Australian Government

Sugar Research and Development Corporation

Sugar Research and Development Corporation Productivity Commission Rural Research and Development Corporations Review

Contents

Executive summary

In February 2010 the Productivity Commission was requested by the Australian Government to conduct an inquiry into the Australian Government's Research and Development Corporations model. This submission is from the Sugar Research and Development Corporation (SRDC)

SRDC has operated under the *Primary Industries and Energy Research and Development Act* (1989) (PIERD Act) since SRDC's inception on 1st October 1990. SRDC's functions are limited to the funding and administration of research and development activities relevant to the Australian sugarcane industry. SRDC does not conduct any marketing activities.

SRDC's Corporate Outcome

> *A profitable and internationally competitive and sustainable Australian sugarcane industry providing economic, environmental and social benefits for rural and regional communities through targeted investment in research and development*

The sugarcane industry

Australia produces around 3% of the world's sugar and contributes 6-7% of world sugar trade. Between 70-80% of Australian production is exported. The gross value of production ranges from $1.0 to 1.5 billion. In 2008-09 sugar was Australia's third most valuable crop export after wheat and wine, and contributed 4.2% of Australia's total farm exports by value (ABARE, 2009). Australian sugarcane and sugar production has declined over the last decade but stabilised in the last three years, primarily as a result of fluctuations in the world sugar price.

The sugarcane industry has some distinctive features. Sugarcane growers and millers are strongly interdependent because the harvested crop is bulky and subject to rapid degradation in quality and sugar content, so mills are located in all growing areas. Payment of SRDC's levy is shared equally by both growers and millers. There are several research, development and extension organisations in the sugarcane industry. They are owned and financially supported by members of the industry, and make a substantial contribution to the R&D fabric of the sector through a focus on particular aspects of industry R&D. SRDC acts as an 'umbrella', providing research coordination and facilitating multi-sector, people development, and higher risk, blue sky research.

SRDC as an organisation

SRDC is one of the smaller RDCs. Its income and expenditure in 2008-09 were $11.09m and $10.25m respectively. Its R&D expenditure in 2008-09 was approximately 2% of the total R&D expenditure of the 16 RDCs that operated in 2008-09. SRDC invested in a total of 154 R&D projects in 2008-09, including those that either commenced or concluded during the year. SRDC has a staff of seven FTE and operates out of an office in the Brisbane CBD.

The RDC model pools industry and government funding and allocates those funds toR&D with purposeful targeting of priorities and oversight by a skills-based board accountable to the funding providers. In SRDC's case the funding contributions by industry and government stakeholders are approximately equal.

The SRDC submission

SRDC's intention in this submission is to provide a perspective from the sugarcane industry and SRDC's experience in resourcing and administering R&D investments for that industry. The key points of SRDC's submission are summarised below.

Both qualitative and quantitative analyses have demonstrated that substantial benefits have been delivered to the industry and community from the outputs of SRDC's investments. It is rare for projects to deliver primarily public or private benefits, and most common for projects to deliver a mix of social, economic and environmental benefits. It would be highly inefficient to develop separate R&D portfolios designed to deliver only public or only private benefits because of their strong interdependence and the difficulty of predicting the range of benefits that a particular R&D investment will deliver.

Quantitative benefit-cost analyses conducted by SRDC at five-year intervals since 1993 found benefit-cost ratios between 4:1 and 13:1 for projects representing aspects of the entire research portfolio.

Outcomes contributing to economic benefits included higher cane yields, higher sugar content, reduced losses of cane and sugar, reduced inputs of fertiliser, water and pesticides, more effective formulations of input products, reduced tractor use and cultivation, reduced crop damage by harvesters, reduced factory costs, greater recoveries from factory processes, improved value chain efficiencies and increased sugar quality.

Many of the outputs delivering economic benefits also produced environmental and social benefits. Explicit environmental benefits included reduced chemical and fertiliser loads in soils and water, reduction in the potential of soil erosion and improved soil structure, increased soil biological activity and diversity, improved on-farm flora and fauna diversity, increased water availability for environmental uses, reduced losses of

waste products, reduced gaseous emissions from farm equipment, soils and mills, and increased generation of electricity and biofuels from renewable sources.

Similarly, social benefits are linked to other benefits and are highlighted for the sake of clarity. They include increased occupational health and safety for industry participants, improved community health, increased human capacity through leadership, collaboration, research capability, and education (including benefits to the community through postgraduate training), and lifestyle benefits through more efficient farm and factory operations.

The promise of enhanced productivity provides a strong rationale for government support for agricultural R&D because of flow-on effects on community well-being, food supply, land availability and export income. One traditional measure of sugarcane productivity, national average crop production per unit land area, has been unresponsive over the last decade. Sugarcane is highly susceptible to the impacts of weather and plant diseases, with two major disease outbreaks and high weather variability over that period. However there is clear evidence that other measures of productivity that are impacted by R&D (and assessed using Total Factor Productivity measures), such as crop genetic potential, crop production per unit of fertiliser, labour, equipment and financial investment have been increasing and have prevented a decline in crop productivity per hectare that would otherwise have occurred from disease incursions and weather extremes. Factory productivity per unit of labour and capital has also increased and enabled milling operations to remain viable in the face of declining returns from low international prices.

There is significant private investment in R&D in the sugarcane industry, largely conducted by industry-owned organisations focussed on agricultural and milling R&D and adoption of improved technologies on farm. These organisations provide complementary services to the R&D investments made by SRDC because they tend to operate at different R&D horizons and with different objectives. There is evidence that since levy payments commenced to SRDC, other R&D investment by industry members has been maintained or increased, and it is clear that the two streams of investment enhance rather than duplicate each other.

SRDC collaborates widely with other RDCs, industry-owned R&D organisations, universities and government to achieve industry and government priorities. In 2008-09, over 97% of SRDC activities were collegially-based.

SRDC is also proactive in addressing emerging needs through project commissioning. Areas such as sugarcane smut incursion, new opportunities for whole cane milling and support for capacity building to address industry/researcher gaps to provide advice on biosecurity-related issues are just a few examples of the agency's responsiveness.

SRDC's investments are purposely targeted according to priorities nominated by government for RDCs generally and established for the sugarcane industry through direct consultations with industry, government and researchers. Addressing these priorities has been a key reason why SRDC's projects have delivered a suite of public and private benefits. The promise of multiple benefits enhances the likelihood that a project proposal will score highly on SRDC's investment criteria.

SRDC has extensive interaction with stakeholders, assisted by its location in close proximity to major industry and research organisations and the ease of travel to sugar-producing districts.

The RDC model has delivered synergies for industry and government stakeholders in the targeting, selection and outcomes of R&D investment in the sugarcane industry. Contribution of R&D funds by both industry enterprises and government ensures that all stakeholders take an active interest in the selection and results of R&D investments. The skills-based Board ensures that no one stakeholder dominates decision-making, but that input from industry and other relevant expertise is taken into account along with the broad priorities set by government.

SRDC does not have sufficient funds to invest in all the proposals that satisfy SRDC's investment criteria. SRDC has found it prudent to retain a reasonable level of reserve funds to deal with biosecurity and climate threats. The level of reserves fluctuate in part because of the difficulty of predicting disruptions to projects (which may lead to either delayed or accelerated spending) and the world sugar price which impacts the government contributions through changes in the GVP. Nevertheless in 2009-10 SRDC budgeted for project investment above the level of forecast income, and a consequent reduction in reserve funds to address key research priorities.

SRDC operates one office located in Brisbane CBD which provides close proximity to the offices of the industry Representative Bodies, the principal industry marketing organisation, key research organisations and Queensland Government agencies. In order to maximise the value of its Brisbane tenancy, SRDC have sublet office space to Horticulture Australia Limited and Australian Pork Limited for their Brisbane-based staff.

1 Background

In this submission, the Sugar Research and Development Corporation (SRDC) will primarily address the issues and questions posed in the Productivity Commission (PC) Issues Paper released in March 2010 from the perspective of the sugarcane industry. Submissions from the Council of Rural Research and Development Corporations (CRRDC) and other bodies will address these questions in the broad context of rural industries generally.

1.1 Objectives and Corporate Outcome

SRDC was established under the *Primary Industries and Energy Research and Development Act* (1989) (PIERD Act) and replaced the Sugar Research Council on 1st October 1990. The PIERD Act is an initiative by the Australian Government to involve industry more closely in the determination of the objectives of R&D, and to make R&D more efficient and effective in addressing industry needs.

Section 3 of the PIERD Act lists the objects of the Act, which are to "*...make provision for the funding and administration of research and development relating to primary industries with a view to:*

(a) increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries;

(b) achieving the sustainable use and sustainable management of natural resources;

(c) making more effective use of the resources and skills of the community in general and the scientific community in particular; and

(d) improving accountability for expenditure upon research and development activities in relation to primary industries."

SRDC undertakes to deliver those objects in relation to the sugarcane industry. SRDC's **Corporate Outcome** is:

A profitable and internationally competitive and sustainable Australian sugarcane industry providing economic, environmental and social benefits for rural and regional communities through targeted investment in research and development

1.2 Board Structure

SRDC is a Commonwealth statutory authority with a board of up to nine directors who hold a range of skills prescribed by the PIERD Act and regulations. The Chair is appointed by the Minister for Agriculture, Fisheries and Forestry. Between five and seven Nominated Directors are appointed by the Minister on the recommendation of the Sugar Research and Development Corporation Selection Committee. The Executive Director is appointed by the Board. Current directors are listed in Appendix 2.

1.3 Resources

SRDC has a staff complement of seven FTE, including the Executive Director. SRDC currently outsources its IT, payroll and accounting functions to professional providers and finds this arrangement to be highly effective in servicing the needs of SRDC whilst reducing the corporation's staffing and administrative costs.

1.4 Industry and Research Stakeholders

The PIERD Act prescribes the following representative organisations of SRDC:

- Australian Cane Growers' Council Limited
- Australian Cane Farmers' Association Limited
- Australian Sugar Milling Council Proprietary Limited

SRDC is jointly accountable to the Australian Government and to these representative organisations.

