which is a key focus of current national reviews. Key issues include:

- Improving the continuity of funding
- Increasing and diversifying the source of funding, including the private sector
- Facilitating specialisation and resource and knowledge sharing; and
- Building the capacity and career paths to retain staff

State governments are currently reviewing institutional arrangements and capability within RD&E, and looking at ways to better organise and coordinate activity and drive new partnerships. Currently, RD&E facilities in many of the jurisdictions are highly dispersed (e.g. in QLD at over 50 sites), which is limiting their capacity in developing effective RD&E centres. They are focusing on establishing a small number of collaborative centres of excellence, strategically located, re-aligning science investments with these. This will include collaboration with universities, CSIRO and other RD&E providers in the form of strategic alliances, joint investments, formal collaborative agreements and co-location of staff and facilities.

4.3.1 Consultation results

The consultation explored whether investors and providers have required capability to undertake RD&E. The majority of responses (62%) indicated that existing capability is inadequate, and a result of reduced funding for RD&E (due to drought and reduced production) and the atrophying of public RD&E which has led to a reduction in funding, technical staff and also scientific standards for research (particularly that conducted by state departments). This, along with the poor perception of the sector and primary industries, means that there are significant challenges associated with succession planning to meet future RD&E capability needs. Respondents commented that it would take considerable effort and time to bring capability back to an adequate level.

Extension was considered to be a particular area lacking in capability, and RD&E outcomes are reaching sub critical mass as a result. One respondent noted that extension was being carried out by inappropriate agents (e.g. consultants). Given the reduced role of public agencies in extension, future capability in extension will need to be sourced elsewhere, in which case it is highly likely that consultants or other specialised providers will need to be developed, supported and funded whether of not this is undertaken by a socialised (industry or government) funding program.

One respondent also noted that there was insufficient RD&E in the areas of hydrogeology and plant/water physiology.

A small portion (15%) felt unsure as to whether existing capability was adequate, and a similar proportion (15%) felt that capability was adequate, but that investment and coordination of capability meant that it was not being used effectively.

Current capability can be improved to better meet future RD&E needs by:

- Ensuring there is an enduring investment pool
- Improving connections and coordination between specialist clusters
- Broadening scope for pool of capability that is used e.g. looking internationally and for technology sharing opportunities.
- Establishing and communicating RD&E needs to providers, creating opportunity for them to organise existing capability, and develop capability to meet demand.

In considering how coordination between investors and providers can be improved, the sector needs to how consider the state of current relationships and engagement between these stakeholder groups. The majority of interviewees feel that engagement with investors and collaboration between them is sub-optimal. It is patchy due to competition, funding cycles and different goals and incentives. This has created some confusion around roles and responsibilities within investors and providers, for example, CSIRO has assumed an administrative role, there is confusion within academic institutions regarding their role in RD&E versus education and state government departments have reduced contribution overall. Despite their reduced capacity and involvement, state government departments are considered (by some respondents) to be effective and cooperative in sourcing and commissioning RD&E, and work well with industry and investors. CSIRO are considered to be less so.

Within some industries and regional centres (e.g. in WA), collaboration is effective and key players are connected due to the small size of the community.

Facilitating improved coordination requires clarity and alignment of goals and vision. Interviewees feel that this lacking in the existing system, specifically with regard to lack of alignment between provider incentives and industry goals. Effort needs to be made to engage and focus providers on required outcomes with appropriate accountability and incentives (demand not supply driven).

Currently, a funding model that fosters competition is not an effective model for all investment areas (particularly for critical issues of national significance and areas where there is significant lack in capability and expertise) and a more collaborative approach is needed.

A collaborative approach will takes significant time and effort and needs to ensure that there is a focus on delivering on industry outcomes, which needs to be demonstrated. Interviewees commented that there needs to be industry support for providers.

5. Delivery Findings

This section describes how services are developed, delivered and distributed.

5.1 Who are the target audiences?

- Irrigators, industry bodies, regional NRM, public and private sector advisors, other researchers, policy makers and water suppliers.

