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Victorian Auditor-General's Office

Auditing in the Public Interest

The Hon. Robert Smith MLC
President
Legislative Council
Parliament House
Melbourne

The Hon. Jenny Lindell MP
Speaker
Legislative Assembly
Parliament House
Melbourne

Dear Presiding Officers

Under the provisions of section 16AB of the *Audit Act 1994*, I transmit my report on *Agricultural Research Investment, Monitoring and Review.*

Yours faithfully

DDR PEARSON
Auditor-General

27 February 2008

Foreword

In 2006, the agriculture industry contributed $7.2 billion to the State economy and in so doing it sustained many communities across regional Victoria. Now, national and global competitiveness, climate change and a decade-long drought are presenting unprecedented challenges to the future viability of the industry. Meeting these challenges and finding solutions will depend in large measure on the industry being supported by innovative, agile and strategic programs of agricultural research.

This audit sought to examine the Department of Primary Industries' (DPI) approach to setting agricultural research priorities, the effectiveness of the governance and management arrangements of the research program, and the program's alignment with State Government objectives.

Generally the audit findings were positive. DPI is progressively implementing changes to its approach to research funding allocation subsequent to the influential review by Professor Göran Roos, Principal Consultant, Intellectual Capital Services Ltd (ICS Ltd), London. Audit endorses DPI's new approach.

Nevertheless, in respect of the new research funding arrangements post Roos, the audit identified a number of difficulties and gaps requiring DPI's attention and action. Most importantly, DPI should increase flexibility in funds allocation so that the research profile can respond more rapidly to changed priorities. Long-term planning for research capability, the development of research partnerships between government and external providers, and participation in national research alliances are also critical to ensuring the future viability and continued relevance of state-funded agricultural research.

The audit also considered DPI's agricultural research reporting framework and its management of commercialisation and intellectual property. In relation to reporting, the key finding was that better systems and processes are required to establish the extent to which the investment in research projects and programs is effectively meeting the stated DPI outcomes and State Government objectives. With respect to intellectual property, DPI should demonstrate the social and economic benefits of investment in agricultural research, including non-commercialised as well as commercialised research.

DDR PEARSON
Auditor-General

27 February 2008

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1 Executive summary

1.1 Introduction

Agriculture is vital to Victoria's economy and regional communities. In 2006, it contributed $7.2 billion to the State's economy and accounted for approximately 20 per cent of regional employment. The agricultural sector is competitive and achieved strong productivity growth (averaging around 3 per cent per annum) over the 15 years to 2004.

The success and future growth of a sustainable agricultural industry is vital for the Victorian Government's goals of increasing exports, creating jobs and attracting people to regional Victoria. To succeed in an environment of local and global competition, the industry must be highly innovative. It undertakes a broad range of research to retain its national and global competitiveness.

The Department of Primary industries (DPI) plays an important role in agricultural research within the State. DPI leads the agricultural investment strategy for the Victorian Government, funds and undertakes research and commercialises and manages intellectual property. DPI also works with the Commonwealth and other State Governments with respect to the development of the research agenda and cooperative arrangements at the national level.

DPI is principally involved in applied research, developing existing technologies, and in 'strategic research' areas identified as having the potential for high growth and high public benefit.

The audit examined:

- how DPI prioritises its investment in agricultural research activities
- how DPI supports, monitors and reports on these research activities and their outcomes
- how DPI reports on the management and commercialisation of its intellectual property arising from agricultural research

1.2 Findings

Agricultural research investment

A fundamental goal for government is to ensure that public research funds are spent in ways that best deliver the desired community outcomes. The process for determining research priorities should assure the community that public funds will flow to the areas of greatest potential economic, social and environmental benefit.

Setting public research priorities is a difficult and complex task. There are several reasons for this: long planning horizons, the inherent unpredictability of research outcomes, the need to balance the interests of public, industry and private beneficiaries, the difficulty of predicting future research priorities and ensuring that the requisite research capability is available. Internationally, governments have adopted a number of different approaches to setting research priorities, from the purely *ad hoc* to more systematic approaches.

In 2007, DPI reviewed its agricultural research investment framework (the Roos review). Pre-Roos, the funding model was complex. Decisions about research priorities were guided by a principles framework rather than a framework of rigorous quantitative measures for setting priorities (e.g. the consistent use of cost-benefit analysis). The Pre-Roos approach was heavily reliant on the collective judgement of senior managers and on DPI's historical involvement in research areas. The scope for research providers inside DPI to influence funding allocation decisions was neither consistent nor transparent.

The Roos review sought to address these shortcomings in the framework and to improve the transparency, flexibility and accountability of allocation decisions. In response to the Roos review, DPI has revised its approach to setting research priorities. Audit supports DPI's new approach as it should enable:

- better alignment of research with government goals
- increased clarity, greater openness and an improved evidentiary base in decision making
- greater scrutiny of research proposals
- a stronger focus on planning.

However, the new approach has not addressed all the shortcomings of the pre-Roos arrangements. For example, under the new approach, DPI's ability to rapidly exploit new research opportunities and to respond to changing priorities is still limited, and there is scope to establish a more thoroughgoing purchaser-provider model.

For DPI to assure Parliament and the community that, under the new approach, funds will flow to the areas of greatest potential benefit, DPI needs to clearly articulate how the elements of the new approach will work as an integrated whole.

To complement the new allocation framework, DPI also needs to prepare a strategic plan for agricultural research capability in the State. The plan should have a long-term horizon, set out explicitly how future capability needs will be met, and align with relevant national plans.

Performance monitoring, reporting and evaluation

Elements of DPI's performance monitoring and evaluation framework for agricultural research are consistent with better practice. However, the specification of desired outcomes in the past has been too broad. It has been difficult for Parliament and stakeholders to establish the extent to which research projects and programs are effectively meeting the stated DPI outcomes and State Government goals.

Audit identified two key areas that will assist DPI to report more fully and accurately on the performance of the agricultural research investment program:

- better integration of agricultural research performance monitoring and evaluation with DPI and government outcome reporting
- improved data quality standards to ensure greater consistency in the performance data collected across DPI.

The consolidation of the various metadata systems across DPI is also advisable to support the delivery of a more integrated system of performance monitoring and reporting.

DPI's extensive reporting arrangements should be streamlined to improve its capacity to show that the management of agricultural research investment is strategic, transparent and accountable. The new reporting regime should provide a comprehensive assessment of research activity (including continued, merged and discontinued projects) and an overview of trends and developments in research.

Also, additional efforts to measure the social, economic and environmental benefits of DPI's agricultural research and extension activities are required in order to provide Parliament and the community with higher levels of assurance of the benefits of the Government's investment in agricultural research.

Intellectual property and commercialisation

Research and development findings, ideas and technology from the publicly funded agricultural research program need to be appropriately protected and commercialised for the public benefit. Appropriate management and commercialisation of research ensures that the community's interests are protected, adding value and contributing to a sustainable and competitive agricultural sector and viable regional and rural communities.

Audit found that DPI has managed intellectual property and the commercialisation processes competently and that the requisite policies, procedures and controls are in place.

Nonetheless, the benefits of non-commercialised research are not fully captured, and the governance and administrative arrangements for intellectual property management in DPI need strengthening. A high-level group should be established, to assist DPI to optimally manage commercialisation opportunities and non-commercialised applications of research, and to provide advice to the Secretary of DPI on trends, opportunities and innovative practice.

1.3 Recommendations

Part 4: Agricultural research investment

DPI should:

4.1 Build on recent changes to its agricultural research investment framework in order to maximise the benefits to Victoria from research activity. It should achieve this by:

- clarifying and communicating the nature and scope of its investment criteria and the method of funds allocation
- implementing a quantitative analytical approach to prioritising research, based on return on investment and other measures (e.g. cost-benefit analysis)
- demonstrating how the key investment principles and elements will be implemented to ensure achievement of the new directions (this will require the preparation of a formal risk framework, and should include consideration and removal of possible barriers)
- clarifying how the various prioritisation elements, approaches and criteria will work as part of an integrated whole
- embedding continuous improvement in the new approach
- undertaking a more extensive 'market validation' process of proposed projects and programs
- demonstrating how a satisfactorily high-level of farming community input into decision making will be sought and utilised.

4.2 Increase flexibility in the annual allocation of funds to enable the profile of funded research to adapt to emerging imperatives and the changing research potential of the respective areas of science.

4.3 Develop a strategic plan for agricultural research capability in the State and foster deeper and more extensive strategic partnerships with other research providers to optimise its research capability.

4.4 Within two years, report on the effectiveness of its new research investment approach. As a minimum, this should include:

- evidence of tangible benefits in the type, volume, cost, quality and return to the community of research investment
- the impact of the new approach on agricultural research capacity and capability.

Part 5: Performance monitoring, review and evaluation

DPI should:

5.1 Strengthen performance monitoring and evaluation of its agricultural research investment to demonstrate the benefits to the government and the community, the achievement of goals and the economic, social and environmental impacts of agricultural research investment. With a view to those imperatives, DPI should develop an evaluation framework which:

- measures the overall contribution of research to government goals, DPI outcomes, value for money and return on investment
- evaluates the allocation of research funds
- assesses the degree of adherence to its investment principles
- informs future priority setting
- tailors the evaluation methodology to different programs and institutions, while achieving consistency of approach and comparability of performance results.

5.2 Review its performance reporting system to enable the assessment of the contribution of research activity to the achievement of DPI and government priorities to be reliably measured, and to increase the transparency of reporting on research activity to stakeholders. DPI's performance reporting system should:

- provide Key Project level and aggregated data
- align project-level indicators and DPI indicators
- address identified reporting gaps, including programs discontinued and capability areas discontinued or merged.

5.3 Develop a standard reporting framework that minimises the duplication in reporting to multiple stakeholders at the Key Project and sub-project level, to reduce the administrative burden on internal stakeholders and expedite the availability of accurate, timely and consistent data.

5.4 Advance the business case for the consolidation of metadata systems across DPI, and investigate alternative customised systems in use in other jurisdictions. This will increase the transparency of reporting to stakeholders and increase the potential for lessons learned through research activity to be leveraged across the Department.

Part 6: Intellectual property and commercialisation

DPI should:

6.1 Communicate more fully the economic, social and environmental benefits of research, extension and commercialisation activities to Parliament and the community.

6.2 Embed a continuous improvement approach and demonstrate more fully the nature and impact of innovation in how DPI manages and commercialises intellectual property. A high-level group should be established to oversee existing practice and identify innovative opportunities to manage and commercialise DPI's intellectual property.

1.4 Consider points

Part 4: Agricultural research investment

DPI should:

4.5 Consider extending the agricultural investment strategy and investment principles to cover all research conducted by DPI on behalf of other State Government Departments and the private sector. This will help DPI develop a more integrated approach to agricultural research, make better use of its financial and human resources and achieve a closer alignment between the goals of the research divisions, the Department and the State Government.

4.6 Consider further developing its purchaser-provider model to place internal and external providers on a more equal footing. To support this, DPI could examine its portfolio of programs and locations to identify opportunities for deeper relationships between DPI units and other research providers, such as universities. To test the application of a more thoroughgoing purchaser-provider model, DPI should consider whether there is scope for a limited trial of such a model in one or more of its research locations or programs.

RESPONSE provided by the Secretary, Department of Primary Industries

The Department of Primary Industries (DPI) welcomes the Auditor-General's report on Agricultural Research Investment, Monitoring and Review.

Agriculture is a significant contributor to the State's economic wealth and social wellbeing. In addition, it is a significant employer in regional Victoria and an important steward of the natural environment.

Our agricultural industries, however, are experiencing a period of unprecedented change. Globalisation, water scarcity, expanding markets in Asia, increased international competition, climate change and variability, increased biosecurity incursions and volatile financial markets are creating an environment where our agriculture must continually innovate and adapt more quickly, efficiently and effectively.

RESPONSE provided by the Secretary, Department of Primary Industries - continued

The success of our agricultural industries has been largely as a result of their capacity to innovate to increase productivity and remain internationally competitive. A key driver of this innovation has been government supported research and development that has generated knowledge and technologies necessary for new products, higher productivity and increased resource use efficiency. Independent studies have shown agricultural research generates a 10 to 30 per cent internal rate of return.

DPI recognises that government supported R&D should focus on providing public good and addressing market failure. Economic growth is a primary objective, whilst ensuring sustainability of our national resource base.

As recognised in the Auditor-General's report, the setting of public research priorities is a complex task, requiring consideration of factors such as the long term horizons between research and the delivery of new products, balancing public, industry and private benefits, securing and retaining expert capability in a highly competitive global market, balancing economic and natural resource objectives, accurately attributing outputs of long term research to public outcomes, and the rapid development of new discoveries and technologies.

DPI believes in a continuous improvement approach to the investment, monitoring and reporting of its agricultural research. Over a decade ago, DPI became one of the first States to adopt a purchaser-provider model for its research. In recent times, it has been building its capability for evaluating the impact of its research and is now recognised by organisations such as Meat and Livestock Australia as a leader in this field. The Audit Office's report recognises that in early 2007, DPI extensively reviewed its science investment framework against international best practice and has subsequently begun to implement a new framework that will improve the strategic focus, transparency, evaluation and reporting of its agricultural research and development.

The recommendations in the audit report will support the further development and implementation of DPI's new Science Investment Framework. Many of the recommendations are already planned or under implementation. Some recommendations, such as 4.1 and 5.3, will require support and input from third party organisations, such as the Rural Research and Development Corporations, which significantly invest in DPI's R&D programs.

In conclusion, this audit has provided valuable input to DPI's science investment reforms, and I thank you and your staff for a constructive and challenging approach.

2 Introduction

2.1 Background

Agriculture is vital to Victoria's economy and regional communities. In 2006, it contributed $7.2 billion to the State's economy and accounted for approximately 20 per cent of regional employment. The agricultural sector is competitive and achieved strong productivity growth, averaging around 3 per cent per annum, over the 15 years to 2004.

The success and future growth of a sustainable agricultural industry is vital for the Victorian Government's goals of increasing exports, creating jobs and attracting people to regional Victoria. To succeed in an environment of local and global competition, the industry must be highly innovative. It undertakes a broad range of research to retain its national and global competitiveness.

The Department of Primary Industries (DPI) plays an important role in agricultural research within the State. DPI:

- leads the agricultural investment strategy for the Victorian Government – this determines the direction and nature of publicly funded research
- funds agricultural research
- performs research (both solely and in partnership with external bodies)
- develops research applications for the industry (extension activities)
- commercialises research and manages intellectual property
- works with the Commonwealth and other State Governments to develop the research agenda and cooperative arrangements at the national level.