As well, SRDC has research partnerships and regular interactions with the main R&D providers in the Australian sugar industry, including BSES Limited, Sugar Research Limited (through Sugar Research Institute at Queensland University of Technology), CSIRO (mainly Plant Industry and Sustainable Ecosystems), Queensland Department of Employment, Economic Development and Innovation (formerly Department of Primary Industries), several universities, companies and private providers. SRDC is at the centre of a web of research entities that work collaboratively to cover the entire spectrum of sugar industry research, and, until its culmination on 30 June 2010, the Cooperative Research Centre for Sugar Industry Innovation through Biotechnology. SRDC plays a focal role as co-sponsor of variety research, on-farm and farming systems research, technology development, traffic and milling systems research and, in addition, supports people development and cross-industry and cross-RDC research.

Formation of industry research agencies

The sugar industry is unusual among Australian rural industries in that there are several industry-owned organisations that provide services in both extension and research. The two industry-wide companies are BSES Ltd and Sugar Research Ltd. As

well, each sugarcane growing region has a Productivity Services company which is jointly owned by the regions' milling company and the growers. These productivity services companies provide advisory services in cane growing and pest management, and manage the distribution of planting material for newly-released varieties.

The Bureau of Sugar Experiment Stations (BSES) was established by the Queensland Government in 1900 as an agency within the then Department of Agriculture, to undertake the Department's functions as they applied to the sugar industry. BSES was established as a separate statutory authority in 1951. BSES Limited was established as an industry-owned company to succeed the Bureau from September 2003, and the assets of the BSES were transferred to the new entity. BSES Ltd now provides services to the entire sugarcane industry, ie throughout Queensland and NSW. Even prior to the establishment of BSES as a statutory authority, the sugar industry contributed to its own research through a "Sugar Fund" administered by the Queensland Department of Agriculture and Stock. The Queensland Government contribution to this fund was limited to $16 000 (£8 000) and that arrangement continued from the inception of the Bureau in 1951 until 1972. Hence the sugar industry has a history of contributing to its own research that extends back many years.

BSES Limited is the major provider of research, development and extension services to the Australian sugar industry with particular responsibility for variety improvement, extension services, and R&D supporting cropping systems, pest management and biosecurity. SRDC projects managed by BSES Ltd over the previous five years have covered all these topics.

Sugar Research Limited (SRL) is a company owned by the Australian sugar mills. Prior to July 2005, SRL provided R&D services to the mills from a facility based in Mackay known as the Sugar Research Institute (SRI). From July, 2005, Sugar Research Limited entered into an affiliation with Queensland University of Technology (QUT), whereby research staff relocated to facilities at the QUT Gardens Point campus in Brisbane and are now part of QUT's Centre for Tropical Crops and Bio-commodities as SRI at QUT. The group has expertise in cane transport, sugar manufacturing, power generation, sugar refining and sugar chemistry. SRL engages the staff at QUT to carry out projects and consultancies in Australia and overseas.

In addition to the industry-based research organisations, CSIRO has undertaken significant R&D in the sugar industry over the last five years through the divisions of Plant Industry and Sustainable Ecosystems. SRDC has been a core party of the CRC for Sugar Industry Innovation through Biotechnology (CRCSIIB), whose seven-year term commenced on 1 July 2003 and will conclude on 30 June 2010. SRDC committed funding of $4.9m over seven years. That funding was provided through specific projects. The main R&D suppliers to the CRC have been CSIRO Plant Industry, BSES

Ltd, the University of Queensland, and Southern Cross University. CRCSIIB's mission is to combine Australia's strengths in molecular genetics, sugarcane biology, agriculture and industrial extraction to construct the essential platform of scientific understanding, intellectual property, and commercial links that will underpin a value-added sugarcane industry. Its focus has been on farming systems, technology transfer, bio-products, and education.

Funding to Universities has included projects and postgraduate scholarships. Industry-linked organisations include Productivity Services companies, grower and miller organisations, milling companies, grower groups, and agribusiness organisations. The proportions of SRDC project investments provided to different groupings of research organisations over the five year period 2004-05 to 2008-09 are indicated in **Table 1**.

Table 1 *SRDC project investment to research organisations 2004-05 to 2008-09*

Organisation	Funding (% of total)
BSES Ltd	28.5
SRI/QUT	5.7
CSIRO	13.5
CRCSIIB	10.2
State Government agencies	1.6
Universities	10.5
Industry-linked organisations	19.9
Other	10.2

1.5 Funding Sources

In contrast to most RDCs, the SRDC levy is paid equally by both growers and millers on each tonne of sugarcane crushed at raw sugar mills. The payments that millers make to growers for their cane from the proceeds of sugar sales are fixed by formal agreements, and the mills deduct the growers' share of levies from those payments and forward both parties' levies to the Department of Agriculture, Fisheries and Forestry. The millers' share of the levy is not recouped from growers. This arrangement ensures that all parties pay the correct levy and there are no free-riders. Industry levies are matched by the Australian Government according to the provisions of the PIERD Act (broadly dollar for dollar, up to 0.5% of the gross value of production of sugarcane).

There is no non-levied production at present apart from a small quantity of cane grown in the former Moreton mill area around Nambour that is supplied to a processing plant manufacturing livestock fodder. There could be a greater issue about levy payments in future if alternative products such as biofuels or bio-refinery products are produced from cane that is not also processed for raw sugar.

The PIERD Act and regulations prescribe a maximum levy of $0.15 per tonne of sugarcane delivered to a mill for processing for the purpose of producing raw sugar. The current levy is $0.14 per tonne, shared equally between growers ($0.07/tonne) and millers ($0.07/tonne). The SRDC levy has been unchanged since April 2002. **Table 2** outlines the SRDC levy rate since inception in 1990. The drop in the levy between 2001 and 2002 reflected the impact of an outbreak of orange rust disease which caused a sharp drop in crop production and industry income. While some change (increase) in the levy since 2002 might have been expected, low sugar prices and poor industry returns through most of that period prevented that from occurring. Nevertheless, the industry chose to maintain the levy at its existing level in spite of considerable economic hardship to many industry participants during that period.

Table 2 *SRDC levy rate since inception*

From	To	Levy rate ($/tonne)
1 August 1990	31 May 1992	0.06
1 June 1992	30 September 1992	0.10
1 October 1992	31 August 1995	0.14
1 September 1995	30 April 201	0.15
1 May 201	31 March 2002	0.12
1 April 2002	Present	0.14

Figure 1 illustrates the relationship between industry levies and government contributions received by SRDC for the period 1999-2009. The potential government contribution is the amount that could have been paid based on 0.5% of GVP. The actual contributions cannot exceed 50% of SRDC's expenditure in any particular year, but shortfalls below the potential government contribution may be made up in future years if SRDC expenditure is high enough.

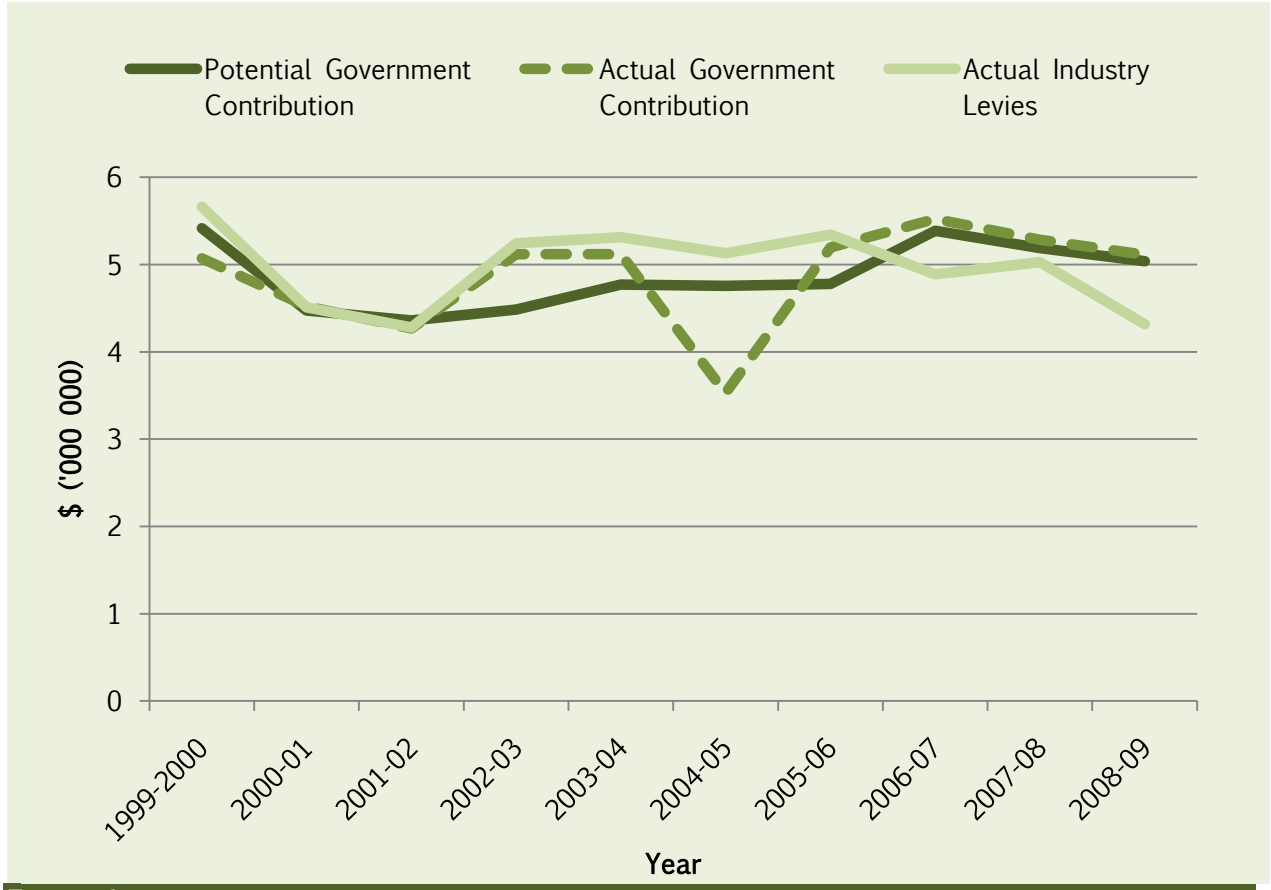

Figure 1 *Industry levies and Commonwealth contributions received by SRDC for the period 1999-2009*

1.6 SRDC Budget

SRDC's budgeted expenditure is $10.044m in 2009-10, and actual expenditure varied between $8.660m and $11.093m over the previous five years. **Figures 2 and 3** show components of income (levies, government contribution, and other sources) and expenditures (projects and operations) for SRDC over the past five years.