5.2 How is irrigation RD&E provided to the target audiences?

Delivery of R&D and innovation is complex, non-linear and not the responsibility of one organisation. The fragmented nature of irrigation RD&E means that it is delivered through existing industry and provider and/or investment program frameworks. For example the cotton industry has an extension framework through which R&D is delivered to the irrigators, which draws in part off NSW and Queensland's own water/irrigation extension frameworks. Both NPSI and the CRCIF have their own frameworks for communicating and extending the collective findings of their R&D.

The range of best practices used to deliver R&D include:

- Participatory action research – where researchers work directly with a group of irrigators, including demonstration sites
- Publishing R&D – electronic and hard-copy reports, factsheets, guides, newsletters, portals, media campaigns
- R&D communication – field days, meetings, seminars etc
- Adult education – group activities to deliver either self directed or structured learning
- Direct advice – provided for free or fee for service.

Coordination of RD&E delivery also occurs to an extent within the sector, for example, through cooperation between researchers, irrigation companies and collaborative farmers through regional research stations, existing demonstration sites, as well as extension committees in some industries (e.g. in the rice industry). Irrigation companies aim to coordinate RD&E delivery through linkages between different researchers, landholders, industry and the community generally, both intra and inter valley. A further example of RD&E delivery is the Horticulture Water Initiative Water Steering Committee.

There is a need within the irrigation sector, and indeed RD&E within other industries, to identify more effective models for extension, and ensure extension is considered in planning and resourcing of RD&E programs. There are current examples of effective extension programs; e.g. GWRDC Innovators Network.

As part of the National Framework for Primary Industries RD&E, national strategies propose to have communications, development and extension programs to coordinate regional D and local E. It is proposed that these be positioned and directed under

existing industry-agency consultative forums; and that they will use regional network of consultative industry-agency committees in delivery. This arrangement will work to:

- Identify needs and align appropriate CD&E delivery methods in consultation with industry and extension agencies.
- Develop and promote quality controls and minimum delivery standards, based on accountable and consistent monitoring and evaluation of program outcomes, and
- Broker delivery arrangements in each state through government agencies, Research and Development Corporations, and other organisations and individuals, including efforts to build private capability where appropriate.

6. Industry Use Findings

This section discusses how the industry uses RD&E and the anticipated benefits.

6.1 Who are the users of irrigation RD&E and what are their future needs?

The primary users of irrigation RD&E are industry and government. Industry users include irrigators, irrigation companies and peak industry bodies. The latter two require R&D knowledge to improve on-farm and irrigation system management to improve their sustainability, competitiveness and profitability. Government and peak industry bodies need R&D to inform policy development. Government, particularly at the state and regional level also needs applied R&D to design and implement programs and provide extension services.

The primary need identified through the interviews was how to produce more with less while sustaining the environment.

6.2 Are users adopting RD&E? (How are they using it?)

There is little information on whether R&D is being used (adopted) at the irrigation sector level. Rather the information, where it is available, is distributed amongst the various stakeholders in various forms.

6.2.1 Consultation results

Most interviewees felt that users are adopting irrigation RD&E, though the degree to which this is occurring is quite patchy. There were divergent views on the impact of drought on adoption. Some felt that within industry, the drought has meant that broadly, adoption has declined. This is not the case in all situations though, for examples, dairy farmers on the Murray have adopted a range of water use efficiency practices in response to the drought.

Typically, adoption and use is occurring

- Where products are well targeted and meet industry needs:
- Where barriers to adoption are low;
- In small centres of concentrated industry activity e.g. in northern Australia and the cotton and rice industries. Engagement and participation in field days are well attended in these areas/industries.

An observation (from two respondents) was that extension is underdone in RD&E within the sector and this is impacting on adoption rates.

Issues and limitations regarding adoption and use that were identified were:

- That innovation is occurring within the private sector however linkages to public sector RD&E are poor;

- There is not enough ownership of RD&E results within industry to foster adoption.

Interviewees consider that governments are using RD&E (e.g. as part of evidence-based policy), but the product to them is poor.