2.2 Audit objectives

The audit examined:

- how DPI prioritises its investment in agricultural research activities
- how DPI supports, monitors and reports on these research activities and their outcomes
- how DPI reports on the management and commercialisation of its intellectual property arising from agricultural research.

The audit applied a three-part assessment framework which, together with the audit approach, is described in Appendix A.

2.3 Audit scope

The audit considered DPI's approach to agricultural research investment, performance monitoring and evaluation, continuous improvement and the management of intellectual property and commercialisation. The audit focused on the relevant operations of the following units and agencies:

- Agriculture Development Division
- Primary Industries Research Victoria
- Catchment and Agricultural Services Victoria
- Technology and Commercialisation Partnerships Unit
- Agriculture Victoria Services Pty Ltd
- Food Science Australia.

Fisheries research was outside the scope of the audit.

2.4 Audit method

The audit method included:

- a literature review on research investment prioritisation and evaluation methodologies
- interviews with staff from DPI and benchmark organisations
- a review of material from DPI and benchmark organisations
- detailed examination of DPI's approach to agricultural research investment.

3 Background

3.1 State Government goals for primary industries

The Department of Primary Industries (DPI) was established in 2002 as the Victorian Government's economic development agency for primary industries including agriculture, fisheries, timber, aquaculture and minerals.

The Victorian Government's goals with respect to primary industries and the rural sector, as stated in *Growing Victoria Together*, require DPI to contribute to:

- the efficient use of natural resources
- more jobs and thriving, innovative industries across Victoria
- protecting the environment for future generations
- building friendly, confident and safe communities.

DPI fulfils its role by managing and regulating the use of Victoria's natural resources, encouraging the sustainable development of primary industries, encouraging industries to adopt new technologies, and providing advice to rural communities on how best to anticipate and respond to change.

3.2 Agricultural research industry

Across Australia, agricultural research is funded and delivered by State and Territory Governments as well as by:

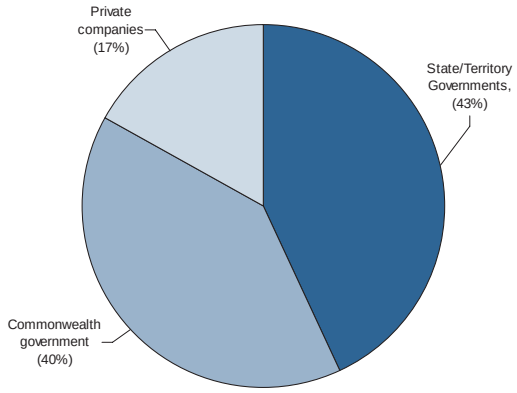
- 12 Rural Research and Development Corporations (RRDC) which are jointly funded by the Commonwealth Government and industry. In 2004-05, these RRDCs provided $474 million in funding to external organisations undertaking research and development.
- 22 Cooperative Research Centres (CRCs). CRCs were established in the 1990s to foster a greater level of collaboration between the public sector, universities and the private sector.
- The CSIRO. In 2005-06, the CSIRO spent 24 per cent ($240 million) of its total budget ($967 million) on agricultural research and related activities.[1] The CSIRO focuses on strategic, multi-disciplinary Research & Development (R&D), primarily related to issues of national relevance.
- Universities. Australia's universities have concentrated their agricultural research primarily on basic research.

[1] Productivity Commission Research Report, *Public Support for Science and Innovation*, 9 March 2007, pp. 428-462 and 466-468.

In their own agricultural research, State and Territory agencies have emphasised applied research and extension activities over basic research. Applied research includes original investigation but is primarily directed to using existing technologies to resolve a recognised problem. Extension activities involve packaging and disseminating knowledge and technologies to end users, in order to address particular issues.

The States and Territories account for 43 per cent of national spending on research and development in agriculture each year. The Commonwealth accounts for 40 per cent, of which higher education institutions (mostly universities) receive half. Private companies account for 17 per cent. The expenditure shares are summarised in Figure 3A below.[2]

Figure 3A
Research expenditure shares



Source: Department of Primary Industries.

Across Australia, government departments and agencies have focused their R&D involvement on areas determined to be in the public interest and where industry is less likely to become involved (market failure). The funding of agricultural research increasingly involves collaboration between government, universities and industry. International research partnerships are being formed in areas of common interest or complexity to maximise research effort, for example, water management, bio-security, land management and greenhouse.

3.3 DPI's role in agricultural research

DPI plays an important role in agricultural research, leading the development of the agricultural investment strategy for the Victorian Government, and funding and undertaking research, extension activities and the commercialisation and management of intellectual property.

2 Australian Bureau of Statistics, *Share of Agricultural, Veterinary and Environmental Science R&D by Sectors*, 2004.

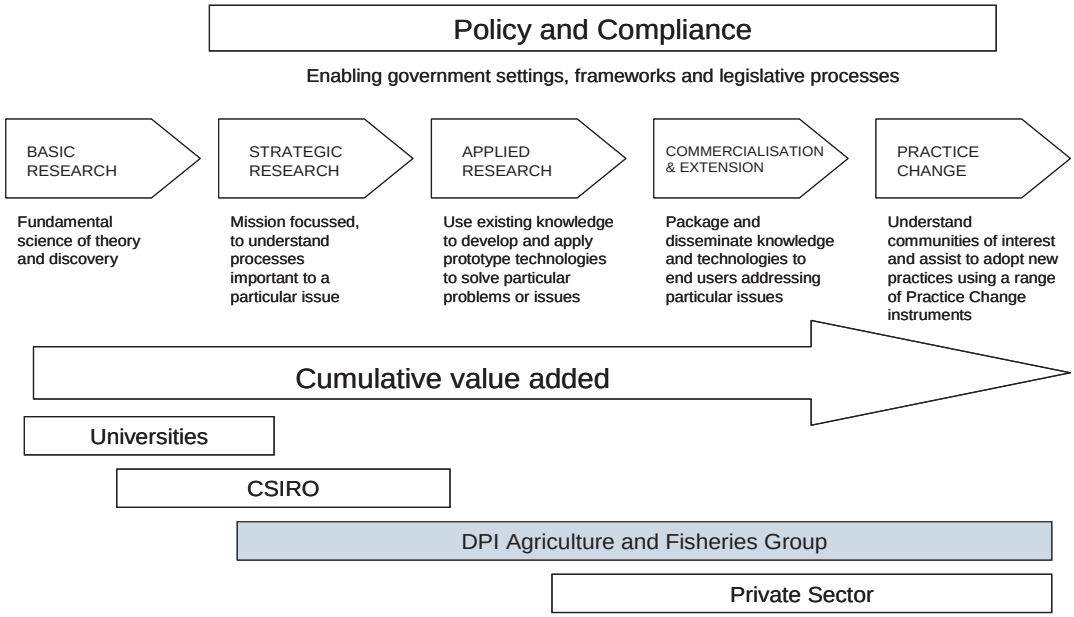
DPI also works with the Commonwealth and other State Governments with respect to the development of the research agenda and cooperative arrangements at the national level.

In investing in agricultural research, DPI resembles other State and Territory agencies insofar as it is largely involved in applied research that entails developing existing technologies, and in 'strategic research' in areas that are identified as having the potential for high growth and high public benefit, such as biotechnology. DPI has attracted funds from RRDCs, which mostly target applied research, and the Victorian Government's Science Technology and Innovation (STI) initiative, which is focused on strategic research.

DPI is reducing its role in 'adaptive research' (i.e. research that can be directly applied to the development of new products or processes), which is the area most likely to attract funding from the private sector.[3]

Figure 3B below depicts DPI's involvement within the broad continuum of science research:

Figure 3B
DPI's position in the research continuum



Source: Department of Primary Industries.

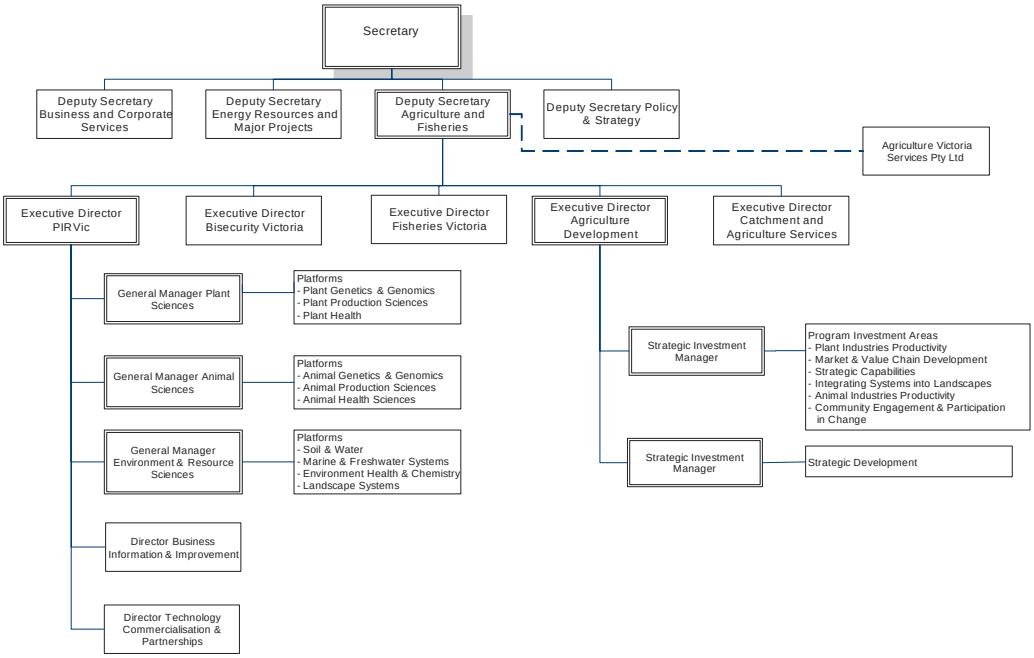
3 Victorian Government's Submission to the Productivity Commission's Review of Public Support for Science and Innovation, 2006, pp. 14-16.

3.4 DPI's organisational arrangements for agricultural research

Until the latter part of 2007, DPI provided agricultural research activities through four distinct types of activity and organisational areas:

- research funded through the Agriculture Development Division
- research performed through Primary Industries Research Victoria (PIRVic)
- extension services through Catchment and Agriculture Services (CAS)
- specialist services in the management and commercialisation of intellectual property through both PIRVic's Technology Commercialisation and Partnership Group and Agriculture Victoria Services.

Figure 3C
DPI Organisational Chart



Source: Department of Primary Industries.

The Agriculture Development Division was responsible for DPI's agricultural research investment strategy. The Division set governance policies and procedures for funds allocation, attracted additional external funding and was responsible for performance monitoring and reporting on agricultural research.

PIRVic was established in 2003 to coordinate DPI's research activities that were previously conducted by 13 semi-independent agricultural research institutes. The institutes formed part of Agriculture Victoria, which at that time was a business unit of the former Department of Natural Resources and Environment. PIRVic was funded mostly from payments for research services provided to DPI, other State Government departments and the private sector. The services were priced at full cost recovery levels. PIRVic had responsibility for the Technology Commercialisation and Partnerships Group, and undertook research in ten research areas, called 'science capability platforms':

- animal production sciences
- animal health sciences
- animal genetics and genomics
- plant genetics and genomics
- plant production sciences
- plant health
- soil and water
- marine freshwater systems
- environmental health and chemistry
- landscape systems.

CAS facilitated the farming community's adoption of new technologies and sustainable farming methods, providing services to farming businesses aimed at increasing productivity and competitiveness in world markets.

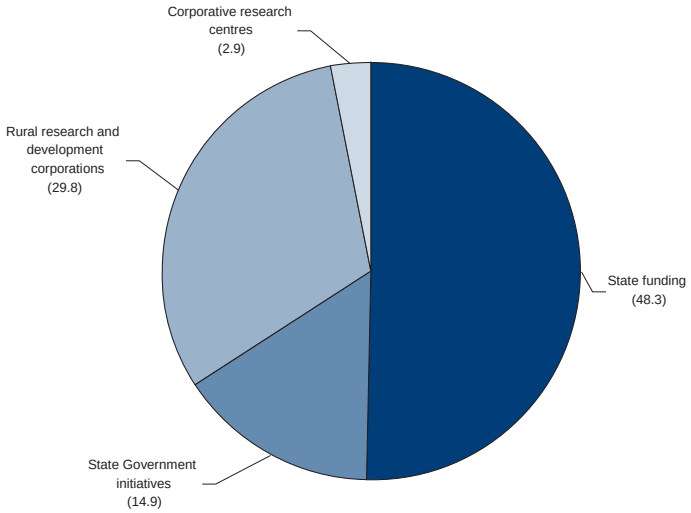
Following a restructure in late 2007, Agriculture Development Division and PIRVic were abolished and their activities redistributed to other Divisions in DPI. Under the new arrangements DPI has established an Office of Science, Technology and Commercialisation and formed two new research divisions (from PIRVic), the Biosciences Research Division and the Future Farming Systems Division.

The DPI restructure follows an expert review of the Department's Science Investment Framework, by Professor Göran Roos. Internal and external consultation also informed the expert review.

3.5 DPI funding for agricultural research

In 2005-06, the Agriculture Development Division had a budget of $109.7 million, of which $95.9 million was directed to agricultural research (this included management costs and funds allocated to private forestry and other Government assistance programs). The sources of funds are shown in Figure 3D below:

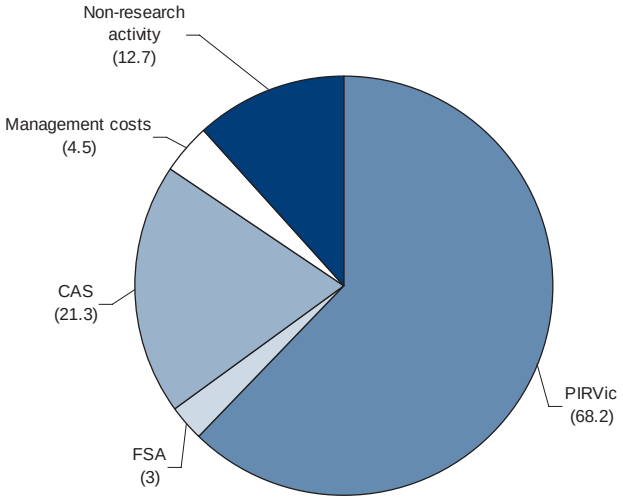
Figure 3D
Agriculture Development Division funding sources ($m)



Source: Department of Primary Industries.