Over the past five years, SRDC operational costs have ranged from 14 to 18 percent of annual income, which is higher than some RDCs. However, SRDC includes the full salaries of its research program staff (Investment Managers and Project Assistants) and all staff travel associated with projects in operational costs, rather than treating these as project costs in the accounts. In 2008-09, these costs represented approximately 25% of the operating costs.

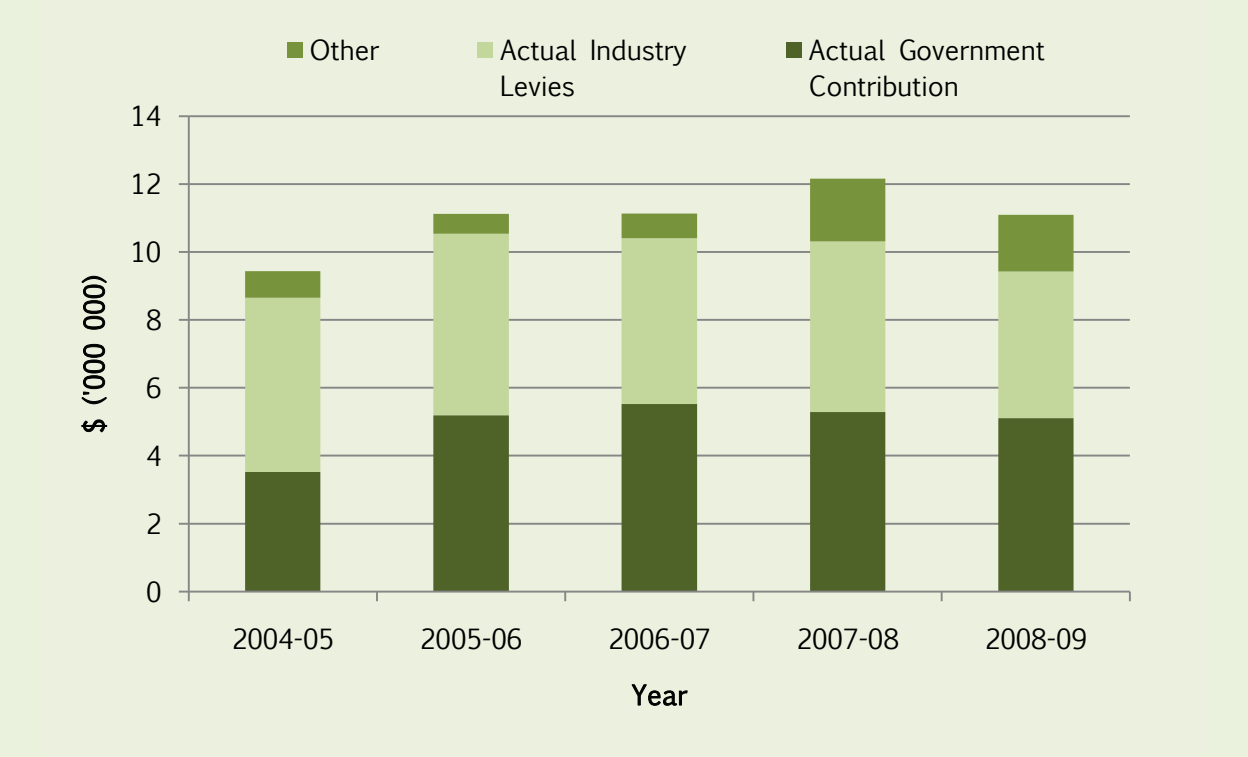

Figure 2 *Components of SRDC income 2004-05 to 2008-09*

Note: Funds classified as 'other' in 2007-08 and 2008-09 include RCP funding

Figure 3 *Components of SRDC Expenditure 2004-05 to 2008-09*

Office rental is another significant proportion of SRDC's operating costs (10.5% in 2008-09). SRDC renewed its office lease early in 2007 at a time of high demand in the Brisbane CBD and a higher staffing complement. Alternatives on the outer fringe of the CBD were investigated, but the savings were minimal and were fully negated by the costs of vacating, removal and new fit-out. In 2009-10, SRDC has ameliorated the costs in part by subleasing part of the premises to two other RDCs (Horticulture Australia Ltd and Australian Pork Ltd) for their Brisbane-based staff. As well, SRDC's meeting facilities are regularly used by project teams and industry stakeholders for meetings between regional and Brisbane-based personnel. On balance, SRDC believes the advantages of a Brisbane location that provides proximity to key industry and research organisations, universities, Queensland Government agencies, and providers of professional legal and accounting services, as well as ready access to all of the Australian sugarcane-growing regions, outweighs the cost of having office space in the CBD. These matters will be reassessed early in 2012 in anticipation of the expiry of the current lease.

The majority of SRDC's income is received from levy payments and government matching contributions. In the five years from 2004-05, levies and government matching provided 44.9% and 43.9% respectively of SRDC's total income. The total income from these sources from the inception of SRDC to 30 June 2009 was $89.0m and $83.8m respectively.

The SRDC Annual Report for 2008-09 reported total financial assets at year-end of $10.491m compared to $11.148m the previous year. This is somewhat above the Board's target level as a proportion of the annual budget, and SRDC has budgeted to reduce the reserves. Nevertheless the Corporation believes that a relatively high level of reserves (between 50% and 80% of annual budget) is prudent in order to respond quickly to crisis situations beyond its control such as the sudden arrival of orange rust disease in 2000 or sugarcane smut in 2008. Such events can trigger the need for a rapid expansion in research activities to screen varieties for disease resistance, something that cannot be done to a large extent before the disease is actually present in the industry. As well, the reserve overcomes the impact of fluctuations in levy income induced by crop variability from year to year. Sugarcane production has varied between 30 and 40 million tonnes per year over the past decade due to a combination of weather, agronomic and economic conditions. For example, there was a difference of nearly $1 million in levy income between the 2008 and 2009 financial years.

1.7 The Australian Sugarcane Industry

Australian sugarcane is grown by approximately 4000 growers and processed by 25 mills on the coastal strip between Northern New South Wales and Northern

Queensland. Australia produced 4.5mt of raw sugar in 2009-10 which is around 3% of world production. In recent years Australian sugar exports represented 70-80% of Australian production and 6-7% of world sugar trade, and the gross value of production has ranged from $1.0 to 1.5 billion. In 2008-09 sugar was Australia's third most valuable crop export after wheat and wine, and contributed 4.2% of Australia's total farm exports by value (ABARE, 2009). The world sugar price was low between 1999 and 2004 but has been rising steadily since then. In consequence, Australian production levels have been stable for the last three years but over the last decade, the area under sugarcane has reduced by around 20%, the number of growers by 40%, and five mills have closed.

Sugarcane is grown in a relatively confined part of the Australian environment (coastal Queensland and northern New South Wales), which is environmentally sensitive. A significant part of the industry's production area is locked in between World Heritage Rainforest and the Great Barrier Reef while the rest of the industry shares the natural environment with the large coastal cities of eastern Australia. The industry's environmental management therefore comes under intense scrutiny from the urban population. Sugarcane is usually the predominant crop by area and value on farms that produce sugarcane. The farming system does involve rotation crops such as soybeans, other legumes and vegetables in some areas. Historically, farm business size in the sugar industry was small and tightly regulated and even though those restrictions have been broken down, the industry still comprises a high proportion of small family run enterprises whose economic viability is marginal in times of low sugar prices. The majority of sugarcane growers are definitely not in a position to conduct their own research. The larger milling companies conduct some independent research but the mills' main involvement with R&D is in collaboration with research organisations.

Characteristics of the sugarcane crop

The sugarcane crop has many unique features compared to other Australian crops. Commercial sugarcane is a genetically complex, polyploidy hybrid between two progenitor species of *Saccharum*. It is planted and harvested as sections of stem rather than seeds or fruits. The crop is harvested annually, or every two years in the southernmost regions, but is only planted once every 4-8 years. In most years, the crop is allowed to regrow after harvest, and these later crops are referred to as ratoons. The crop is tall and bulky and the harvested product must be processed rapidly (typically within 16 hours) to minimise the degradation of the sugars in the cut stems. This and the logistics required to transport the bulky commodity necessitates the presence of mills in all production areas. Therefore millers and growers are strongly interdependent and for most of the history of the industry until relatively recently their commercial interactions were highly regulated.

Varietal germplasm is not readily transferrable from overseas. Almost all of the sugarcane varieties currently grown by Australian farmers were developed in Australia, as overseas varieties tend to perform relatively poorly in Australian environments. Breeding of new sugarcane varieties cannot be achieved quickly. The normal time from crossing (sexual reproduction) to commercial release of a new cultivar is 10-12 years, due to the nature of the crop. Trial results take a long time to finalise since both plant and ratoon crop information needs to be accumulated for evaluation of varieties and agronomic practices.

Machinery used in the Australian sugarcane industry especially for planting and harvesting, was all developed locally to suit Australian crops and conditions, although manufacture of harvesters no longer takes place in Australia and has been relocated to Brazil. In future, as the necessary trend will be to develop machinery for Brazilian, US, or even Indian or Chinese crops and conditions because of the size of their market base, substantial local adaption may be required. Introduction of common technology and some transfer from other crop industries is possible for cultivation and spraying equipment for example, but the sugar industry will always be reliant on its own resources to adapt, modify, and develop appropriate specialised machinery for planting and harvesting. SRDC commissioned a review of harvester technology in 2009 which endorsed the need to develop local protocols for adaptation and efficient use of harvesters developed overseas.