Improving adoption and use of irrigation RD&E needs to happen but is challenging as barriers and drivers for adoption can be cultural. The key suggestions and issues to address are as follows (and were identified by a number of respondents):

- Need to focus effort and resources on extension (adoption, incentives, removing barriers) rather than better RD&E. Developing effective approaches to extension needs to be built into RD&E programs from the start. There are two components to extension – provision of independent advice as well as change agent/marketer.
- Improve interactions and partnerships between industry and government and develop a joint vision/framework for extension to secure commitment. This will ensure barriers and drivers for industry use are understood and RD&E products are relevant. It requires support through continuity and certainty of funding. Respondents were of the view that industry needs to take leadership and responsibility for adoption.
- One respondent commented that current approaches to extension are too focussed on linear transfer – diffusion of innovation is messy.
- Regarding models for extension, a number of respondents commented that effective approaches are those that involve growers, particularly early adopters and industry champions; in the demonstration and delivery of results.

Appendix A

Analytical Framework

- **Drivers & insight** – how insight into future drivers of innovation shapes irrigation RD&E;
  - What are the key future challenges and opportunities for the irrigation industry?
    - What will the irrigation industry look like in 10-20 years time?
    - What is driving change in the irrigation industry?
  - Who are the key stakeholders in irrigation?
  - What are the key policy directions for irrigation/water policy and rural RDE?
- **Strategy & investment** – identifies strategic RD&E priorities as the basis of the vision and the mechanism through which investment is sourced and allocated;
  - What are the strategic priorities for irrigation RDE and what benefit will they create?
    - What is the current vision for the industry's RDE (and from the perspective of investors, users and RDE service providers)?
  - Who invests in irrigation RDE and what are their priorities and level of investment?
    - Historical and current priorities and investment?
    - What are the future trends for investors (resource availability, constraints)?
  - How are priorities and investment coordinated?
  - What are the gaps in irrigation RDE priorities, investment and coordination?
  - How can they be improved? (consider degree of flexibility in reallocating resources, opportunities for consolidation)
  - TEST – do investor priorities and investment align with irrigation industry drivers?
- **Sourcing and commissioning** irrigation RD&E services – how sourcing and commissioning criteria shape RD&E provider responses and contribute to effective and efficient capability development;
  - Who are the irrigation RDE providers and what are their priorities and focus (type of research)?
  - How do investors and providers source and commission irrigation RDE (individually and collaboratively)? Do they have the required capability?
  - TEST – How does investor investment and provider capability align with future RDE priorities?
- **Delivering** RD&E services – how services are developed, delivered and distributed; and
  - Who are the target audiences (e.g. regions, properties, organisations, policy makers etc)?
  - How is irrigation RDE provided to the target audiences (ie how does RDE facilitate adoption)?
  - TEST – does delivery align with RDE priorities and target audience needs?

- **Industry use** – how the industry uses RD&E and anticipated benefits.
  - Who are the users of irrigation RDE and what are their future needs?
  - Are users adopting RDE? (How are they using RDE?)
  - TEST – do user needs and adoption align with:
    - RDE priorities and benefits (outcomes)?
    - RDE investment and delivery?

Appendix B

Stakeholders Consulted

Organisation/ industry	Contact
PSC members	1. Chris Bennett IAL 2. Peter Toome, IAL 3. Bruce Pyke, CRDC 4. Peter Hayes, CRC for Irrigation Futures 5. Ian Atkinson, CRC for Irrigation Futures 6. Rob Houghton, NPSI
Cotton	7. Adam Kay, Cotton Australia
Grains	8. James Clarke (Chair of Nthn Panel, GRDC)
Rice	9. Ruth Wade (Executive Direction RGA) and Ian Mason (Chair of Rice RDC)
Sugar	10. Eric Danzi (CaneGrowers)
National Farmers Federation	11. Deb Kerr (NRM Manager, National Farmers Federation)
National Irrigators Council	12. Danny O'Brien (CEO, National Irrigators Council)
Tasmania Northern Australia Queensland WA	13. Chris Thompson (General Manager, Agricultural Resource Management) 14. Geoff Strickland (CEO Ord Irrigation) 15. Keith Bristow (CSIRO and CRC for Irrigation Futures) 16. Geoff Calder, CEO Harvey Water (and Chair of Bondi Group)