The bulk of the Division's research and extension funding was directed to PIRVic ($68.2 million, including State funds combined with RRDC funds) and CAS ($21.3 million). The remainder went to Food Science Australia (FSA) ($3 million); management costs ($4.5 million); and non-agricultural research activity ($12.7 million) including drought assistance programs, the plantations incentive strategy, private forestry, agricultural assistance programs and FarmBis (a Commonwealth Government program to help farmers improve their business skills). These funding shares are shown in the following diagram (Figure 3E).

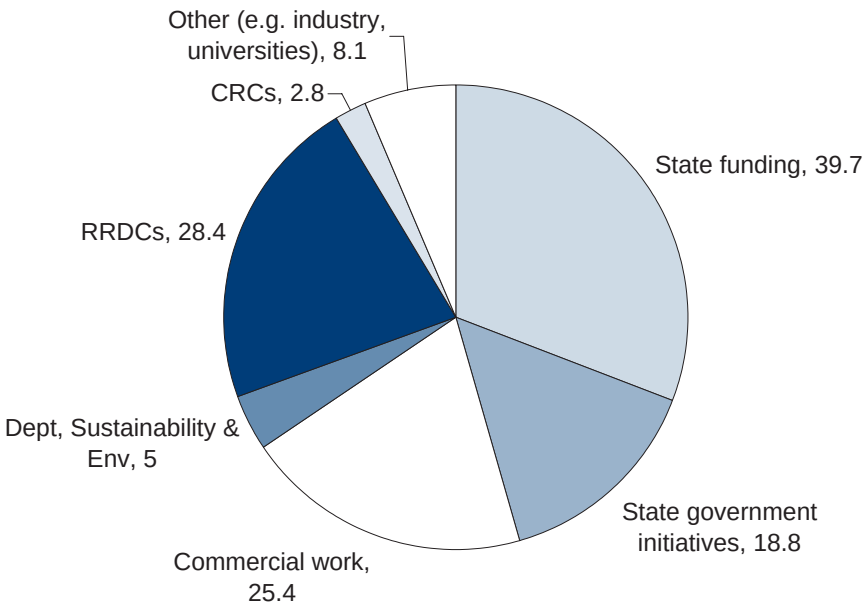
Figure 3E
Allocation of Agriculture Development Division funding (State plus RRDC) ($m)



Source: Department of Primary Industries.

In addition to funding received through the Agriculture Development Division (incorporating RRDC and CRC funding), PIRVic received funding from other sources, for a total allocation of $128 million in 2005-06. The respective shares of the funding sources are illustrated in the following diagram (Figure 3F).

Figure 3F
PIRVic funding sources ($m)



Source: Department of Primary Industries.

4 Agricultural research investment

At a glance

Background

Arrangements for determining public research priorities must assure the community that funds will flow to the areas of greatest economic, social and environmental benefit.

Key findings

In 2007, DPI reviewed its agricultural research investment framework (the Roos review). The Roos review sought to address shortcomings in the framework and to improve the transparency, flexibility and accountability of allocation decisions.

In response to the Roos review, DPI has revised its approach to setting research priorities. The new approach should enable better alignment of research with government goals, increased clarity and openness in decision making, and greater scrutiny of research proposals.

The new approach has not addressed all the shortcomings of the pre-Roos arrangements. For example, under the new approach, DPI's ability to rapidly exploit new research opportunities and to respond to changing priorities is limited, and there is scope to establish a more thoroughgoing purchaser-provider model.

DPI needs to clearly articulate how the elements of the new approach will work as an integrated whole, to assure Parliament and the community that, under the new approach, funds will flow to the areas of greatest benefit.

DPI needs to prepare a strategic plan for agricultural research capability in the State, to complement the new allocation framework.

At a glance - *continued*

Key recommendations

DPI should:

- implement a quantitative approach to funds allocation, based on return on investment and other measures such as cost-benefit analysis
- demonstrate how the new prioritisation elements, approaches and criteria will work as part of an integrated whole
- undertake a more extensive 'market validation' process of proposed projects and programs, and demonstrate how a satisfactorily high-level of community input into decision making will be sought and utilised
- establish increased flexibility in the annual allocation of funds across research streams, so as to enable the profile of funded research to adapt to emerging imperatives and research potential
- develop a strategic plan for agricultural research capability in the State and foster deeper and more extensive partnerships with other research providers
- report, within two years, on the effectiveness of its new research investment approach.

4.1 Introduction

A fundamental goal for government is to ensure that public research funds are spent in a way that best deliver the desired community outcomes. The process for determining research priorities should assure the community that public funds will flow to the areas of greatest potential economic, social and environmental benefit.

Sound governance and investment allocation frameworks are required to assist government to make informed decisions about agricultural research investment. Poor investment choices can have adverse consequences for wealth and competitiveness, employment, the sustainability of rural communities and the environment.

Setting public research priorities is a difficult and complex task. There are several reasons for this, including:

- a long planning horizon
- the inherent unpredictability of research outcomes
- the need to balance the interests of public, industry and private beneficiaries
- the difficulty of attributing the impact of research to a desired outcome
- the difficulty of predicting future research priorities and ensuring that the requisite capability is available.

Internationally, governments have adopted a number of different approaches to setting research priorities, from the purely ad hoc to more formal approaches. These include:

- estimation of likely future benefits from research ('return on investment'), in the form of benefits for local firms, revenues from commercialisation, and community benefit
- consideration of social and environmental impacts as well as economic impacts
- ranking of potential research programs according to estimated benefits (quantitative)
- ranking of potential research programs according to qualitative factors such as degree of alignment with stated research priorities
- seeking expert, stakeholder, industry and community input into allocation decisions
- applying purchaser-provider models of research procurement and governance. Such models seek to avoid internal 'capture' or conflicting interests (which can arise when researchers set their own priorities) and achieve more transparent decision making. In their most developed form, purchaser-provider models place internal and external providers on an equal footing, with the purchaser able to choose between internal and external providers, and internal providers able to provide research to internal and external purchasers
- explicitly purchasing research capability (as opposed to actual research) from public research agencies and other organisations.

Based on our review of the literature and recent past practice, audit considers that the following key principles should underpin priority-setting frameworks for public research:

- *clarity and transparency* – government and stakeholder roles are clear and understood, and stakeholders and clients understand and have confidence in how the framework and processes work
- *consistency* – the same principles are applied across the framework; like programs are treated in like ways
- *rigour and evidentiary base* – processes are robust and explicit and would stand up to external scrutiny in how they are designed and applied; decisions are based on sound data and are well documented
- *alignment with relevant goals* – there is a clear bridge between allocation decisions, divisional and agency goals, whole-of-government goals and the role of government in research. This ensures the right research is undertaken.

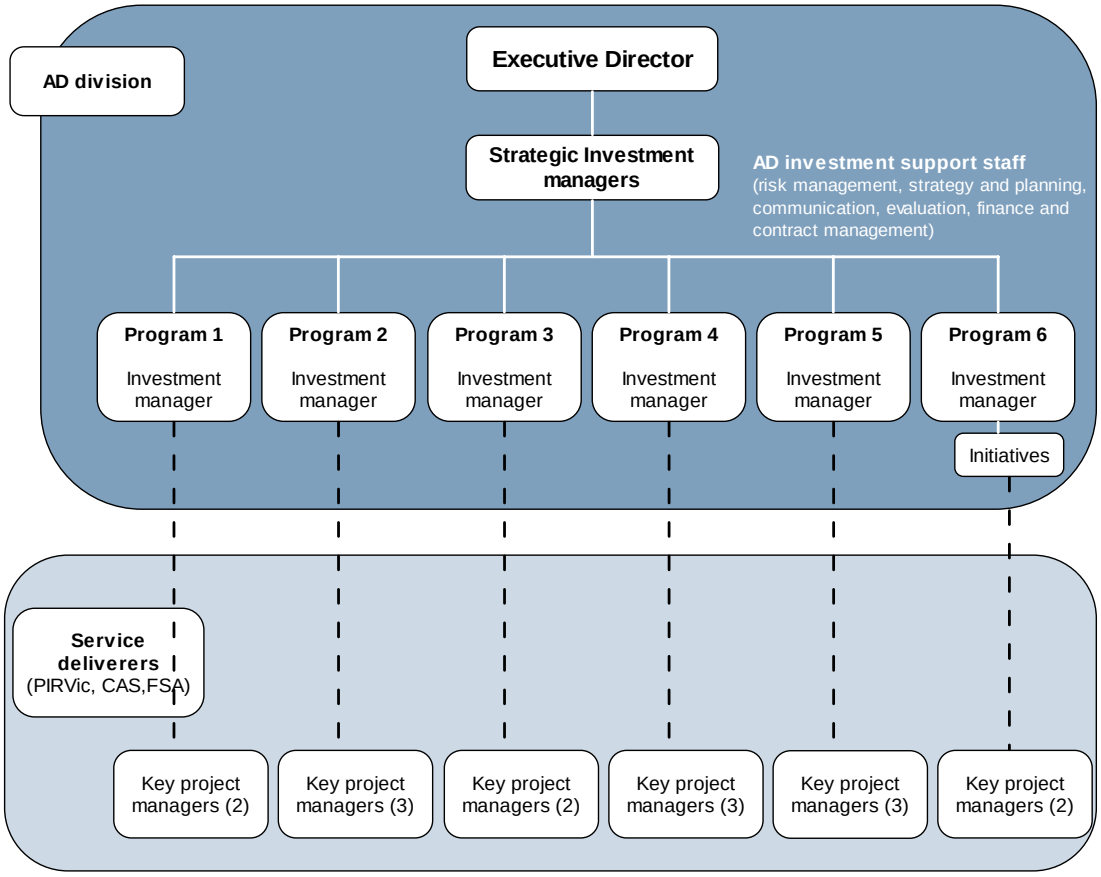
In addition to making the right choices about the priorities for research, sound governance systems and processes are required to support decision making with respect to the providers of research.

Governance is about clarity of roles and accountabilities, and establishing the right institutional arrangements and incentives. Clear roles and accountabilities are necessary for efficiency and effectiveness. Appropriate structures, systems and processes need to be in place to support strategic planning, delivery and performance measurement. Participants' incentives must be aligned with their roles, so that resources and effort are aligned with the organisation's objectives. This includes avoiding conflicting interests and roles. In setting a research program, good governance requires arms length, transparent decision making, and choices about provider that are based on merit and State requirements for research capability.

4.2 DPI funds allocation framework for agricultural research investment – prior to the Roos review

Prior to the recent review of DPI's research investment, the Agriculture Development Division developed and managed DPI's funding allocation framework. This framework was an 'investor-provider' model through which ADD allocated funds internally to DPI units. The model is depicted in Figure 4A below.

Figure 4A
DPI's previous investor–provider model



Source: Department of Primary Industries.

Under the model in Figure 4A, the Agriculture Development Division managed and allocated State Government funds and attracted external funds. The model was only used to fund internal providers of research (largely PIRVic and CAS; Food Science Australia, a joint venture between the Victorian Government and the CSIRO, also received research funds annually but it has been a minor provider of research services).

External research providers, such as the CSIRO, universities and other Government research organisations from Victoria, were excluded from bidding for research projects but were not excluded from working in partnership with PIRVic (Australian universities and the CSIRO have worked as partners with PIRVic on a number of research projects). Similarly, DPI was excluded from bidding for research funds from within those external organisations.

The model allowed for only limited reallocation of funds across the research and extension funding streams, as part of the annual research investment funds allocation process. PIRVic and CAS did not compete for funds, as PIRVic applied for funds from the research stream and CAS from the extension stream.

Investment priorities were articulated through an investment strategy for agriculture programs and 'priority for action' documents, which were produced for each agricultural industry. There were three principal steps in the development of projects for funding consideration under the funding allocation model:

- researchers proposed a project that was linked to a research program's 'key result area' and that related to the 'priorities for action'
- project managers, employed by the research providers (PIRVic or CAS), approved the initial proposal
- program investment managers, employed by the 'investor' (the Agriculture Development Division, ADD), made the final decision and allocated funds to projects.

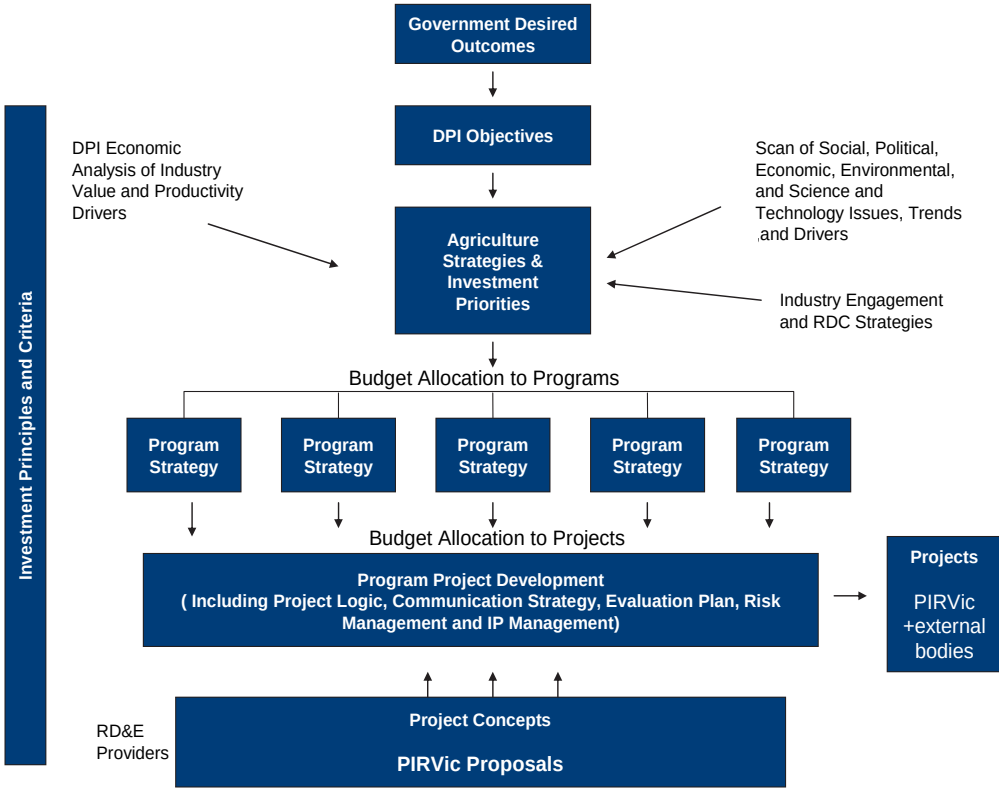
Research programs were selected by executives from ADD, in consultation with executives from CAS and PIRVic. These groups of executives together pooled their collective knowledge and judgement to develop a view of how to best link the research program to the State Government's goals. As part of this process, the executives had regard to:

- statements of State Government policies and goals
- relevant economic data (such as industry trends, and patterns of growth and employment)
- input from industry
- DPI's research capabilities
- technology trends worldwide
- the role of government in agricultural research (mostly but not entirely limited to areas of market failure)
- the expected economic benefit to Victoria's agricultural industry and communities.