Similarly, Australia has been at the forefront of the development of milling and processing technology. Although most Australian mills have been operating for many decades, R&D has identified a large number of process and design improvements that have been progressively installed in factories.

In pest control, again the nature of the problem is different to that experienced in other crops. The predominant insect pests are indigenous insect species that attack the roots of the sugarcane plant, causing effects similar to restricted water uptake and yield loss. A unique method of controlled release insecticide was developed by the industry to control these pests.

Disease control in sugarcane is achieved predominantly by breeding and controlled planting of disease resistant varieties. This requirement imposes severe constraints on the breeding program in terms of achieving yield and productivity improvements. Together with the extreme complexity and variability in the genetic make-up of the sugarcane genome, these reasons increase the size of the breeding program, and the length of time, that is needed to achieve effective results in developing new sugarcane cultivars. Furthermore, requirements for the range of production environments included in the industry are diverse so that single variety solutions for large sections of the industry are not appropriate. Periodically, entirely new diseases need to be dealt with by the sugar industry. Recent relevant examples include orange rust and sugarcane

smut disease. Smut is a disease which was not present in Australia until 2008 although the industry was always concerned about its arrival and took steps to do appropriate research prior to its arrival. However, the arrival of the disease made it uneconomic to grow some varieties, and the whole breeding program had to be re-focussed causing loss of valuable genetic material with inadequate resistance. Once the disease arrived in Australia, more extensive field testing to evaluate resistance of potential varieties was possible and a substantial re-allocation of research effort was required.

Sugarcane produces a high quantity of biomass and it could be adapted to produce many products apart from sugar. Its unique combination of sucrose (a fermentable substrate) and fibre (cellulose and related compounds that can be burned or otherwise converted to energy products) mean it can be converted to a large range of products that can replace those derived from fossil fuels, such as transport fuels, bio-degradable plastics, organic chemicals, and other bio-materials. It is the only biomass crop grown in sufficient quantity (world production exceeds one billion tonnes), to justify global consideration as a renewable source of fuel and bio-materials. Life-cycle assessment indicates that the environmental impact of diversifying the sugarcane industry to produce bio-energy and bio-materials is consistently positive, as demonstrated by Marguerite Renouf's PhD research at The University of Queensland (Renouf *et al.*, 2010).

Additional advantages of the sugarcane crop for biomass production are the developed system of cane breeding, including genetic engineering research and collaboration with overseas research institutes that exist within the industry, which could be used to develop energy canes once there is an economic outlet for bio-mass derived products. Also the unique set of sugarcane production, harvesting, and transport machinery available to the industry can meet the logistical challenges associated with utilising biomass crops on the scale necessary to be economically viable. These features of the sugarcane crop give it unique advantages not matched by other sources of biomass, which could allow it to contribute to global-scale renewable energy industries and justify continued investment by government in the industry.

The intrinsic qualities of sugarcane mean that much of the critical research for the industry is done over a long timeline that does not align with a three year or five year view and may require different approaches to monitoring and commissioning of R&D investment compared to many other agricultural commodities. Examples include the development of varieties, farming systems and alternative products.

2 Rationales for Government funding support

2.1 Productivity Improvement

One of the strongest arguments for government support for agricultural R&D is that it is the most potent way to improve farm and industry productivity. "It is only when agricultural productivity is very high - so that a farm family can feed many urban residents - a significant share of the population can reside in urban areas and be engaged in manufacturing and services" (Sachs 2008, cited by O'Donnell ,2009). In more general terms, when agricultural productivity is high, land, labour, capital and other resources can be released from food production to expand the non-agricultural sectors of the economy and valuable resources, such as land and water, can also be preserved for environmental use. In coming decades, if populations continue to grow, and natural resources continue to be depleted, growth in agricultural productivity will become increasingly important for maintaining the environment and improving standards of living (O'Donnell, 2009).

Two of the main drivers to improve agricultural productivity are technical progress and improvement in technical efficiency. Both are achieved by research, development, and extension. Technical progress implies the expansion of production possibilities, for example new products made from sugar, and comes through increased knowledge, while improvements in technical efficiency implies that greater output can be produced with the same inputs, possibly by making better decisions in the production process. Investment in scientific research and development is an obvious strategy to expand production possibilities while complementary policies in education, training and extension programs can increase productivity through changes in technical efficiency.

Total factor productivity

The conventional measures of sugarcane productivity are tonnes cane and tonnes sugar per hectare. For organisations with multiple inputs and outputs, more accurate measurements of improvements in productivity are made by total factor productivity (TFP). Total factor productivity is defined as the ratio of aggregate output to aggregate input. Traditionally, index numbers that measure changes in TFP can be expressed as the ratio of an output quantity index to an input quantity index (a measure of growth in output divided by a measure of growth in inputs).

While there have been studies of changes in TFP for Australian agriculture (Mullen *et al.*, 2008) and Australia's position has been compared with other countries internationally (O'Donnell, 2009), there has been no comprehensive study of productivity growth in the Australian sugar industry. Alston *et al.* (2010) describe a number of partial productivity measures, such as yield per hectare, which have risen more or less consistently for Australian sugarcane over many years.

Most published data refers to agricultural productivity broadly. Australian agricultural production is generally characterised by large land to labour and land to capital ratios except in the case of sugarcane farms which are smaller than average size and use much more intense production systems. Because of this, there is little that can be deduced about productivity changes in the sugarcane industry from more general studies.

Statistics are not readily available from sugarcane farms for all of the inputs used in published TFP studies but statistics are available on production area, and several inputs. An analysis of factors influencing TFP in sugarcane production was undertaken, and the results are documented in Appendix 1.

While the area of cane harvested has declined over the last decade, the number of individual growers has also declined and the area per farm has increased. As well, inputs including fertiliser per hectare and water use per hectare have also reduced.

The contribution of new varieties is widely acknowledged throughout the Australian sugar industry, both in terms of productivity improvement and in reducing the risk of severe losses due to disease. However the impact of new varieties on average yield is confounded by seasonal variation, expansion to less suitable soils, and the variable adoption of improved agronomic practices. Cox *et al.* (2005) reported on the rate of improvement in productivity of new varieties in five regions of Queensland during 1980 – 2003, covering varieties released between 1946 and 2002. They found overall industry-wide gains are of 11.8 tonnes cane/ha, 0.3 units CCS, and 1.9 tonnes sugar/ha each decade when a range of other factors such as location (mill) and year of release were accounted for in the analysis.

There was considerable concern in the sugarcane industry in the late 1980s-early 1990s when yields appeared to have reached a plateau. That subsequently led to the formation of the Sugar Yield Decline Joint Venture. This project has led to several improved agronomic practices which are being progressively adopted and are delivering productivity improvements. A more detailed description of the project is provided in the next section of this paper.

The TFP analysis concluded that while total sugar industry output has been relatively static over the past two decades, all major inputs have been declining – some of them markedly so – including land, labour, fertiliser, and capital (machinery). The obvious conclusion is that Total Factor Productivity must have risen substantially during this time. R&D has been an important contributing factor delivering both increasing genetic potential and agronomic performance. Research results have given the growers confidence to reduce inputs that are widely regarded as having a major effect on productivity, for example, nitrogen fertiliser, and improve the efficiency with which other inputs are utilized, for example irrigation water, without causing detrimental losses.

2.2 Evaluation of benefits from SRDC investments

Since its inception, SRDC has invested approximately $172 million in research and development projects. SRDC has commissioned evaluations of the SRDC portfolio at approximately 5-year intervals between 1993 and 2008. These evaluations have enabled refinement of SRDC's assessment and evaluation procedures and have consistently indicated that SRDC's investments have provided considerable overall benefits to the industry and the community.

As well, SRDC is participating in the current three-year evaluation program of the Council of Rural Research and Development Corporations (CRRDC). Four clusters of SRDC projects (nominated by the CRRDC) are currently being assessed by an external consultant as part of the 2010 evaluation. SRDC contributed data from randomly-selected project clusters to the 2008 and 2009 evaluations, which have been reported in detail by the CRRDC. In 2008 SRDC engaged PricewaterhouseCoopers (PwC) for a high-level evaluation of the complete investment program since 1990 as well as a more detailed assessment of the previous five-year period.

As required by the PIERD Act, to achieve its objectives SRDC has developed R&D plans for each five-year period since its inception. The investment areas that were the focus of SRDC's activities over the past two decades (presented in **Table 3**) have shifted significantly to achieve two important changes: to simplify administration and to fund projects that deliver public benefits in addition to private benefits.

Changes in portfolio investment directions

Two aspects of change to the SRDC investment program are evident. In the early years of SRDC, the focus was much more on funding research that would deliver private benefits, such as improved productivity, transport, and sugar manufacture. In the first period 1992-1997, only one investment area (out of seven) appeared to address problems with potential public benefit, ie. adoption of improved technology and sustainable management systems. Following the first major review of research priorities in 1991-92, six priority areas recommended by the Queensland Sugar Industry Research Co-ordinating Committee were adopted. For the first time, concepts such as sustainability, efficiency, communication and co-ordination, training and commercialisation, which imply the delivery of public benefits, were introduced. In subsequent periods 1995-2000 and 1999–2004, investment in **environmental and natural resource management** and **whole-of-industry competitiveness** were introduced as significant investment areas. By 2003, a program called industry capacity was introduced which continued in the 2007-2012 investment period as the People Development Arena. The other Arenas in the current portfolio are Regional Futures and Emerging Technologies. In Regional Futures, and to a lesser extent, Emerging Technologies, parties outside the sugar industry are often included among the project stakeholders.

There has been a substantial consolidation of projects in the SRDC portfolio in the most recent R&D Plan. There are now fewer but larger projects which require less administration to manage and the average investment in projects has increased. **Table 4** summarises data presented in the PwC 2009 evaluation report in greater detail.