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Appendix D

RD&E Investment

Investment in irrigation: historical investments and investment trends going forward

Investor	Level of investment - historical	Level of investment – going forward
Commonwealth government	Average gross expenditure on R&D (for all sectors) from 96/97-06/07 was $1.5 billion pa (increased steadily over time from $1.3 billion to $1.9 billion).	Growth is foreshadowed but likely in targeted programs.
State government	Average gross expenditure on R&D (for all sectors) from 96/97-06/07 was $0.93 million pa (increased steadily over time from $0.8 million to $1.1 billion).	State agencies - key trends: ◗ Integration with universities (who attract funding that is not directly available to state governments) ◗ Increased reliance on Commonwealth to fund operating costs
CRC IF	From 2003-2008 – approx. $70-80M cash and in-kind	For 2009/10 ~$8m
NPIRD	Funded through LWA from 1992 – 2002. Investors included – LWA, industry bodies, CSIRO, state agencies. $4.2m (99-02) invested in partnership.	
NPSI	$18m in total through the two Phases (approx. $2.2m per annum). Investment spanned 2008-2010. Partners have included irrigators, water authorities, research agencies, State and Commonwealth Departments and commodity groups.	$2.2m 2009/2010 and $1.1m for 2010/2011
IAL	*Data gap*	*Data gap*
CSIRO		Water for a Healthy Country - $1 billion over 7 years to 2012.
RDCs: CRDC, RIRDC for rice, HAL, Dairy Australia, to a lesser extent SRDC (irrigation is a low priority)	◗ Dairy: Since 2003, DA has invested ~$52m pa in industry services and RD&E ◗ Cotton: approx. $11.2m pa invested in R&D over 2003-2008, allocated across Integrated NRM, (9% of funding), Farming Systems (18%), Breeding and Technology (17%) and People and Knowledge (15%). ◗ Grains: approx. $61.4m spent on water projects (includes projects covering WUE, soil water, drainage/waterlogging, physiology and varieties, irrigation and rotations). Total spent on 'irrigation' category was $5.8m. Expenditure on **extension** ~7.4% historically (total spent $56.2m). ◗ Rice: expenditure on all projects was $55.3m (1991-2002). This included $8.72m on 'Sustainable Development Program' which incl. irrigation techn and practices, ecosystem services, agricultural practices, whole farm planning and infrastructure). Expenditure on **extension** - historically 11-13% (was $8.3m for 1991-2002). ◗ Horticulture: ave investment in R&D from 2001-2007 of $56m (steady increase). From 2004-2007, ~10% in sust. ag. (declined) and ~15% frontier tech. ◗ Grape and Wine: have been a significant investor over the past 20 years	◗ Dairy: total budget $257m over 2010-2014 - 45% ($115.7m) into increasing productivity includes NRM, water, climate change. ◗ Cotton: strategic plan 2008-2013: investment allocation: 40% to value adding and markets; **20% to improving productivity and farming systems with environmental services** 20% to cultivating innovation and learning (incl. **extension**). CRDC 2009-10 investment in RD&E $10.2m (increase of 5%). ◗ Rice: $2-3m pa for R&D, going forward (revised strategic plan), allocated as follows: varietal & rice quality improvement (50%); Crop establishment, agronomy/crop physiology, nutrient management and precision agriculture (10%); Crop protection (10%); Farming systems for whole farm management, profit and sustainability (15%); **extension** (8%); human capital formation (7%). ◗ Horticulture: expected expenditure R&D for 2009/2010, $72.3m. HAL value of projects across R&D priorities – 5.72% ($4.2m) to 'Water'.

Investor	Level of investment - historical	Level of investment – going forward
Irrigation companies	*Data gap*	*Indication* - Harvey Water ~$100,000 for irrigation RD&E
Industry bodies	*Data gap*	Small in some industries such sugar
Universities	Average gross expenditure on R&D (for all sectors) from 96/97-06/07 was $3.5 billion pa (increased steadily over time from $2.3 billion to $5.4 billion).	*Data gap*

GHD

133 Castlereagh St Sydney NSW 2000

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T: 2 9239 7100 F: 2 9239 7199 E: sydmail@ghd.com.au

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