To facilitate the allocation process, the investment managers convened steering committees and reference groups. The steering committees assisted the program managers in the coordination of projects across the programs. The reference groups provided advice, acted as a sounding board, dealt with relevant issues and provided an advocacy function for each program. These committees were chaired by program investment managers and their membership mainly comprised staff from Agriculture Development Division, PIRVic and CAS. Two of the six reference groups included one to two external members.

Figure 4B below provides an overview of the approach to funds allocation that was in place at the commencement of the audit.

Figure 4B
DPI funding allocation framework Pre Roos



Source: Department of Primary Industries

The five investment principles which guided investment decisions were:

- *Contribution to achieving Government outcomes*. Research programs were required to align with DPI's high-level outcomes and Government policy
- *Alignment with strategic direction and investment priorities*. Project proposals needed to align with the Agriculture Development Division's Investment Strategy
- *Role of Government*. A market failure test was used to help determine the role of Government in future research and development investment. The test involved assessing the extent of market failure, to identify those situations where the private sector is unable, or unwilling, to invest in a research area, and assessing the public benefit from investing in the proposed research. The beneficiaries and funders test was then applied to determine who would benefit and therefore who should fund the work
- *Equity in funding*. Where an agricultural industry or sector was likely to be a significant beneficiary of Government investment, it was encouraged to make an investment proportionate to the benefit of the output, using the market failure test described above. After applying the 'beneficiaries and funders test' to determine who would benefit and therefore who should fund the work, DPI undertook to:

  - invest 100 per cent in projects if there was market failure and projects were expected to have solely public benefits
  - invest jointly with industry where there was partial market failure and both public and industry benefits were expected
- *Impact of investment and value for money*. Evaluation of Government investment in research, development and extension rested on demonstrated achievements in relation to economic impacts for the agri-food sector, benefits to the natural resource base and benefits for regional communities.

When allocating funds in accordance with the five investment principles, consideration was given to three factors:

- *portfolio balance* – investments were selected to cover the entire agricultural portfolio. This included agriculture industries, cross-industry issues and geographic needs
- *development of strategic alliances and partnerships* – building long-term strategic alliances and partnerships with external co-investors
- *consistency with developing DPI capability and accessing new capability* – strategic investment in the longer term capability needed to deliver on the investment programs and ensure suitable capability within service deliverers.

Every three to four years, at the conclusion of the relevant Priority for Action Plan and at the commencement of the preparation of the next strategy, DPI reviewed its investments across industries, cross-industry issues and between research and extension, and decided whether to increase, decrease or maintain the level of investment in the respective research areas. Decisions documented for ministerial briefings took account of factors such as:

- DPI research capability
- national consolidation of research activity in a particular industry
- economic benefit
- level of co-investment
- collaborative opportunities
- industry outlook (capacity to export) and license to operate (in animal welfare).

Audit identified a number of shortcomings in the funding allocation arrangements that applied up to 2007.

The funds allocation model was complex, comprising, inter alia, five principles, three factors, numerous process steps, multiple divisions, and relevant goals at the project, program, divisional, Departmental and whole-of-government levels.

Decisions about research priorities were guided by a principles framework rather than a framework of rigorous quantitative measures for setting priorities (e.g. the consistent use of cost-benefit analysis). The approach was heavily reliant on the collective judgement of senior managers and on DPI's historical involvement in research areas. The scope for research providers inside DPI to influence funding allocation decisions was neither consistent nor transparent.

In contrast to DPI's historical approach to allocating research funds, a formal analytical approach to priority setting, combined with a clear separation of governance roles, would have the advantage of ensuring decisions are not vulnerable to undue, subjective or inconsistent influence by research staff and internal research providers. Such an approach would provide a higher level of assurance to Parliament and the Government that research funds were being allocated optimally.

The ability to quickly and flexibly allocate funds to respond to changing research imperatives and priorities was limited under DPI's approach to funding research, and there were flaws in the alignment of some research programs with DPI's stated priorities. For example, research conducted by PIRVic on behalf of other departments was not explicitly aligned with DPI's own agricultural outcomes, as PIRVic was required to comply with the investor's research strategy rather than ADD's. Also, performance targets demonstrating the relative benefits from each research program and providing guidance with respect to future research priorities and investment were not well developed, and were not well aligned to the higher level goals. (Performance targets and evaluation are the subject of Chapter 5 below.)

4.3 The Roos Review

In 2006, Professor Göran Roos led a review of DPI's approach to research investment. The aims of the review were to:

- improve rigour, transparency and the evidentiary base of decision making
- better align the research program to Government goals and DPI strategic directions.

The review consulted extensively with DPI staff with respect to the Department's approach to science investment; undertook a literature review on research and development and innovation management; benchmarked DPI's approach to science investment with best practice organisations; and developed and assessed options for future investment approaches.

The review recommended a new Science Investment Framework with the following elements:

- a purchaser-provider approach
- a three-tiered system allowing for senior levels of DPI to set directions (top-down), for proposals to be put forward by providers (bottom-up) and for interaction between top-down and bottom-up activity
- a Research, Development and Practice Change Strategy developed in consultation with stakeholders and providing the framework for future science investment practice.

Professor Roos also proposed that, in the longer term, DPI should move toward an enhanced purchaser-provider model by expanding the scope for choosing providers, so that the choice of provider included delivery by solely internal, joint internal and external, and solely external providers.

The review report stated that the proposed model aligned with international best practice. The anticipated benefits from the new approach include a strengthened strategic focus, increased transparency, flexibility, efficiency in decision making and improved quality of research proposals.

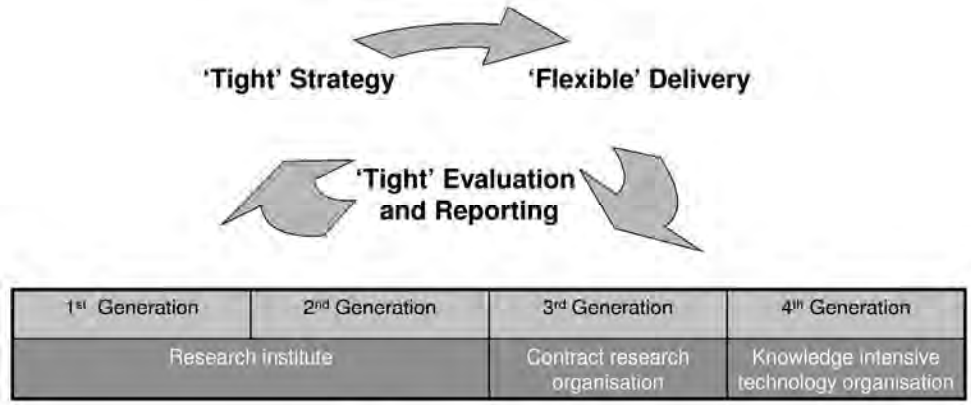
4.4 DPI's funds allocation approach post the Roos Review

Under its post-Roos arrangements, DPI has introduced changed organisational arrangements with the aim of:

- strengthening the Department's capacity to determine strategic directions (long and short term) that will drive research investment decisions
- achieving a more flexible approach to the delivery of required research
- achieving a more rigorous approach to reporting and evaluation.

In the words of the Department, the arrangements realign the Department from a 'contract research organisation' ('third generation research organisation') to a 'knowledge intensive technology organisation' (a 'fourth generation research organisation'). Figure 4C below depicts the Department's approach to agricultural research investment.

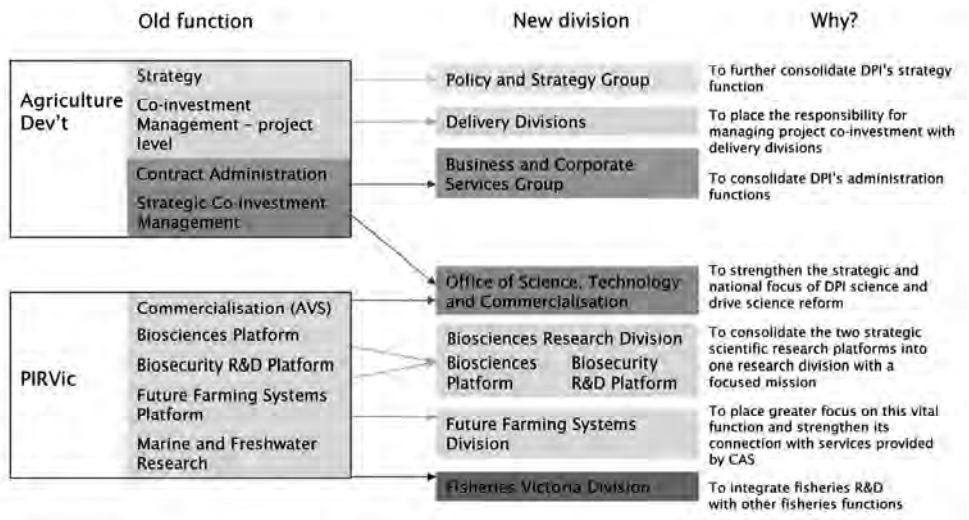
Figure 4C
Evolution of DPI's approach to agricultural research investment



Source: Department of Primary Industries.

The organisational chart in Figure 4D below describes the new structural arrangements and how they relate to the previous DPI structure.

Figure 4D
New functional changes



Source: Department of Primary Industries.

With the establishment of the new Office of Science, Technology and Commercialisation, DPI intends to strengthen the strategic and national focus of its research. It has also formed two new research divisions (from PIRVic):

- the Biosciences Research Division – consolidating two research platforms into one division
- the Future Farming Systems Research Division – aiming to provide greater focus on this issue and better coordination with CAS.

Under the post-Roos arrangements, DPI has developed a 'strategic directions framework' for setting research priorities and a new set of investment criteria for assessing research proposals. The features of this framework are:

- a four-year strategy to guide agriculture research investment. The priorities defined in the strategy will guide future investment decisions. The four year strategy:
  - examines the strategic context affecting agriculture (competition and trade, changing community attitudes, demographic changes, climate change and water scarcity, new sources of capital, technology trends, innovation and change drivers)
  - defines the role of government in research
  - sets DPI's strategies and priorities for the agriculture sector
  - proposes an 'Innovation System' spanning the development of new knowledge to delivery and adoption of products, specifying DPI's involvement in the research continuum
  - proposes six outcome areas for agricultural research, with focus areas and targeted actions for each outcome
- a 20-year Research, Development and Practice Change Strategy to increase clarity for medium and long-term planning, core capability and infrastructure

- new investment criteria, that are to be applied to assessing research proposals:
  - strategic fit, project logic
  - role of government, level of co-investment
  - route to market
  - return on investment
  - risk assessment, likelihood of success
  - capability and capacity to deliver
  - innovation
  - portfolio balance.

Appendix B provides further information on project criteria.

Under the new framework, six agricultural research streams have been selected:

- Bio-Sciences
- Future Farming Systems
- Practice Change Services
- Bio-protection
- Biosecurity
- Food Science Australia.

The stated aims of identifying the six streams were to improve alignment with State Government goals and to address industry needs. The following arrangements apply with respect to the streams:

- there is a 'notional' funding allocation for each stream
- projects compete for funds within each stream annually
- projects that do not meet the investment criteria or that fall outside the funding streams will not be funded
- there is limited capacity to move funds across streams annually (e.g. no more than 5 per cent in any year, and typically significantly less)
- the 20-year strategy and the four year strategy are intended to define shifts between streams, to accommodate changing priorities in the future.

During the audit, DPI identified three principles as driving the new arrangements:

- tightly defining strategic directions
- more flexibility with respect to delivery to promote innovation
- tight evaluation and meaningful reporting.

DPI characterises this approach as 'tight – flexible – tight'. According to DPI, the principal elements of the new framework are:

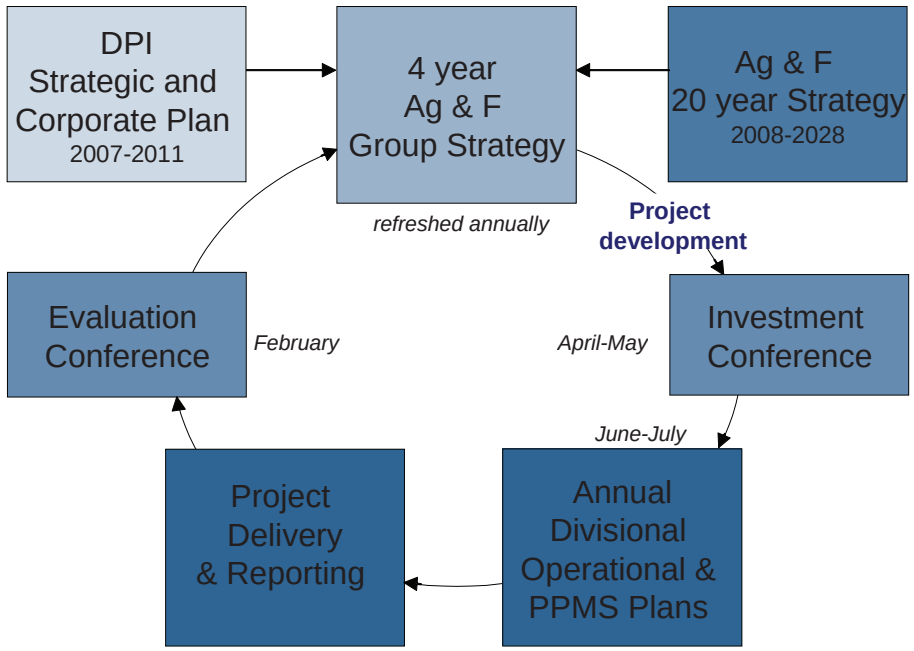
- greater alignment between strategy and capability planning
- a more inclusive process and 'empowerment' of deliverers
- more rigorous and interactive project development
- a stronger evaluation framework
- a culture of continuous improvement
- an open and transparent investment evaluation and reporting process.