Table 3 *SRDC Investment areas (Programs and Arenas) over five R&D Plan periods*	
1992-1997	Improved cane productivity in a sustainable environment Improved farm mechanisation and transport systems Enhanced efficiency of sugar manufacture Enhanced marketability Improved utilisation of by-products Adoption of improved technology *and sustainable management systems* Operation of SRDC
1995-2000	Plant improvement Crop management Crop protection Cane harvest and transport Sugar manufacture *Environmental and natural resource management* Enhanced marketability *Whole-of-industry competitiveness*
1999-2004	Plant improvement Crop management Crop protection Cane harvest and transport *Environmental and natural resource management* Enhanced marketability *Whole-of-industry competitiveness*
2003-2008	*Program A – value chain integration* *Program B – farming systems* *Program C – Processing and distribution systems* *Program D – Industry capacity*
2007-2012	*Regional futures* *Emerging technologies* *People development*

Table 4 *Program and project statistics for all SRDC R&D Plans*				
R&D Plan	Programs	Number of projects	Cumulative expenditure ($'000)	Average expenditure per project by program (range, $'000)
1992	6	315	23 181	74 (42-92)
1995-2000 & 1999-2004	8	517[a]	90 860	88 (65-165)
2003-2008	4	791	46 753	59 (28-91)
2007-2012[b]	3	148	11 094	75 (32-194)

Source: Adapted from PwC (2009) Table 1, p 10
[a]Total projects for two R&D Plans divided by 2
[b]The period of this Plan is not complete

PwC 2009 noted significant concentration of project investment over time. Among projects commenced under the Sugar Research Council (1988-89 to 1991-92), 70% were less than $100,000 for the total project. By the fourth R&D Plan, that was reduced to 55% with consistent changes in other measures, as shown in **Table 5**.

This consolidation has continued to the present time, with an emphasis on fewer but more comprehensive projects. This has enabled a considerable reduction in administrative workload and a lower cost of administration as a proportion of the expenditure on each project.

Table 5: Project statistics for selected periods under successive R&D Plan periods				
Criteria	88/89-91/92	92/93-94/95	95/96-98/99	99/00-01/02
Projects funded <$100 000 (% of total expenditure)	77 (36)	76 (43)	66 (30)	55 (17)
Projects funded >$100 000 (% of total expenditure)	30 (64)	24 (57)	34 (70)	45 (83)
Largest project ($'000)	<400	<400	>1 000	>1 000
Total planned expenditure ($'000)	6 296	13 506	31 093	28 705
Average investment/project ($'000)	94.9	72.6	96	135.4

Source: Adapted from PwC (2009) pp 14-16

The PwC Report ranks the 21 programs undertaken by SRDC over the period from 1990 to 2008 by total funding. Of these, the 12 programs which would generate significant public (social or environmental) benefit are listed in **Table 6**. Among these programs, it can be noted that Sustainable Farming Systems was the most heavily funded, followed by another eight projects with more than $5 million invested, where significant social and environmental benefits were gained.

Table 6: Expenditure for selected programs over the life of SRDC with significant public benefits			
Original rank by investment out of 21	Program name	Cumulated project expenditure (Nominal $'000)	Adjusted rank by social and environmental benefits
1	Sustainable Farming Systems (Program B, 2003-08 R&D Plan	25 000	1
4	Improved cane productivity in a sustainable environment (Program 1, 1992 R&D Plan)	14 000	2
5	Crop protection (1995-2000 and 1999-2004 R&D Plans)	12 000	3
8	Competitive Whole-of-Industry System (System A, 2003-08)	8 000	4
9	Industry Development (System D, 2003-08 R&D Plan)	7 500	5
10	Environmental and Natural Resource Management (Program 6, 1992 R&D Plan)	7 000	6
12	Sustainable processing and distribution systems (System C, 2003-2008 R&D Plan)	6 500	7
13	Regional futures	6 200	8
14	Industry competitiveness (Program B, 2003-2008 R&D Plan)	6 000	9
18	Adoption of improved technology and sustainable management practices (Program 6, 1992 R&D Plan)	3 000	10
19	People development	2 000	11
21	Improved utilisation of by-products (Program 5, 1992 Plan)	100	12

Table 7 summarises the results of SRDC's evaluations prior to 2008. These evaluations were conducted on a random sample of research projects from SRDC's portfolio. A subsample of projects was identified for quantitative analysis, consisting of all projects with sufficient information about economic benefits to enable a quantitative analysis. To obtain economic statistics for the entire sample of projects, it was assumed that no economic benefits would be delivered from the remaining projects where benefits could not be quantified. The first evaluation in 1993 produced a high benefit cost ratio, but it was based on a small sample of projects. However, the same group of projects was re-evaluated in 1998, and the revised results were only marginally lower.

Table 7: Projects evaluated and benefit-cost ratios for SRDC evaluations 1993-2003

	1993	1998	2003
Total Projects evaluated	20	28	27
Projects suitable for quantitative analyses	5	11	14
Benefit-cost ratio[a]	13:1	6:1	4:1

[a]For the total project sample, at a 5% discount rate

Environmental and social benefits were identified in each evaluation, although details were limited in the first two. In 2003, environmental benefits included reduced nutrient exports from farms, improved waterway health, improved air quality, lower chemical use, increased water use efficiency and improved soil health. Social benefits included capacity building in industry leadership and learning skills, improved farm safety and reduced health risks to the community.

Table 8 (reproduced from the from PwC report) listed a range of benefits that were identified qualitatively as economic, environmental, or social in the 2003 evaluation.

All of the benefits listed under environmental and social categories are clearly public benefits. However several of the economic benefits also incorporate public benefits. Some of the most obvious ones are reduced nitrogen inputs and reduced fertiliser costs (which would result in improvements in water quality of drainage water leaving farms). Higher quality sugar could indicate consumer benefits through lower prices or better quality attributes. Improvements in water use efficiency may also lead to public benefits as do improvements in scientific knowledge.

Table 8: Qualitative categorisation of benefits identified in the 2003 evaluation report	
Economic benefits	Saved fertiliser* Ease of operation Higher cane yields Scientific knowledge* Water use efficiency gains* Reduced yield loss Higher CCS from green harvesting and trash retention Saved production costs Improved CCS due to reduced lodging
Environmental benefits	Reduced nutrients entering waterways Potential reduced impact on other ecosystems Reduced chemical use Improved waterway health Reduced eutrophication and algal blooms Potential for environmental benefits through more effective water management strategies Improved state of soil resources Improved water quality
Social benefits	Increased capacity of industry with respect to leadership Reduced ash and smoke emissions through less burning Capacity building through grower involvement in trials and R&D Improved farm and chemical safety Reduced health risks to community Some capacity building in working together along the value chain Increased capacity of the industry in terms of data collection and awareness of industry impact

Source: PwC (2009) Table 4, p 21

*Economic benefits with a recognised component of public good. Some of these benefits could also be classified as environmental or social benefits, eg. scientific knowledge

The 2008 evaluation was primarily qualitative, and concluded that on average over the portfolio, 50% of benefits were economic, 23% environmental and 27% social. Environmental benefits were in the areas of water quality, enhanced natural resources, improved soil health, and reductions in chemical use, emissions and wastes. Social benefits were in the areas of occupational health and safety, community development, participation in innovation, and communication.

Analysis of public and private benefits

SRDC's evaluations demonstrate that investment in sugarcane industry R&D results in significant private and public benefits. Public benefits are those that accrue to society at large and which society considers valuable, for example improved reef/estuary

health, reduced atmospheric emissions and an increasing number of qualified scientists/engineers. As most projects deliver a mix of private and public benefits, it is usually not possible at the start of a project to identify what the mix of benefits will be.

The Productivity Commission asked RDCs to examine the extent to which each of them provides an appropriate balance between projects that benefit the industry versus those that address the broader public interest in areas such as climate change, managing the natural resource base, responding to market and consumer needs, food security, and bio-security threats.

The 2008-09 SRDC portfolio of 135 projects was analysed according to the expected categories of benefits. Project proposals identify the percentage distribution of social, environmental and economic benefits that the project expects to deliver (totalling 100% for each project). **Figure 4** indicates for each category the numbers of projects for which different levels of benefits are expected. A large majority of projects indicated that they expected to deliver benefits in more than one category, with only 7% of projects indicating they would deliver only social benefits, 3% that they would deliver only economic benefits and none indicating that they would deliver only environmental benefits. Overall, 95%, 92% and 80% of projects respectively indicated that they expected to deliver at least some social, economic and environmental benefits.