Three governance mechanisms are scheduled to be established in early 2008:

- Project Assessment Groups, to assist Divisions to develop quality project proposals which will align with the four-year group strategy
- an annual Evaluation Conference, chaired by the Secretary of DPI, to be held with industry and other representatives to evaluate research performance, review strategic directions, set future research strategic directions and priorities and address barriers to research performance
- an annual Investment Conference, chaired by the Secretary of DPI, to be the primary decision making forum for allocating funds against the new investment criteria. The goals of the Investment Conference are to enable more open and rigorous assessment of project proposals, establish a strong incentive to improve the quality of research proposals, improve the conduct of research (technical efficiency) and fund areas of research and development with the greatest expected impact on the outcomes identified in the four-year strategy.

Role and function statements have been developed for each of the above three mechanisms. Figure 4E below depicts the annual planning cycle for agricultural research investment.

Figure 4E
Annual cycle



Source: Department of Primary Industries.

4.4.1 Findings about the new arrangements

DPI's new approach to agricultural research investment aims to provide better alignment with State Government goals by strengthening the strategic focus and improving the evidentiary base for decision making.

The recent and proposed changes are likely to provide a sound platform for the future development of agricultural research within Victoria. The new approach should enable:

- better alignment of research with government goals
- increased clarity and openness in decision making
- a higher level of organisational scrutiny of research proposals.

However, there are other areas where the framework could be improved. Also, audit identified measures that will improve the implementation of the new priority setting process.

Like its predecessor, the new framework is complex, including six outcome areas; eight investment criteria; a number of funding streams; cyclical and consecutive consultative and decision making processes with stakeholder input; interrelated roles and relationships across divisions; short and long-term strategic plans; and cascading goals and objectives at the project, program, divisional, Departmental and whole-of-government levels.

The key shortcoming of the new framework is the limited flexibility in the allocation of funds, and limited competition and comparison, across research streams annually. In any given year, funds are allocated to a specific research stream, with projects competing for funding within that stream. There is limited capacity to reallocate funds between streams in response to shifts in priorities. This impairs the ability of DPI to move rapidly to exploit new research opportunities and to respond to changing priorities. It also means there is a risk that low-potential research projects in one stream will be selected over substantially higher potential projects in another.

DPI advised audit that the proposed 20-year and four-year strategies, combined with the proposed evaluation framework and conference, will seek to address the matter of funding flexibility.

DPI characterises the new framework as a 'purchaser-provider' model. However, the framework is not a thoroughgoing purchaser-provider model. For example, there is no clear governance separation between a purchaser group and a provider group; internal providers are not treated on the same terms as external providers; and internal providers have limited ability to service other clients.

Under a purer purchaser-provider model, DPI would be able to purchase research from a broader range of providers, including internal and external bodies, based on assessments of their research capability and strategic fit with the particular research priority. Symmetrically, DPI's research units would extend their provision of research to external purchasers, such as universities and CSIRO (this would of course require the cooperation of external organisations). An extended purchaser-provider model would enable DPI to fund research in high priority areas where DPI might lack internal capability, and to focus internal research capability on specific areas of research.

Under the new model, DPI has two related and overlapping goals: to procure appropriate research, and to maintain capability in key research areas so as to be able to procure the right research in the future. There are instances where these goals can conflict. For example, an area of research may be generating poor results at present but may hold significant medium-term potential, while another area may be generating valuable and high-return research at present, but may be judged to have limited potential in the medium and longer term. How these two goals will be balanced, and how such potential conflicts will be resolved, is not clear under the new arrangements. DPI advised audit that the forthcoming 20-year and four-year strategies and the proposed evaluation framework will seek to address this issue.

One way to better integrate these conflicting goals would be to report the extent to which capability considerations were decisive in allocation decisions. This would need to be underpinned by an analytical framework that linked levels of capability to levels of funding. To inform the development of such an approach, DPI could consider:

- how other jurisdictions in Australia and overseas balance the imperatives of procuring appropriate research and maintaining capability
- how capability issues are dealt with in other sectors.

Research capability planning is a relatively new area with limited precedents. At present, there is no strategic plan for agricultural research capability and institutions in Victoria. Such a plan would set out explicitly how future capability needs will be met. Such a plan should align with relevant national plans, have a long-term planning horizon and consider:

- the future shape of the agricultural research industry, taking account of international and national trends
- the nature of the government's future role and involvement in research
- the capacity to identify and readily respond to changing needs and emerging priorities
- the development of strategic partnerships with business, industry and universities at regional and national levels.

Such a plan would complement the four-year strategy which sets research directions and priorities over a shorter span but does not address the development of research capacity and capabilities.

In order for DPI to be able to provide clear assurance that investment funds will flow to the areas of greatest benefit, a number of actions are required as part of the implementation of the post-Roos arrangements. DPI should now:

- clarify and communicate the nature and scope of the investment criteria and the method of allocation
- provide a clear pathway for implementing the proposed analytical approach to prioritising allocation, based on return on investment and other measures (relevant examples from other agencies are provided in Appendix C)
- demonstrate how the key principles and elements will be implemented to ensure the achievement of the proposed new directions. This will require the preparation of a formal risk framework, and should include consideration of (and removal of) possible barriers
- clarify how the various prioritisation elements, approaches and criteria will work as part of an integrated whole (e.g. how the return on investment measure will work alongside the measures of risk, capability and portfolio balance)
- embed continuous improvement in the new approach, through a rigorous approach to monitoring and evaluation and building on lessons learned through research activity
- undertake a more extensive 'market validation' process of proposed research projects and programs
- demonstrate how a satisfactorily high level of community input into decision making will be sought and utilised.

In the longer term, DPI should consider:

- building more flexibility in funds allocation, so that the profile of investment can change more rapidly as circumstances and priorities change, and to build on lessons learnt
- building in increased industry input, particularly into strategic planning, priority setting, program development and capability assessment
- developing a longer-term strategic plan for agricultural research capability in the State, including consideration of relationships and synergies with national research agencies
- fostering strategic partnerships with other research providers, to better leverage external resources and expertise
- extending the agriculture investment strategy and investment principles to cover all types of agriculture research conducted by DPI, including research conducted on behalf of other government departments and the private sector
- further development of the purchaser-provider model to increase DPI's capacity to purchase research from the most appropriate provider, internal or external, based on assessment of their research capability and strategic fit with the particular research priority and extending DPI's internal capacity to develop research partnerships with, or provide research to, external bodies, such as universities and the CSIRO.

4.5 Conclusion

Setting research priorities and making investment choices in a manner which provides the greatest benefit for the community is recognised internationally as a difficult and complex task. DPI has most recently attempted to meet this challenge by instituting a number of changes to agricultural research priority setting.

Shortcomings in DPI's pre-Roos funding allocation model included undue complexity in the decision making process and problems with transparency, flexibility and accountability in funds allocation decisions.

The post-Roos arrangements should improve transparency and accountability for decision making and the quality of research proposals. However, further development of the model is warranted in order to support the choice of the most appropriate provider, avoid conflicting interests internally, and make the best use of existing and emerging capabilities.

A strategic plan for agricultural research capability in the State is required to build innovation and sustainability of agricultural research and to deliver maximum benefit for the community into the future. In order to ensure the necessary research capability, more extensive strategic partnerships with other research providers should be pursued.

Recommendations

DPI should:

4.1 Build on recent changes to its agricultural research investment framework in order to maximise the benefits to Victoria from research activity. It should achieve this by:

- clarifying and communicating the nature and scope of its investment criteria and the method of funds allocation
- implementing a quantitative analytical approach to prioritising research, based on return on investment and other measures (e.g. cost-benefit analysis)
- demonstrating how the key investment principles and elements will be implemented to ensure achievement of the new directions (this will require the preparation of a formal risk framework, and should include consideration and removal of possible barriers)
- clarifying how the various prioritisation elements, approaches and criteria will work as part of an integrated whole
- embedding continuous improvement in the new approach
- undertaking a more extensive 'market validation' process of proposed projects and programs
- demonstrating how a satisfactorily high-level of farming community input into decision making will be sought and utilised.

4.2 Increase flexibility in the annual allocation of funds to enable the profile of funded research to adapt to emerging imperatives and the changing research potential of the respective areas of science.

4.3 Develop a strategic plan for agricultural research capability in the State and foster deeper and more extensive strategic partnerships with other research providers to optimise its research capability.

4.4 Within two years, report on the effectiveness of its new research investment approach. As a minimum, this should include:

- evidence of tangible benefits in the type, volume, cost, quality and return to the community of research investment
- the impact of the new approach on agricultural research capacity and capability.

Consider points

DPI should:

4.5 Consider extending the agricultural investment strategy and investment principles to cover all research conducted by DPI on behalf of other State Government Departments and the private sector. This will help DPI develop a more integrated approach to agricultural research, make better use of its financial and human resources and achieve a closer alignment between the goals of the research divisions, the Department and the State Government.

4.6 Consider further developing its purchaser-provider model to place internal and external providers on a more equal footing. To support this, DPI could examine its portfolio of programs and locations to identify opportunities for deeper relationships between DPI units and other research providers, such as universities. To test the application of a more thoroughgoing purchaser-provider model, DPI should consider whether there is scope for a limited trial of such a model in one or more of its research locations or programs.

5 Performance monitoring, reporting and evaluation

At a glance

Background

Performance monitoring and evaluation is essential to ensure organisations are able to:

- demonstrate levels of achievement against stated objectives
- measure and report on efficiency and effectiveness
- continuously improve programs and services
- develop future strategic directions based on evaluation of past experience.

Key findings

Aspects of DPI's performance monitoring and evaluation framework for agricultural research are consistent with better practice. Program logic models are well established and used for program definition and evaluation.

For DPI to assure Parliament and the community that the agriculture investment program is effectively meeting the stated DPI outcomes and State Government goals DPI needs to further improve the monitoring, reporting and evaluation of the agricultural research program. To support increased effectiveness in DPI's performance measurement and reporting regime DPI needs to:

- better integrate agricultural research performance monitoring and evaluation with DPI and whole of government outcome reporting
- improve data quality standards to ensure greater consistency in the performance data collected across DPI
- consolidate the various metadata systems to support integrated data collection and performance reporting
- streamline the reporting regime to enable the delivery of a comprehensive and balanced assessment of the agricultural research program and trends over time
- ensure the system for monitoring and reporting on project assessment and approvals provides comprehensive, accessible and up to date information
- build on lesson learned to further improve performance.

At a glance - *continued*

Key recommendations

DPI should strengthen performance monitoring and evaluation of agricultural research investment to demonstrate the benefits to government and the community, the achievement of goals and the economic, social and environmental impacts of agricultural research investment. Accordingly, DPI should develop an evaluation framework which:

- measures the overall contribution to government goals, DPI outcomes, value for money and return on investment
- assesses adherence to investment principles
- evaluates the allocation of research funds
- informs future priority setting
- tailors the evaluation methodology to different programs and institutions, while achieving consistency of approach and comparability of performance results

To support improved performance monitoring, reporting and evaluation DPI should:

- revise the performance reporting regime
- introduce a standardised reporting framework
- advance the business case for the consolidation of the meta data systems

5.1 Introduction

Performance monitoring and evaluation enables organisations to:

- demonstrate levels of achievement against stated objectives
- measure and report on efficiency and effectiveness
- continuously improve programs and services
- develop future strategic directions based on evaluation of past experience.

An effective performance monitoring and evaluation framework should include appropriate arrangements for:

- measuring performance (this includes collecting and validating performance information)
- reporting performance (particularly, accurate and timely reporting to stakeholders).[1]

A good practice framework should include:

- a formal structure for performance monitoring and measurement
- clearly defined roles, responsibilities and accountabilities for output performance measurement and reporting
- well documented data quality standards and expectations for output performance information which are clearly communicated across the agency
- monitoring and quality assurance procedures for performance information which enable assessment of the agency's service delivery
- integrating performance management processes and accountabilities with reporting of output performance information.[2]

Systems and processes for performance monitoring and evaluation should provide assurance regarding data integrity. They should include:

- adequate controls to support data integrity, including documentation of data sources, collection methods, standards and procedures
- approved costing methodologies, established and supported by appropriate assumptions and adequate documentation. This should include standard processes for undertaking economic and financial analysis of activities.

An effective performance reporting system is also critical. Good performance reporting practice requires that the information:

- is relevant, demonstrating a clear link to the organisational objectives and government goals
- is appropriate, providing sufficient information to assess the extent to which the organisation has achieved its goals, outcomes or specific targets
- fairly represents the performance of an agency accurately and without bias, including performance shortfalls.

1 Queensland Audit Office, *Better Practice Guide, Output Performance Measuring and Reporting* February 2006

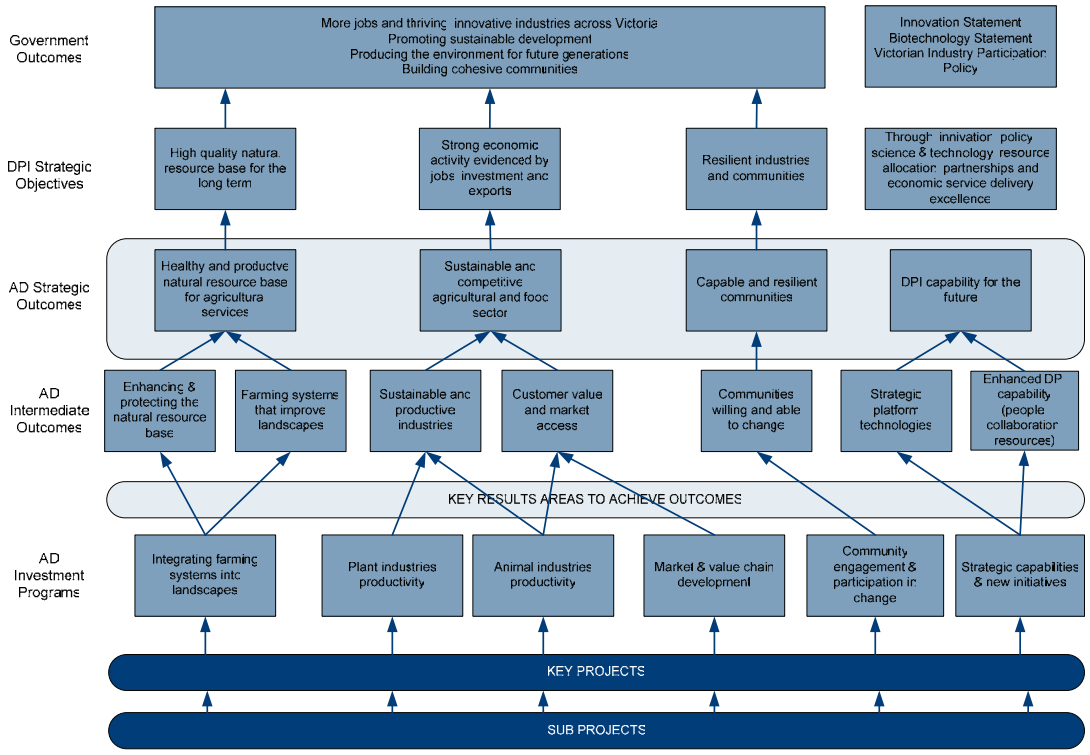
2 Australian National Audit Office, *Better Practice Guide: Better Practice in Annual Performance Reporting* April 2004 and Queensland Audit Office, *Better Practice Guide: Output Performance Measuring and Reporting* February 2006

5.2 DPI's approach to performance monitoring, reporting and evaluation

5.2.1 Performance monitoring and evaluation framework

The performance monitoring and evaluation framework for agricultural research within DPI meets some of the better practice criteria described previously. The framework links activity at the sub-project (individual research project) level, through the Agriculture Development Division Key Result Areas (key research areas) and then to the DPI strategic objectives and government priorities. These linkages are illustrated in Figure 5A below.

Figure 5A
DPI Agricultural Research Strategic Framework



Source: Pitt Group Pty Ltd.

DPI's agricultural research performance monitoring and evaluation framework has been guided by a number of corporate documents including the *Theory of Action for the ADT* (Agricultural Development Team) *Strategy*, *DPI Outcome Hierarchy of Investment*, *Agricultural Development Reporting Framework* and the *Key Project Proforma*. The framework covered activity across the previous Agricultural Development Division and feeds into legislated DPI and government reporting requirements including the Annual Report and Budget reporting. Program logic models are well established and used for program definition and evaluation; an example is shown in Appendix D.

DPI has clearly defined roles, responsibilities and accountabilities for performance monitoring, evaluation and reporting. Responsibility and accountability rests with a number of positions within DPI, including Evaluation Officers, Key Project Managers (responsible for Key Projects / clusters of common sub-projects), Program Investment Managers (responsible for higher-level Agricultural Development Division 'Investment Programs'), Research Directors (responsible for the scientific rigour of sub-projects) and Sub-project Leaders (responsible for individual sub-projects).

5.2.2 Agricultural research related performance indicators

Agricultural research related performance data is collected at numerous levels within DPI and specifically within the former Agriculture Development Division. The nature of this data varies depending upon the purpose for which it is collected and includes data on the achievement of DPI's key result areas, data on DPI research, Key Project data and administrative data.

At a whole-of-agency level, data on achievement of DPI key result areas is collected by the Policy and Strategy team for the DPI Annual Report. These key result areas have been developed by DPI to assess performance against DPI's key strategies. Figure 5B below provides an example of the DPI key strategies and Key Result Areas (KRAs) for 2006.

Figure 5B
DPI Key Strategies and KRAs

Source: DPI Corporate Plan 2004-2007, Update 2006.

These key result areas differ from the Agricultural Development Division KRAs which linked to the Agricultural Development Division Intermediate Outcomes and are more akin to key research areas. There are no formalised or endorsed Agricultural Development Division indicators, although some attempt has been made to develop these over the last two years. This contrasts with the approach used by other benchmark organisations, such as Science Technology and Innovation (STI) within the Department of Innovation, Industry and Regional Development. STI utilises standardised performance indicators across the organisation; the 36 performance indicators used are provided as an example in Appendix E.

The output measures for agricultural research for 2005-2008 include measures for quantity, quality, timeliness and cost as follows:

- **quantity** (scientific and technical publications in international journals, value of external funding contribution to research projects, numbers of commercial technology agreements finalised, number of applications for Intellectual Property (IP))
- **quality** (e.g. proportion of technical papers accepted for publication, provision of technical advice, proportion of non-commercial Agrifood research funding achieved from external sources aimed at delivering government policy objectives)
- **timeliness** (e.g. agrifood research and development milestones and reports completed on time)
- **cost** (in relation to agricultural research).

The measures have been consistent over the past three years (2005-2008) and vary slightly from the previous year's (2004) output measures as shown in Appendix F.

DPI has now developed a stable set of indicators to track and measure its performance in agricultural research and development. The indicators used are relevant measures, including the number of scientific publications, research agreements, intellectual property applications, technical papers for peer review, externally funded projects achieving government objectives, project reports and milestones met, and the provision of technical and diagnostic advice.

Key performance indicators utilised and the performance data from 2004-07 are shown in Figure 5C below. Examination of the data shows that:

- seven key performance indicators have remained constant for the last three years, whilst one indicator (scientific publications) has been collected over a four year period
- with respect to targets set for research and development performance for each KPI:
  - four targets have remained the same (scientific publications, proportion of technical papers, external projects meeting government policy objectives and technical and diagnostic advice)
  - two targets have increased slightly (research agreements, applications for intellectual property)
  - only one target has decreased (project reporting and milestones).
- In the 2005-06 and 2006-07 financial years, DPI exceeded or met all targets except for the KPI project milestones and reports completed in 2005-06 (DPI advised audit that the failure to meet this target was due to the resource impacts arising from unforseen emergency response commitments).

Figure 5C
DPI Key Performance Indicators

Key Performance Indicators	2004-05 actual	2005-06 target	2005-06 actual	2006-07 target	2006-07 actual	2007-08 target	Measure
Scientific and technical publications in international and peer review journals that promote productive and sustainable farming (including aquaculture) and fisheries systems	314	335	355	335	378	335	Number
Number of commercial technology research and development agreements finalised	nm	70	92	75	91	75	Number
Number of applications intellectual property protection	nm	5	16	10	16	10	Number
Proportion of technical papers submitted to international peer review journals that are accepted for publication	nm	>90	95	>90	99	>90	Per cent
Proportion of non-commercial Agrifood research funding achieved from external sources that is aimed at delivering government policy objectives	nm	100	100	100	100	100	Per cent
Agrifood, fisheries and natural resource management research and development project milestones and reports completed on time	nm	90	85	90	91	85	Per cent
Provision of technical advice, diagnostic identification tests on pests and diseases including suspected exotics within agreed timeframes	nm	90	92.5	90	97	90	Per cent

nm = new measure

* Figures reported are expected outcomes

Source: Victorian Government Budget Paper no.3, 2007-8. Actuals for 2006-07 were provided by DPI.

Each Key Project has its own set of performance indicators under the three areas of Control, Influence and Outcome. These are separate to the indicators used by the Policy and Strategy team described above. Key Project indicators will vary across projects. Some Key Project indicators will include benefits from extension services, commercialisation of IP and direct benefits to agriculture. An example of the Key Project indicator reporting template is provided at Appendix G.

The formation of the new Office of Science, Technology and Commercialisation is intended to strengthen the evaluative and continuous improvement capacity within the agricultural research program. The new investment approach has an outcomes framework and will incorporate a more developed set of indicators. The goal is to provide a more rigorous approach to performance monitoring and evaluation. The new approach involves:

- the six main outcome areas relevant to agricultural development, aligned to government and DPI objectives
- specified focus areas and targeted actions for each outcome area
- consideration of community-level outcomes and government goals.

DPI has commenced a project to develop Triple Bottom Line (TBL) indicators in collaboration with the Department of Sustainability and Environment. This has not been finalised. At present, there are no linkages between TBL indicators and the evaluation framework. This should be a priority area for improving the monitoring and evaluation framework.

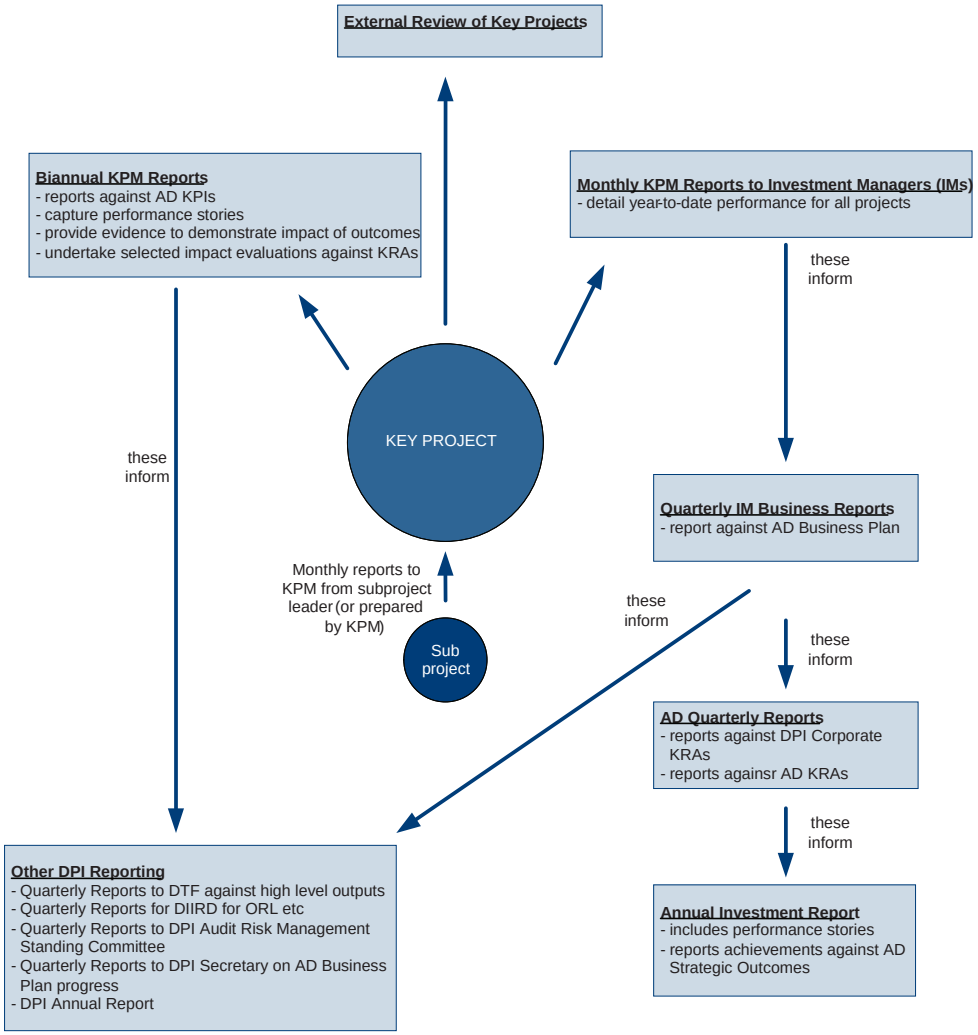
5.2.3 Performance reporting

DPI's reporting regime is complex by virtue of the need to report to various target groups internal and external to Government. Reporting takes place at the sub-project and Key Project levels, and at higher levels against desired DPI and Government outcomes. The set of reports produced by DPI includes:

- the Department's annual report
- *Agriculture Development Division, Agriculture and Food Sector: Investment Performance Report*, produced annually
- *Primary Industries Research Victoria, Achievement Report*, produced annually
- Agriculture Victoria Services' annual report.

The relationships in the reporting structure are illustrated in Figure 5D.

Figure 5D
DPI Reporting Structure for Agricultural Research



Source: Pitt Group Pty Ltd.

There is significant variation in sub-project reporting in DPI. In general, one of three different approaches may be adopted:

- Sub-project Leaders provide monthly reports to Key Project Managers in accordance with a specific template developed for the Key Project
- Sub-project Leaders report using templates or processes agreed with external research co-sponsors
- Key Project Managers prepare reports on behalf of Sub-project Leaders.

These reports then inform Key Project reporting on issues and achievements to General Managers and the Program Investment Managers on a six-monthly basis.

The Key Project six-monthly report is a pivotal document that captures evidence of project success and impact and assesses the progress made towards achieving the planned Key Project performance indicators (as described previously, these fit under the categories of Control, Influence and Outcomes).

Within the six-monthly report, Key Project Managers are required to:

- report against the Key Project performance indicators
- provide performance stories
- provide evidence to demonstrate impact of the outputs; and
- undertake selected impact evaluations against Key Result Areas (key research areas).

5.3 Findings

5.3.1 DPI's performance evaluation methodology

Integrating performance monitoring and evaluation systems

Although DPI's research performance monitoring and evaluation framework demonstrates elements of good practice, there are others which could be strengthened. In particular, there should be:

- better integration of agricultural research performance monitoring and evaluation with DPI and government outcome reporting
- data quality standards to provide greater consistency in performance data across DPI.

The absence of consistent performance indicators across the previous Agriculture Development Division and DPI, and the inadequate aggregation of sub-project performance into Key Project reporting has:

- limited DPI's ability to measure the overall achievement of DPI and government outcomes
- reduced the transparency of reporting on research activity to stakeholders
- prevented DPI from determining the specific contribution of each sub-project to DPI and government outcomes.

DPI has a formalised evaluation methodology that has evolved over a number of years. This is used extensively at the Key Project level, but less commonly at the sub-project level, where its use is dependent on the nature of each particular sub-project.

Monitoring compliance

The audit team conducted eight case studies of research projects from different programs that had been approved in 2005-06. These case studies were chosen from a list of projects provided by DPI. They cover five of the six research programs and varied in terms of funding allocated to each project. The purpose of this analysis was to establish if decisions to allocate funds to a research proposal had been made in accordance with DPI's five Investment Principles and the project evaluation approach. The audit assessed each case study according to whether each project had met, not met or partly met each of the five investment principles.

On the basis of this case study examination, audit found that insufficient information was provided in a number of proposals to allow for an adequate assessment of each project against all of the five Investment Principles. The audit also found that a number of research projects did not comply with standard DPI practice regarding the evaluation of research projects.

Under the new arrangements a more rigorous approach to the assessment of project compliance with Investment Principles and to the evaluation of proposals is proposed. At the same time, DPI also needs to ensure that the system for monitoring and reporting on project assessment and approvals provides comprehensive, accessible and up to date information. A summary of the case study examination is provided at Appendix H.