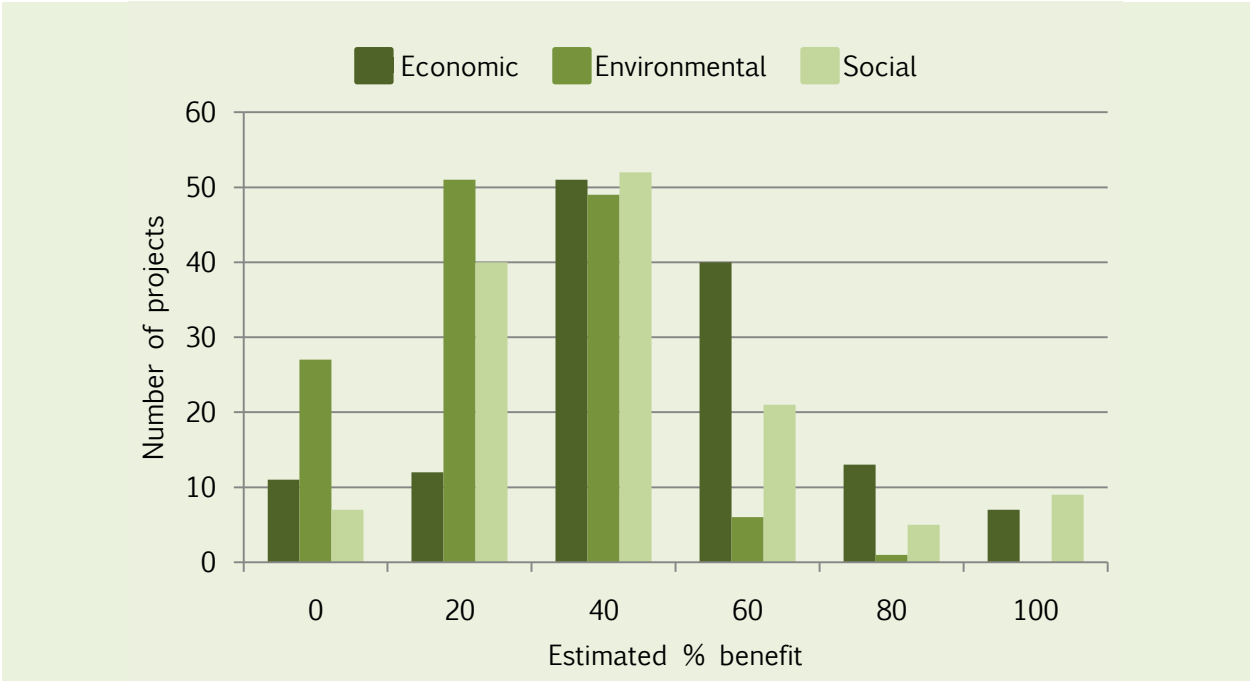

Figure 4 *Number of projects delivering expected benefit in economic, environmental and social areas in 2008-09*

This set of projects shows a balance between achieving economic, social, and environmental benefits from the research portfolio. While the optimum balance could be debated, there is not an overwhelming emphasis on projects that achieve economic benefits (which can mostly be regarded as private benefit) to the exclusion of projects that have social and environmental benefits. There is a reasonable balance in the portfolio between projects that are designed to achieve economic or industry benefits and social or environmental benefits which mostly constitute public benefits.

Two case studies of one recent and one current project are given in the following pages. These are large collaborative projects which illustrate the range of benefits that are being delivered and expected.

Other examples of projects that are achieving public benefits include the adoption of green cane trash blanketing instead of burning the cane crop prior to harvest. Growers in nearly all cane growing districts can now harvest their cane unburnt, or 'green' and leave a portion of the plant trash material on the soil surface to build up soil organic carbon and to improve soil health. While this practice has significant private benefits to the individual farmer, it also results in a public benefit from a reduction in cane fires and reduced ash and CO_2 emissions that would have otherwise been released in the burning process. There is also reduced potential for soil erosion and leaching of nutrients to runoff and groundwater.

Similarly, another SRDC project nearing completion has developed a nutrient management package for industry that outlines best practice nutrient management. While this project was initially established to maximise on-farm productivity, it has subsequently also identified situations where nutrients may have been oversupplied and were likely to cause water quality concerns. This project has devised guidelines to balance productivity with environmental stewardship.

The mix of public and private benefit arising from SRDC's portfolio of investments supports the continued use of the model where funding is shared between the Australian Federal Government, through SRDC, and the sugarcane industry.

The cumulative effect of private benefits results in a public benefit, that is, profitable sugarcane growers and a profitable and sustainable sugarcane industry has a spill over effect, helping to maintain a strong Australian economy that is diversified (resources, agriculture, manufacturing etc).

Case study 1 *The sugar yield decline joint venture*

One of the largest and longest running SRDC projects set out to identify the causes of yield decline and cane yield plateaus, which had been a concern to the sugar industry for a number of years. An investment called the Sugar Yield Decline Joint Venture was established in 1993 and involved a number of funding agencies and R&D providers. SRDC provided significant investment, and the research organisations included BSES Ltd, CSIRO Land and Water and two Queensland Government Departments (the then Departments of Primary Industries and Fisheries and Natural Resources and Water). The first phase of the project ran for six years to June 1999. The second phase followed from July 1999 and ran to June 2005, after a mid-term review in 2002. Projects following up different aspects of this work are still underway.

Economic analysis has indicted an average benefit from the investment over a 25-year period was 9.1 times the costs. A summary of the principal benefits and related costs associated with the outcomes of the project is shown in the table below. The costs included here are implementation costs and exclude the costs of the R&D investment.

Public versus Private Benefits

The project led to widespread and ongoing adoption of a package of farming practices including wider rows, permanent beds, control traffic, and legume rotations that have delivered better yields and reduced costs.

Although a large proportion of the benefits have been captured by the sugar Industry, some significant spinoff benefits to the wider public have occurred from the outputs of this research investment. The rate of adoption and the magnitude of private benefits from this project were significant and have had an impact on maintaining a viable sugar industry on the north east coast of Australia, where a number of communities, particularly in north Queensland, rely on the industry for employment and income. There may also be indirect benefits accruing to the soybean processing and peanut industries in terms of maintaining or increasing the throughput of their processing and/or marketing facilities.

The environmental benefits listed in the table below are clearly public benefits. The improvements in water quality (which have not been valued and may take many years to be revealed) could have significant implications for the sustainability of the Great Barrier Reef as well as other biodiversity implications in streams and rivers downstream from cane farms.

Engaging in such a large program with multiple agencies also provided the opportunity to build collaboration across organisations which will endure beyond the end of the

project. Management at SRDC has studied the factors that made collaboration in this project work and this has been documented in two papers presented at the industry conference (Australian Society of Sugar Cane Technologists). One important lesson for the group was the value that SRDC provided not only from funding, but also through its involvement in the joint venture by reducing organisational bias (as research organisations initially sought to control direction of the project) and by representing the interest of the industry. Such lessons have allowed SRDC to improve its processes.

Principal benefits and costs associated with project outcomes	
Economic	*Benefits* • Cane yield increase in the plant cane and subsequent ratoon crops after the legume crop, due to improved soil health • Cane yield increase due to minimum tillage • Sale of legume grain crop if harvested • Costs avoided of growing and harvesting the foregone cane crop • Cost savings from reduced nitrogen fertiliser and its application in the cane plant crop and (in part) the first ratoon crop • Reduced cultivation and chemical costs for the plant cane crop • Labour savings and improved timeliness and flexibility of operations • Capital savings due to lowered requirements for high powered tractors and tillage equipment • Increased adoption of legume break crop and minimum tillage by cane farmers, due to technology packaging, extension, and greater confidence of cane farmers *Costs* • Loss of income from sale of cane crop for one year • Cost of establishing and managing the legume crop (e.g. cultivation, planting weed control) • Cost of harvesting and marketing the legume crop (if harvested) • Cost of harvesting the additional cane yield • Additional machinery costs due to need for double disc opener direct cane planter
Environmental	• Reduced fuel and fertiliser use • Reduced soil compaction and improved soil health and reduced soil erosion • Reduced level of nitrogen export from farms due to reduced nitrogen fertiliser use • Reduced level of sediment export from farms due to less tillage • Overall likely reduction in any impact the cane industry could have been having on the water quality and biodiversity of proximate coastal waters and possibly on the Great Barrier Reef. • Use of less and softer chemicals so potentially benefiting water quality and biodiversity • Less non-renewable energy used and fewer carbon emissions
Social	• Reduced tractor operations has resulted in growers having more time for family and other activities • Higher level of capacity for change in the sugar industry • Improved scientific understanding and contribution to knowledge • Improved integration of effort between disciplines and inter-institutional cooperation

Case study 2 *Collaboration in precision agriculture*

With the increased adoption of new farming systems by growers and their efforts to reduce soil compaction, many growers and harvesting contractors have been turning to Precision Agriculture (PA). Recognising the high level of interest in the potential benefits of PA, SRDC commissioned studies in 2007 to review and analyse the technologies that were applicable to sugarcane farming and harvesting. The findings were presented at an industry-wide workshop. People attending this workshop represented growers, millers, industry organisations (such as CANEGROWERS), research bodies (such as CSIRO, BSES, QDPI&F and universities), and agribusiness (such as productivity services organisations and consultants). Priorities for further R&D were set to support the Australian sugarcane industry's adoption of PA technologies.

As a result of the potential value from using these technologies, SRDC partnered with CSIRO Sustainable Ecosystems, BSES Limited and the University of Southern Queensland through its National Centre for Engineering in Agriculture, in a collaborative RD&E project. The project, 'A collaborative approach to Precision Agriculture RD&E for the Australian sugar industry', seeks to help cane growers and the broader sugar industry, take advantage of the tools and techniques of PA to achieve both production and natural resource management goals.

Part of the intuitive appeal of PA is that by maximising the efficiency with which inputs such as fertilisers are used, the risk of them being lost off-site is reduced. The sugar industry has begun to use this idea to promote its environmental credentials.

Collaboration between researchers allowed the different skills and resources of the group to be used to great advantage. The group brought experts in precision agriculture research from other industries, particularly viticulture, together with those in technology development, in agronomy and evaluating crop variability. When combined with experts in extension and knowledge of the industry culture and networks, they represent a powerful force to bring about change.

Cane growers from Bundaberg; Burdekin; and Herbert areas are also part of the research group. These growers have experience with at least some elements of PA and have been actively involved in the development of the project.

To date, the project has evaluated the performance of yield monitoring options available to the industry. The results showed that only one of the options provided acceptable results, but it needed to be refined to account for variation in pour rate. Recommendations on the use of yield monitors in the sugarcane industry have been made, including evaluation of other concepts that were not included in the study.

The results were presented to industry at the Australian Society of Sugar Cane Technologists Conference in Bundaberg, in May 2010, with much interest from the industry expressed in the discussions. Other groups conducting research in PA also presented their work at this conference and were part of the discussions. SRDC has taken an active role in the development of this project, to make sure that ideas are exchanged among the groups conducting research in PA and also with industry.

2.3 Level of private investment in industry research

Private investment in agricultural R&D is believed to be less attractive than other sectors such as the manufacturing or mining industries because of the large number of small enterprises and the difficulty of preventing other parties from adopting R&D outputs without contributing to the cost. Private investment in some aspects of sugarcane R&D may be less attractive than investment in other agricultural crops because of the long timelines involved in achieving returns on R&D investment.