Comparison with other organisations

DPI's approach to evaluation contrasts with benchmark organisations examined by the audit, including STI, where the evaluation framework is standard across the whole STI program and incorporated into the project initiation phase. The inconsistent application of DPI's evaluation methodology across sub-projects has a number of implications for DPI. The absence of an established evaluation process at the commencement of the sub-project has the potential to affect the potential alignment of the sub-project with broader departmental and government priorities. It also affects DPI's ability to effectively evaluate individual research projects and programs.

Unlike some other organisations (including the CSIRO and the Queensland Department of Primary Industries), DPI does not use a standardised process for undertaking cost-benefit analysis or measuring return on investment across all agricultural research activity. This prevents DPI from being able to demonstrate the cost-benefit of individual research activities, or the cumulative benefit of these activities to government (through contribution to Gross State Product). DPI has however committed to developing more extensive and rigorous measures, including return on investment. DPI advises that these measures will be developed in 2008 following the introduction of the post Roos new science investment framework.

DPI has indicated its commitment to strengthen performance monitoring and evaluation to be better able to demonstrate benefits of agricultural research investment to the government and community. A high priority of the newly established Office of Science, Technology & Commercialisation is to develop a more effective evaluation framework.

Audit recommends that the revised evaluation framework for agricultural research investment should:

- measure the overall contribution to government goals and DPI outcomes, value for money and return on investment
- assess adherence to investment principles
- evaluate the allocation of research funds
- inform future priority setting.

5.3.2 Agricultural research performance data

Agricultural research performance data are collected at numerous levels within DPI. The data includes information about the achievement of DPI key results areas, data on DPI research, Key Project data and administrative data.

Data quality standards for agricultural research are primarily linked to sub-project and Key Project specifications. While this allows for data to be tailored around specific research activity, it does not achieve consistency of data gathering and reporting across DPI, or between individual research activities (sub-projects) within a Key Project. This prevents DPI and stakeholders from determining the relative benefits for different research activities. This is the case at the consolidated Key Project level, between different Key Projects, and at the lower sub-project level.

DPI should consolidate its data systems to improve accessibility and data comparability. The audit identified three priorities for improving reporting:

- provide sub-program-level data and aggregated data
- align the project-level indicators with the DPI indicators
- address the reporting gaps identified in the audit.

5.3.3 DPI's performance reporting

There are numerous requirements placed on DPI staff to report on research activity. Key problems identified with current reporting arrangements relate to the efficiency and effectiveness of current reporting:

- the wide range of reporting formats place a degree of administrative burden on key team members such as Sub-project Leaders and Key Project Managers
- the number of sub-projects underway at any given time exacerbates the reporting burden
- at the sub-project level, co-sponsor reporting requirements and the number of multi-partner collaborations place a further additional burden and may not be consistent with DPI reporting requirements.

Although there is an extensive range of reports produced within DPI on agricultural research, collectively they do not provide a complete coverage of research activities nor are they able to provide an overview of trends and developments in research activity over time. This capacity is essential to providing assurance that the management of agricultural research investment is strategic, transparent and accountable. The reporting regime should not only report on projects completed but should also include analysis of projects merged or discontinued as this will provide a comprehensive and balanced analysis of the overall performance of agricultural research investment, including both successes and failures. Particular reporting gaps noted by audit were:

- not all sources of funds are recorded in one place
- explanations are not provided regarding the prioritisation of funds
- complete lists of research funded or conducted are not included
- programs discontinued; capability areas discontinued or merged are not reported on.

DPI has indicated that it is reviewing the number of sub-projects and will increase emphasis on larger projects with more extensive reporting.

5.3.4 Metadata systems

A further contributing factor to the challenges faced by DPI in reporting effectively is the number of different metadata systems in place within DPI, including the Contract Management System (CMS) that incorporates the Milestone Monitoring System (MMS). While there is a business case within DPI for linking metadata systems, this has not progressed.

In contrast, Queensland DPIF utilises a system called “Clarity” (a performance, management, reporting and metadata tool developed by Clarity Systems) to maintain information about programs. The system has been in place for several years and recently has also been adopted by the New South Wales Department of Primary Industries.

The consolidation of metadata systems across DPI is advisable as it will increase the transparency of reporting to stakeholders and also the potential for lessons learned through research activity to be leveraged across the Department.

5.3.5 Continuous improvement of performance monitoring, reporting and evaluation

Although the agricultural research performance monitoring and evaluation framework has evolved over a number of years, the framework should be further developed to enable DPI to build on lessons learned and further improve performance in this complex and challenging area of agricultural research investment.

This will be particularly important in light of current restructuring within DPI and the implementation of the new Investment Framework. The creation of the new Office of Science, Technology & Commercialisation will provide a centralised area within DPI to take responsibility for the continuous improvement of the monitoring and evaluation framework, as well as providing a specialist area within DPI for overseeing research monitoring and evaluation.

5.4 Conclusion

Aspects of DPI's performance monitoring and evaluation framework for agricultural research are consistent with good practice. Program logic models are well established and used for program definition and evaluation.

However, the specification of desired outcomes for AD and DPI in the past has been broad and difficult to establish the extent to which research projects and research programs are effectively meeting DPI outcomes and Government goals. A multiplicity of reporting formats and performance indicators has prevented DPI from effectively measuring and reporting on scientific achievement. Data collection systems do not readily support research investment program monitoring, evaluation and continuous improvement.

DPI has indicated its commitment to strengthen its approach to performance monitoring and evaluation with its recent reforms. DPI would achieve good practice by:

- aligning organisational objectives, performance indicators and targets that are specific, clear and measurable with Government goals and DPI objectives
- reporting outcomes as well as outputs to demonstrate achievement of the stated Government goals and DPI objectives, including areas where the Department has not made progress, the reasons for this and what action will be taken
- achieving a complete coverage of the organisation to enable a full and fair assessment of an agency's performance (i.e. covering all key areas of agricultural research and related activities, sources of funds, prioritisation of funds, allocation of funds and the management and commercialisation of intellectual property)
- reporting on trends in DPI's agricultural research program and benchmarking DPI's performance to enable Parliament and the public to assess DPI's performance and establish whether DPI is performing as well as similar organisations.

Recommendations

DPI should:

5.1 Strengthen performance monitoring and evaluation of its agricultural research investment to demonstrate the benefits to the government and the community, the achievement of goals and the economic, social and environmental impacts of agricultural research investment. With a view to those imperatives, DPI should develop an evaluation framework which:

- measures the overall contribution of research to government goals, DPI outcomes, value for money and return on investment
- evaluates the allocation of research funds
- assesses the degree of adherence to its investment principles
- informs future priority setting
- tailors the evaluation methodology to different programs and institutions, while achieving consistency of approach and comparability of performance results.

5.2 Review its performance reporting system to enable the assessment of the contribution of research activity to the achievement of DPI and government priorities to be reliably measured, and to increase the transparency of reporting on research activity to stakeholders. DPI's performance reporting system should:

- provide Key Project level and aggregated data
- align project-level indicators and DPI indicators
- address identified reporting gaps, including programs discontinued and capability areas discontinued or merged.

5.3 Develop a standard reporting framework that minimises the duplication in reporting to multiple stakeholders at the Key Project and sub-project level, to reduce the administrative burden on internal stakeholders and expedite the availability of accurate, timely and consistent data.

5.4 Advance the business case for the consolidation of metadata systems across DPI, and investigate alternative customised systems in use in other jurisdictions. This will increase the transparency of reporting to stakeholders and increase the potential for lessons learned through research activity to be leveraged across the Department.

6 Intellectual property and commercialisation

At a glance

Background

An important component of a publicly funded agricultural research program is ensuring that research and development findings, ideas and technology are appropriately protected and commercialised. This allows intellectual property to be used for the community's interest, adding value and contributing to a sustainable and competitive agricultural sector and viable regional and rural communities.

Key findings

DPI has managed intellectual property and the commercialisation processes competently. The requisite policies, procedures and controls are in place.

As part of an improved evaluation framework, DPI should more fully capture information about the overall benefit of its research and extension activities, including both commercialised and non-commercialised research, to provide Parliament and the community with greater levels of assurance on the benefits of the State Government's investment in agricultural research.

DPI should more clearly demonstrate its innovative practice in the management and commercialisation of intellectual property and show how it compares with similar organisations, and how it adopts or leads innovation.

Key recommendations

DPI should:

- Communicate more fully the economic, social and environmental benefits of its research, extension and commercialisation activities to Parliament and the community.
- DPI should embed a continuous improvement approach and demonstrate more fully the nature and impact of innovation in how it manages and commercialises intellectual property.

6.1 DPI's approach to intellectual property and commercialisation of agricultural research

An important component of a publicly funded agricultural research program is ensuring that research and development findings, ideas and technology are appropriately used and commercialised. This allows intellectual property to be protected for the community's interest, adding value and contributing to a sustainable and competitive agricultural sector and viable regional and rural communities.

DPI's research and development program is conducted primarily to provide a public benefit. Generating revenue from research activity via the commercialisation of intellectual property is not seen by the Department as a key priority.

Prior to the recent DPI restructure, the development, management, protection and commercialisation of intellectual property took place through three distinct parts of PIRVic, each with its own responsibilities:

- the research scientists and their respective research directors identified any intellectual property that was generated from current research activity and notified the Technology Commercialisation and Partnership Group
- the Technology Commercialisation and Partnership Group was responsible for managing and commercialising the outcomes of intellectual property generated by PIRVic researchers where the route to market required a commercial firm to be involved. It developed business cases for each element of intellectual property generated and provided marketing, commercial and contract management services to PIRVic. It also managed PIRVic's intellectual property portfolio
- Agriculture Victoria Services (AVS), a private company fully owned by the Victorian Government, played a role in commercialisation. Under the post-Roos arrangements, AVS continues to play the same commercialisation role in collaboration with the new Office of Science and Technology. AVS is a legal entity through which PIRVic protects and commercialises intellectual property. AVS employs two staff and relies on Technology Commercialisation and Partnership Group for commercial, marketing and legal services. AVS is governed by a five-member board. The board's Chair and another board member are DPI executives.

Supporting arrangements for the management and commercialisation of intellectual property have been developed by DPI, PIRVic and the AVS Board. Key documents include the DPI *Intellectual Policy Manual*, and PIRVic *Contract Management: Overview and Procedures for PIRVic Staff*. These documents provide directions on:

- roles and responsibilities of scientists, research directors, the Technology Commercialisation and Partnership Group and AVS
- creation of rights – ensuring that intellectual property generated by DPI employees stays with DPI

- recording of inventions – a record of research conducted and key research findings
- controls on scientific publications and non-disclosure agreements to protect intellectual property from being compromised before it is formally protected
- tracking licensed intellectual property and associated revenues
- managing contracts
- criteria for AVS investment.

Our audit framework identified two key questions for examination with respect to DPI's management of intellectual property and the commercialisation process:

- How effectively is the management and commercialisation of intellectual property monitored and reported?
- Does DPI take an innovative approach to the management and commercialisation of its agricultural research intellectual property?

To assess DPI's management of intellectual property and its approach to the commercialisation of research products, audit reviewed international trends and practice, analysed and reviewed DPI documents and conducted interviews with key DPI staff and external experts.

6.2 Findings

DPI has managed intellectual property and the commercialisation processes competently. The requisite policies, procedures and controls are in place.

DPI's research and development program provides extensive services to the agricultural sector through the sharing of non-commercialised research. Examples were provided to audit of non-commercialised research activity which reportedly provided significant social and economic benefit for the community. However, under current arrangements these benefits are not identified.

As part of a revised evaluation framework, there are opportunities for DPI to develop a more comprehensive set of measures of the economic, social and environmental benefits derived from their agricultural research investment with respect to both commercialised and non-commercialised products. This will more fully capture the overall benefit of DPI's research and extension activities and provide Parliament and the community with greater levels of assurance of the benefits of the State Government's investment in agricultural research.

DPI compares its approach to the management and commercialisation of intellectual property with comparable international and national organisations. DPI could demonstrate this more fully by annually preparing an overview of innovation and the benefits of practice change in its management and commercialisation of intellectual property, including where DPI is at the forefront of practice.

The governance and administration of DPI's commercialisation and intellectual property management activities could be strengthened. A high-level group should be established, comprising senior staff in DPI and external experts, to assist DPI to optimally manage its commercialisation opportunities. This group should review intellectual property and commercialisation activities and processes, and provide advice to the Secretary of DPI on trends, opportunities and innovative practice.

Audit found that lessons learned from the management and commercialisation of DPI's agricultural research intellectual property should be more clearly linked to future planning and development for this area. A more systematic approach to monitoring and review, and a more demonstrable linkage between DPI's approach and innovative practice, will provide higher levels of assurance that DPI is managing this important area well and that it is at the forefront of good practice.

Recommendations

DPI should:

6.1 Communicate more fully the economic, social and environmental benefits of research, extension and commercialisation activities to Parliament and the community.

6.2 Embed a continuous improvement approach and demonstrate more fully the nature and impact of innovation in how DPI manages and commercialises intellectual property. A high-level group should be established to oversee existing practice and identify innovative opportunities to manage and commercialise DPI's intellectual property.

Appendix A
Audit framework and approach

The audit applied a three part assessment framework, outlined below.

1. **How are funds allocated across the Department of Primary Industries' agricultural research sites, programs and projects?**
   - Is there a clear funding allocation framework underpinning research investment that covers the full range of agricultural research activities and sites?
   - Is the allocation method consistent with analogous methods and allocation principles used by benchmark organisations, e.g. DIIRD (Science, Technology and Innovation), CSIRO?
   - Does the allocation method explicitly align to relevant policy frameworks including the DPI strategic plan and Growing Victoria Together?

2. **Are performance monitoring and reporting arrangements for agricultural research adequate and consistent with benchmark organisations?**
   - Is the performance framework clearly articulated and understood?
   - What performance data are collected (e.g. outcomes/impacts, value of intellectual property, levels of industry partnering, benchmark data against agencies here and in other jurisdictions)? How are the performance data analysed? (e.g. by research program, region)
   - What monitoring and reporting arrangements are in place?
   - How effectively is the management and commercialisation of IP monitored and reported?

3. **Is there a focus on continuous improvement in DPI's management of agricultural research?**
   - How do performance results influence subsequent research investment decisions?
   - Is there a focus on continuous improvement and innovation in DPI's management of its research program in general?
   - Is there a focus on continuously improving the funding allocation framework? (With examples of deliberations and improvements.)
   - Is there a focus on continuously improving the data collection and monitoring framework? (Again, with examples of deliberations and improvements.)
   - Does DPI take an innovative approach to the management and commercialisation of its agricultural research IP?

To examine how DPI prioritises its investment in agricultural research activities, and how it monitors and reports on these research activities and their outcomes, the audit team completed the following tasks:

- literature review of research investment and evaluation methodologies with a view to identifying better practice models
- interviews with staff of DPI and selected benchmark organisations, including the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Queensland Department of Primary Industries and Fisheries (DPIF) and the Science, Technology and Innovation (STI) division within DIIRD
- review of investment, evaluation and reporting material from benchmark organisations
- process mapping of investment, performance monitoring and evaluation frameworks and processes within the DPI
- review of DPI investment, monitoring, evaluation and reporting frameworks, including eight case studies and review of reports at various levels across DPI
- testing of DPI processes against better practice models.

Total cost of the audit was $500 000.

Appendix B
Project and Key Project selection criteria

Project and key project selection criteria for research, development and practice change	SCORES[1] (1 = Low/No to 5 = High/Yes)
1. Strategic fit, project logic: • Does the project logic clearly align the project activities and outputs with the Outcomes, Focus Areas and Targeted Actions described in the Four year Agriculture and Fisheries Group Strategy? • To what extent do the outputs contribute to the achievement of these Outcomes?	**Yes** – proceed to criteria 2. **No** – project will not be successful in gaining funding.
2. Role of Government, level of co-investment: • Is there market failure (public goods, externalities and potential spill-over benefits)? • Is the funding ratio appropriate? (Does the level of private and/or industry and/or government co-investment align with potential beneficiaries?)	**Yes** – proceed to criteria 3. **No** – project will not be successful in gaining funding.
3. Route to market: • Is the route to market (including appropriate cross-Divisional linkages, appropriate use of practice change tools and commercialisation strategies) clearly defined? • What is the likelihood of adoption?	1 to 5
4. Return on investment: • What are the economic, environmental and/or social benefits for Victoria? • What is the scale and extent of the issue addressed by the project? • What are the R, D and PC costs and business/industry adoption costs required to achieve the benefit? Does the benefit warrant the cost? • What timeframe is required to yield benefits? • What potential IP will be identified, captured and managed? (*Note: This criteria does not usually apply to Practice Change projects*)	1 to 5
5. Risk assessment, likelihood of success • What are the significant negative environmental, social and economic impacts? • What alternative options have been considered? • Are Quality Evaluation, Communication and Risk Management plans in place? • Is the project well planned (clear objectives, robust methodology, properly costed, clear milestones for project deliverables) and well managed? • Is the project of high quality? • Is the project likely to succeed technically?	1 to 5
6. Capability and capacity to deliver: • What is the track record and capacity of project leader and team? • Is the mix of skills and resources available for project team appropriate? • Are there any potential capability or resource/infrastructure gaps? • Are appropriate linkages in place across groups/divisions? • Do appropriate collaborative arrangements with external parties exist?	1 to 5
7. Innovation (novelty, new approaches, and networks): • Does the project incorporate innovative new activities which may result in step change solutions? • Does the project engage with innovative networks or innovation systems? • Does the project team maintain effective collaborative linkages with leading research and practice change providers both nationally and internationally?	1 to 5

Note: Scores are a useful tool to assist PAG members to debate the relative merits of projects within a Key Project.

Source: Department of Primary Industries, Agriculture and Fisheries, *Four Year Strategy,* 21 January 2008, DRAFT.

Appendix C
Approaches to prioritising research investment

Dairy Australia, Queensland Department of Primary Industries and Fisheries and CSIRO provide examples of other approaches to prioritising research funds.

Dairy Australia links weighted key research priorities with specific funding and type of research to be conducted. It allocates funds according to:

- three key objectives: increase farm productivity (46 per cent); develop value added, high margin markets, channels and products (31 per cent); promote and protect the unique benefits of Australian dairy (23 per cent)
- each key research priority: productivity and adding value (35 per cent); supply chain and markets (18 per cent); natural resource management (9 per cent) climate variability and climate change (3 per cent); biosecurity (3 per cent) innovation skills (18 per cent); technology (14 per cent)
- the time taken for each program to deliver value to farmers:
  - short term: less than two years - it allocates 41 per cent of its funds
  - medium term: more than two and less than five - it allocates 49 per cent of its funds
  - long term: more than five years - it allocates 10 per cent of its funds
- the level of risk involved in delivering research outcomes - not more than 50 per cent of funds are committed to projects that have a less than 50 per cent chance of delivering the planned project outcomes.[1]

Queensland DPI allocates a portion of funds to three specific research areas. This includes:

- established industries and re-working of existing technologies (60 to 80 per cent of funding)
- emerging issues such as biosecurity and food safety (10 to 20 per cent of funds)
- new technologies and establishing new industries (10 to 20 per cent of funds)[2].

[1] Dairy Australia, Strategic Plan 2008-12, *Sustainable Wealth Creation for Australian Dairy Farmers*, 2007.

[2] Queensland Department of Primary Industries and Fisheries, *Research and Development Strategy*, 2005, pp. 12-13.

CSIRO develops its high level research priority areas by evaluating the possible relevance and impact of research. CSIRO prioritises high level research by examining:

- the value of R&D
- whether CSIRO should be involved
- relevance of R&D
- likelihood of adoption
- willingness of partners and receivers of technology to adopt research
- CSIRO research competitiveness.[3]

[3] Tim Yapp and Kate Taylor, CSIRO Presentation to the Victorian Auditor-General's Office, 7th September 2007.

Appendix D
DPI Program Logic examples

The following Program Logic Model example was sourced from current programs within DPI.

KEY PROJECT THEORY OF ACTION

Program Outcomes
Target outcome for KP5.3 is "Profitable and sustainable agricultural industries *contributing to high level DPI and Government outcomes*

⇧

Practice changes by end users audience (Farmers & land managers)
Primary producers and land managers more readily understand, anticipate and respond to changing government, community and market signals in terms of ... • High and rapid adoption of best practice farm management techniques and technologies • Primary producers and land mangers meeting their landscape responsibilities • More rapid uptake of farming practices that meet market requirements • Emergency response and recovery (to be reviewed as part of emergency response project of 04/05) * Performance indicator : examples of practice change (ie what land managers are doing differently as a result of the project

⇧

Extension & other change activities delivered to end users
• Productivity, Sustainability Marketing, Emergency response and Risk management

⇧

Networks & pathways
• Delivery networks, Information pathways

⇧

Value added inputs to design & delivery
• Applied practice change research & review, Development of technical information packages & tools, Social & technical information incorporated into subprojects, Community intelligence, DPI Capacity building, Farming systems, Program planning & management, Statewide Program Planning * Performance indicator : evidence recent research information being incorporated into AD5.3 practice change subprojects * Performance indicator : cross industry information sharing, synergies and consistencies

⇧

Resource Inputs
• DPI and collaborator funding and staff resources

Source: Department of Primary Industries.

Appendix E
DIIRD STI Performance Indicators

Skill base

- Employment research scientists, engineers & support staff.
- Number of Victorian scientists listed in the Essential Science Indicators.
- Number of employees with science or technology PhDs.
- International migrants with science or technology skills.
- Number of science or technology PhD & Masters candidates and students.
- Number of science or technology students awarded PhDs & Masters.
- Number of students enrolled in new undergraduate science or technology courses.
- Number of students in Certificate science or technology courses.
- Professional development and external training courses.

Commercial outcomes

- Employment in “spin-off” companies.
- Number of “seed” and “early” stage new capital investment.
- Value of “seed” and “early” stage new capital investment.
- Number of commercialisation agreements from Victorian research.
- Commercialisation income from Victorian research groups.
- Number of organisations transferring IP on “Public Good” basis.
- Effort in identifying ideas with commercial benefit.
- Number of discoveries with commercial potential.

Scientific research

- Number of scientists listed in the Essential Science Indicators.
- Number of provisional patents and Australian patent applications.
- Number of US patent applications and US patents granted.
- Number of provisional patents granted.
- Number of discoveries protected by copyright.
- Overseas research / co-investment attracted.
- Funding leveraged from other government agencies.
- Refereed journal articles acknowledging STI project.

Collaboration

- Number of research collaborations with industry.
- International research collaborations.
- Number of overseas based researchers involved in projects.
- Number of research / consulting tasks for industry.
- Number of researchers supporting management of research with industry.
- Access to equipment / capabilities by industry / research sector.

Science awareness

- Number of participants directly involved in science projects.
- Number of participants involved in science competitions.
- Number of participants attending science information sessions delivered at schools or community events.
- Number of overseas based lecturers delivering lectures in Australia.
- Number of unique hits on STI related websites.

Appendix F
Agricultural Research Output Measures

		2004-05	2005-06	2006-07	2007-08
Output Measures	Quantity	Technical publications in international and peer review journals that promote productivity and sustainable farming systems	Scientific and technical publications in international and peer review journals that promote productivity and sustainable farming systems	Scientific and technical publications in international and peer review journals that promote productive and sustainable farming (including aquaculture) and fisheries	Scientific and technical publications in international and peer review journals that promote productive and sustainable farming(including aquaculture) and fisheries
		No comparable output measure	Value of external (non-state) funding contribution to research projects that support productivity and sustainable farming systems	Value of external (non-state) funding contribution to research projects that support productive and sustainable farming (including aquaculture) and fisheries	Value of external (non-state) funding contribution to research projects that support productive and sustainable farming (including aquaculture) and fisheries
		No comparable output measure	Number of commercial technology research and development agreements finalised	Number of commercial technology research and development agreements finalised	Number of commercial technology research and development agreements finalised
		No comparable output measure	Number of applications for publicly owned and protected intellectual property	Number of applications for intellectual property protection	Number of applications for intellectual property protection
		Research development and extension projects in progress that promote productivity and sustainable farming systems	No comparable output measure		
	Quality	Proportion of technical papers submitted to international and peer review journals that are accepted for publication	Proportion of technical papers submitted to international and peer review journals that are accepted for publication	Proportion of technical papers submitted to international and peer review journals that are accepted for publication	Proportion of technical papers submitted to international and peer review journals that are accepted for publication
		No comparable output measure	Proportion of non-commercial Agrifood research funding achieved from external sources that is aimed at delivering government policy objectives	Proportion of non-commercial Agrifood research funding achieved from external sources that is aimed at delivering government policy objectives	Proportion of non-commercial Agrifood research funding achieved from external sources that is aimed at delivering government policy objectives
	Timeliness	Project milestone reports completed on time	Agrifood research and development project milestones and reports completed on time	Agrifood, fisheries and natural resource management research and development project milestones and reports completed on time	Agrifood, fisheries and natural resource management research and development project milestones and reports completed on time

Appendix G
Key Project Performance Indicators reporting

Description (Negotiated with the PM)	Contribution to AD* KPIs (please indicate which AD KPI it contributes to)	Target (for this six months – should be in the last report)	Actual performance against the target	Expansion of variance	Target (for the next six months)
Control Indicators (What you control as a Key Project Manager)					
Example Control Indicators					
Influence Indicators (The next users of the KP outputs and their responses)					
Example Influence Indicators					
Outcome Indicators (The results of what the next users achieve and contribute to a higher level outcome)					
Example Outcome Indicators					
Other contributions to AD *(a)* Key Performance					

(a) Agricultural Development Division

Source: Department of Primary Industries – six-monthly reports.

Appendix H
Summary of case study results

The audit team conducted eight case studies of research projects from different programs that had been approved in 2005-06. These case studies were chosen from a list of projects provided by DPI. They covered five of the six research programs and varied in terms of funding allocated to each project. The purpose of this analysis was to establish if decisions to allocate funds to a research proposal had been made in accordance with DPI's five Investment Principles (articulated in the Investment Handbook) and DPI's standard evaluation and reporting practices.

The eight case studies were chosen from different investment programs with some projects larger than others. These were:

- ADT 43 - 8892 – Sustainable Long Term Strategies for Phylloxera Management under Australian conditions (Plant Health Sciences)
- ADT 21 - 1056 – Barley Molecular Plant Breeding (Plant Genetics and Genomics)
- ADT 53 - 8079 – Intensive Pear Production (CAS)
- ADT 22 - 8071 – Sustainable Tobacco Production (Plant Production Sciences)
- ADT 31 - 7321 – MLA/AWI Haemonchus Surface and Secreted Proteins (Meat/Wool) – (Animal Genetics and Genomics)
- ADT 11 - 7583 – Productive Agricultural Systems that Improve Water Quality – (Soil and Water)
- ADT 12 - 7284 – Improved Fertiliser Decisions for Australian Grazing Industries – (CAS)
- ADT 21 - 7500 – Molecular Markers – Canola (Plant Genetics and Genomics).

The audit assessed each case study according to whether each project had met, not met or partly met each of the five Investment Principles, as well as a number of criteria relating to evaluation and reporting[1].

Reviewing the eight research project proposals selected as case studies, the audit found that insufficient information was provided in a number of proposals to allow for an adequate assessment of each project against all of the five Investment Principles. The audit also found that a number of research projects did not comply with standard DPI practice regarding the evaluation of research projects.

[1] DPI commonly used program logic models such *as Bennet's Hierarchy* for evaluating projects. In the case studies, project documentation was reviewed to determine if an evaluation methodology, such as a program logic model, had been developed.

Under the new arrangements a more rigorous approach to the assessment of project compliance with Investment Principles and to the evaluation of proposals is proposed. At the same time, DPI also needs to ensure that the system for monitoring and reporting on project assessment and approvals provides comprehensive, accessible and up-to-date information.

Appendix I
Acronyms

Name	Title
ADD	Agriculture Development Division
ADT	Agriculture Development Team
CAS	Catchment and Agriculture Services
CRCs	Cooperative Research Centres
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DIIRD	Department of Innovation, Industry & Regional Development
DPI	Department of Primary Industries
DPIF Qld	Department of Primary Industries & Fisheries, Queensland
DSE	Department of Sustainability & Environment
IP	Intellectual Property
KPI	Key Performance Indicator
KRA	Key Result Area
ORL	Our Rural Landscape
PIRVic	Primary Industry Research Victoria
RRDC	Regional Research and Development Corporations
STI	Science, Technology and Innovation (DIIRD)
TBL	Triple Bottom Line
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