SRDC believes the SRDC levy is not a disincentive to private investment. SRDC's experience outlined below indicates that some levy-based investments lead to additional private investment. The principal sources of private (non-levy) expenditure on R&D in the sugar industry are believed to be:

- Subscription fees paid by growers and millers to BSES Limited
- Fees paid by growers and millers to productivity services companies
- Cash and in-kind contributions by milling companies to SRDC projects in the milling sector
- Cash and in-kind contributions by milling and other companies to the CRC for Sugar industry Innovation through Biotechnology (CRCSIIB)
- Cash and in-kind contributions by members of grower groups to SRDC Grower Group Innovation Projects
- In-kind contributions by growers and millers to R&D projects
- R&D commissioned privately by milling companies
- R&D commissioned privately by growers and grower groups
- R&D conducted by and on behalf of agribusiness companies

Further information and data sources for each of these are described below.

Subscription fees to BSES Ltd

BSES Ltd annual reports list amounts received as fees and service charges in 2008-09 and 2007-08 as $13.595m and $14.390m respectively. These amounts reflect voluntary fees paid by millers and growers as a contribution to BSES Ltd R&D and services, including access to extension services, publications and PBR-protected varieties. BSES Ltd also receives funding from the Queensland Government (recently $4.0m per year, BSES Ltd Annual Report 2008-09).

Fees to Productivity Services companies

Each milling region in Queensland is serviced by a Productivity Services company, jointly owned by the mill and the growers of the region. These companies provide a range of advisory and R&D services including pest surveys and control measures, and provision of disease-free planting material for recently-developed varieties. The R&D component of these services would be for applied R&D and adoption support for R&D outputs. Income received by these companies is not on the public record, but they are known to be funded by a levy on cane production of between 5 and 7 cents per

tonne paid by both growers and millers. An estimate of the total annual funding of these companies by members of the industry is $3.6m, based on 30m tonnes of cane and an average total contribution of 12 cents per tonne.

Cash contributions by milling companies to SRDC projects

Many SRDC projects conducted by the Sugar Research Institute are supported by cash contributions from a syndicate of milling companies. SRDC's data on these contributions is for whole-of project, not for individual financial years. For the five years from 2004-05 to 2008-09, 30 new milling research projects were commenced by SRI/QUT. Mills contributed funds to 26 of the 30 projects. Total SRDC funding of those projects was $2.933m, and total funding by milling companies was $1.701m.

Cash contributions by companies to the CRCSIIB

Parties to the CRCSIIB include three milling companies and five other companies, all of whom have made cash contributions to the CRC in support of its R&D program. Over the term of the CRC, the milling companies have contributed $1.901m and the other companies $5.854m. SRDC has contributed $4.90m.

Cash contributions by members of grower groups to SRDC Grower Group Innovation Projects

In 2005-06, SRDC commenced a new initiative to support R&D activities by grower groups. Between then and 2009-10, 57 Grower Group innovation Projects (GGIPs) have been approved. The data available on the cash contributions by members of grower groups to these projects is on a whole of project basis rather than individual financial years. For the 57 projects approved in the five-year period, total SRDC funding was $2.948m and total funding by group members was $3.344m.

In-kind contributions by growers and millers to R&D projects

As well as the cash contributions by millers to milling R&D projects and growers to GGIPs, both groups provide in-kind contributions to these projects. Many milling projects are conducted on mill sites, and milling companies contribute in-kind resources in the form of staff time and equipment. Similarly, growers are required to contribute their time to GGIPs to conduct the operations of the project. Growers also contribute to other R&D projects by providing land on which to conduct experiments and in some cases growers undertake farm management operations on experimental sites including cultivation, applications of fertiliser, herbicide and irrigation, and harvesting. SRDC has limited data on the value of in-kind support provided to R&D projects by growers and millers.

R&D commissioned privately by industry members

SRDC has no data on funds directed to R&D commissioned privately by industry members. SRDC believes that commissioning of R&D by growers and grower groups would be relatively minor compared to the total levies paid by growers towards R&D. The level of private funding of R&D by milling companies may be higher. For example,

some mills conduct in-house R&D and some collaborate with Sugar Research Limited to undertake commissioned R&D on topics of specific interest to their particular mills. As well, milling companies are known to have commissioned other work through various universities.

R&D conducted by and on behalf of agribusiness companies

As in other rural industries, agribusiness companies conduct R&D on topics such as pesticides and fertilisers. There is also considerable private investment overseas in developing new sugarcane varieties including GM varieties. Much of the R&D relevant to the sugar industry would build on product development work conducted elsewhere in Australia and overseas. SRDC has no data on the level of R&D investment by agribusiness companies and has not participated in R&D to evaluate agricultural pesticides or novel fertilisers.

In summary, the combined investment by industry members in BSES Ltd and Productivity Services companies is around three times the amount that is paid to SRDC as levies. In other rural industries without similar industry-owned companies, some of this investment would be met by an RDC, private companies and/or state governments. An example would be RDC investment in routine plant breeding and selection. In the sugar industry, SRDC invests in projects aimed at developing improved breeding and selection systems, while routine breeding activities are undertaken by BSES Ltd. Likewise, the oversight of pest and disease management in the sugar industry has been predominantly funded by the industry, initially by the local Pest and Disease Control Boards which have more recently become the local Productivity Services companies funded by growers and millers. Private provision of advisory and consulting services in farm management and planning, and state government support for similar activities in the sugar industry have been limited.

Prior to the 1980s, the then CSR Sugar Ltd (now Sucrogen) invested heavily in sugarcane and sugar products research, to the extent of running a cane breeding program for CSR mill areas from a base at Macknade Mill in north Queensland, a plant physiology research facility (David North Research Centre, Indooroopilly, now site of BSES Limited Head office), and extensive sugar quality laboratories at Roseville in Sydney. In more recent years, the through-put of the company mills has been inadequate to justify continuing this R&D investment. Sucrogen has continued to collaborate in variety selection with CSIRO and BSES Ltd, and with other industry-based and external R&D organisations to support ongoing R&D activities.

Harvester research is another good example of the industry scale needed to justify significant research activities. In the period when the Australian sugar industry was transforming from manual to mechanised harvesting (1960 to 1980s), two of the world's leading cane harvester manufacturers, with their respective back up R&D activities, were located in Australia (at Bundaberg). Massey Ferguson closed their

factory many years ago, and Case (Austoft) re-located harvester manufacture to Brazil around 2005. The commercial reality of conducting agricultural R&D within companies is that it can only be justified economically if the outcomes can potentially be applied on a sufficiently large scale to give an adequate return on a risky investment. The risks associated with investment in agricultural R&D are much too great, and the potential returns not attractive enoough, to encourage most public companies to invest.

The significant investment by industry is largely linked to collaboration with research projects. In particular, SRDC investment in projects managed by grower groups appears to stimulate significant levels of joint investment by members of the groups. However on an annualised basis the levels of this investment appears to be less than the amounts paid in levies.

Over a 20 year time-frame, SRDC has invested in research and development projects to benefit the sugarcane industry and the communities that it supports. In accordance with the objects of the PIERD Act, SRDC has sought to broaden the number of R&D suppliers to the industry beyond the traditional sources. SRDC has promoted R&D relevant to the sugar industry in organisations such as CSIRO and Universities, and has been a core party in two industry-related CRCs (CRC for Sustainable Sugar Production, 1996-2003, and CRC for Sugar Industry innovation through Biotechnology, 2003-2010). SRDC has also promoted collaboration among research organisations, and a high proportion of SRDC's research projects (49% in 2008-09) involve partnerships between two or more research organisations.

While CSIRO and the Universities also receive government funding, SRDC understands that those organisations rarely participate in R&D for the sugar industry unless SRDC or another body is providing the funds to do so. Organisations external to the sugar industry are increasingly unwilling to provide in-kind contributions of staff time to R&D projects.

Broadly speaking, SRDC's portfolio of applied research is predominantly conducted by industry-related bodies, while the more basic or fundamental research tends to be the province of universities, CSIRO, CRCs and in part BSES Ltd. While industry-funded R&D may also deliver some public benefit, it tends to be only as an indirect result of R&D that is specifically targeted to industry objectives. By contrast, SRDC's R&D portfolio is required to address the Australian Government's National and Rural R&D priorities which ensure that projects explicitly focus on delivering both public and private benefits. Flexibility in choosing research suppliers has enabled SRDC to respond appropriately to both government priorities and emerging issues. Approximately two thirds of projects in SRDC's portfolio in 2008-09 were assessed as addressing more than one of the seven rural R&D priorities.

Many of SRDC's investments are made in important areas of market failure. The industry is characterised by a large number of relatively small producers unable to capture sufficient benefits from R&D they would fund as individuals, which potentially leads to underinvestment. The difficulty with private investment in cane breeding and in harvester development has already been described. Other gaps in industry R&D not sufficiently addressed by industry R&D providers include people development, environmental stewardship and large cross-commodity issues such as climate change.

3 Is the RDC model fundamentally sound?

3.1 Market failure

The RDC model as implemented by SRDC ensures that significant beneficiaries of the research contribute to its cost. SRDC derives income from levies paid by growers and raw sugar millers, roughly matched by contributions from the Australian Government, while the research conducted with these funds provides public as well as private benefits. Because of the difficulty in quantifying public benefits from either individual projects or the whole research program, it is not possible to say conclusively that contributors are getting value equivalent to their contributions, but the balance achieved by the current portfolio, suggests each group of participants is getting a substantial return on their investment.

Some of the main economic justifications for the RDC model lie in the fact that it overcomes potential market failure which prevents the optimal level of research services being provided to an industry. It also allows projects that deliver substantial public benefits to be funded, and encourages industry participation in priority setting and early adoption of research results. Public funding of research also provides the opportunity to influence research in accordance with government priorities, to be articulated as part of the National Rural R&D Plan and the National Sugarcane Industry R&D Plan.

Some of the issues regarding market failure have already been addressed. The large number of industry participants, who are too small to invest individually in the research needed to progress the industry, has already been mentioned. Even the largest enterprises in the Australian sugar industry have found that they could not sustain the level of investment in agricultural R& D that they made in earlier times. The R&D Corporations model allows relatively small individual contributions to R&D to be aggregated, and supplemented with government funds, to achieve research goals that would be beyond the scope of any individual investor. Furthermore, research administrators are willing to direct industry funds to projects that achieve public benefits when there is a public contribution, something that is unlikely to occur when only industry funds are available.

3.2 Priority Setting

With multiple pressures on RDC funds, it is imperative that SRDC responds to these pressures with a clear focus on priorities. The SRDC Board targets industry and government priorities in determining its investment portfolio. The SRDC Annual Operational Plan (AOP) outlines how the coming year's activities will address the priorities outlined in the SRDC R&D Plan. The AOP also outlines the level of annual investment directed towards each of the National and Rural R&D priorities.

The SRDC Annual Report outlines how recently completed and ongoing project investments are addressing the priorities outlined in the SRDC R&D Plan. The Annual Report also outlines the level of annual investment directed towards each of the National and Rural R&D priorities.

As one of the PIERD Act requirements, SRDC must develop and prepare a Research and Development Plan. SRDC's R&D Plan 2007-2012 was finalised by the SRDC Board in July 2007 after extensive stakeholder consultation and approved by the then Parliamentary Secretary for Agriculture, Fisheries and Forestry in August 2007. The consultation process began in 2006 when SRDC sought the views of a range of stakeholders through Regional Workshops and meetings of Working Parties (panels which assisted SRDC with assessment of new R&D proposals). In the latter part of 2006, SRDC commissioned reports on future R&D needs and discussed these at workshops with industry, research, Government and community stakeholders. Feedback on early drafts of the Plan was sought from Government and the industry Representative Bodies, and their responses were taken into account by the SRDC Board in finalising the Plan.

The National Research, Development and Extension (RD&E) framework is being jointly developed by government, RDCs, CSIRO and universities. It encompasses fourteen sectoral strategies including sugar. SRDC and the Queensland Department of Employment, Economic Development and Innovation are overseeing the development of the sugar industry strategy in collaboration with industry and other stakeholders. The agencies aim to have a final draft prepared for submission to the PIMC meeting in September 2010. A workshop to identify final input for the framework was conducted on 25 June 2010. The goal of the workshop was to finalise and endorse the overarching vision, and the specific RD&E goals contained in the strategy. The National RD&E framework will underpin SRDC's ongoing processes for strategy development and project targeting and selection, and the industry stakeholders are keen to participate in setting the direction for future R&D.

Australian Government priorities for rural R&D investment are outlined in PIERD Act and the National and Rural R&D Priorities. The SRDC Annual Operational Plans and Annual Reports from 2006-07 provide a breakdown of the SRDC investments by each National Research Priority and each Rural R&D Priority. The Minister conveys additional priorities for the Rural R&D sector in writing to each RDC. SRDC addresses these priorities in its investment program and seeks signoff from the Board and the Minister.

All projects address at least one of the National and Rural priorities and many projects address several. Addressing National and Rural R&D priorities developed by the government ensures that the R&D portfolio includes topics that will deliver both public and private benefits. For example, the climate change priority leads to R&D that may have a long delivery time as it targets farming and milling practices that will

be beneficial under future climate scenarios. While this will have future benefit for the industry and the community alike, private industry investment would be less likely to invest in R&D with such a long term payoff time.

Table 9 provides the proportions of SRDC funding allocated to each of the National and Rural R&D priorities in 2008-09. Clearly SRDC investment targets some priorities more than others. In both sets of priorities the focus on environmental protection and natural resource management, and on harnessing innovation and advanced technologies, is evident. Investment in productivity and value-adding is clearly also significant, and there is overlap with supply chain R&D as much value-adding occurs along the supply chain.

Table 9 *Allocation of SRDC investments to the National and Rural R&D Priorities in 2008-09*

National R&D Priority	Allocation of SRDC Investment (%)	Rural R&D Priority	Allocation of SRDC Investment (%)
Environmentally Sustainable Australia	24.1	Productivity and Adding Value	42.2
Promoting and Maintaining Good Health[a]	40.2	Supply Chain and Markets	3.4
Frontier Technologies	28.1	Natural Resource Management	19.0
Safeguarding Australia	7.6	Climate Variability & Change	4.6
		Biosecurity	8.2
		Innovation Skills	11.9
		Technology	10.6

[a] Includes economic health
Source: SRDC Annual report 2008-09

The current SRDC R&D Plan 2007-2012 explicitly addresses the need to target investment across a spectrum of applied and strategic R&D. The Plan outlines three investment horizons which span a continuum of lower to higher conceptual complexity, timescales, potential benefits, and research risks, as illustrated in Figure 5.

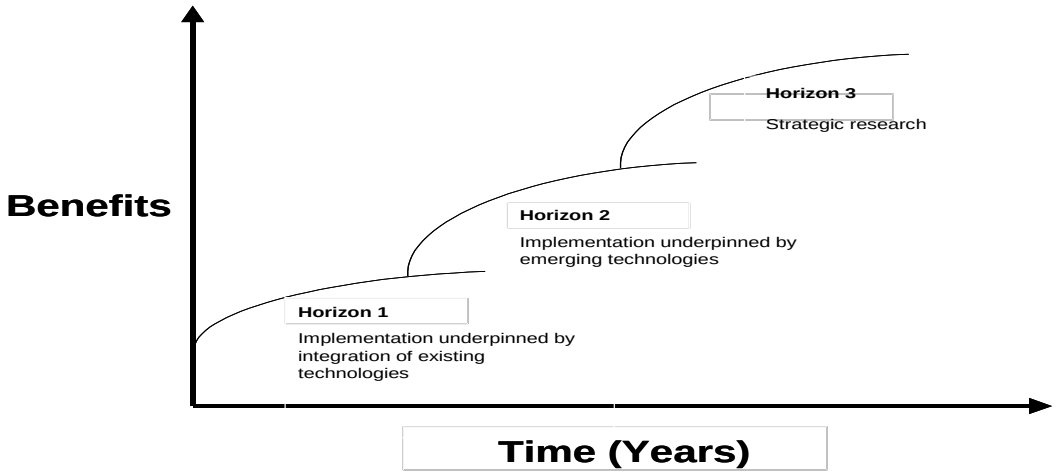

Figure 5 *SRDC's three investment horizons in the R&D Plan 2007-2012*

In Horizon 1 R&D, existing technologies are further developed or integrated, so the timescale is short and the risks of not achieving benefits are relatively low, but with moderate benefits. In Horizon 2 R&D, near-to-market or existing enabling technologies are implemented, but the timescale is intermediate as are the risks of not achieving benefits. The potential benefits, however, can be substantially higher than those from Horizon 1 R&D. In Horizon 3 R&D, strategic research on emerging technologies that are many years from practical application is conducted. In this case, both the risks and potential benefits are very high.

All R&D in the Plan is conducted within one of three Investment Arenas as outlined in Table 10. In the two completed years of the Plan period, the actual funding levels for the three Arenas have been just outside the target ranges of the R&D Plan, reflecting the Board's intention to fund strategic R&D towards the top of the range in the Plan. Over the five year period to 2008-09, research in horizons 1, 2 and 3 comprised 46, 35 and 19% respectively of SRDC's investments. The proportion of horizon 3 R&D increased in the later years of this period, reflecting the emphasis on strategic research in the new Plan.

Table 10: Investment Arenas in the SRDC R&D Plan 2007-2012				
Investment Arena	Arena Outcome	Main Research Horizons	Resource Allocation (%)	
			Target	Actual
Regional Futures	Implementation of innovative farming, harvesting, transport, milling and marketing systems tailored to the needs and opportunities of each region	1 and 2	60-65	58
Emerging Technologies	Rapid translation of relevant emerging technologies that will enhance the industry's competitive edge in the global marketplace	3	20-25	29
People Development	Development of individuals and networks across the sugarcane industry that enhance the capacity for continuous improvement	1 and 2	15-20	13

*Target allocation of resources refers to the targets of the R&D Plan 2007-2012
Actual allocation of resources are, for the first two years of the Plan period, 2007-08 and 2008-09.

3.3 Industry Consultation

In addition to the R&D Plan, SRDC consults with its Representative Bodies annually to ensure that the R&D Plan remains relevant and that the annual call for project applications is suitably targeting the needs of industry. The Representative Bodies formally meet twice a year to receive updates on SRDC performance and to provide feedback on investment directions.

SRDC staff gather a large amount of information on industry priorities through participation in industry events and meetings, for example Board meetings of Representative Bodies and industry strategy workshops. In addition to meetings of industry leaders and representative groups, SRDC staff involvement in regional events such as industry field days, grower conferences, mill engineering workshops and the annual conference of the Australian Society of Sugar Cane Technologists (ASSCT) provide a grassroots level of information on the industry R&D priorities. These informal channels occur on a day to day basis and provide a conduit for industry priorities through to the SRDC Board.

SRDC conducts workshops throughout Queensland and Northern NSW at regular intervals. The input of growers, millers and community to the R&D priorities of the industry is valuable in the preparation of the five-year R&D Plans, while in other years the focus is on providing feedback to industry on the outcomes of R&D projects. SRDC has also run strategic R&D priority setting workshops with representatives of the milling sector and utilised the many grower based meetings that already occur throughout the industry to gather industry stakeholder views.

3.4 Project Selection and Management

SRDC invests in four types of projects, and the process for project selection differs slightly among them. However in all cases assessment is based on two criteria: Attractiveness (the likely benefit) and Feasibility (the risks in delivering it successfully).

- Research Projects are SRDC's core investments in R&D and comprise around 90% of project funding. Research projects undergo a two stage selection process. Stage one involves submission of Expressions of Interest (EOIs) that are reviewed by relevant experts in the field of study to assess their technical merit and expected return on investment. Short-listed EOIs are then invited to make a verbal presentation to a panel consisting of industry and research organisation members to ensure that projects are relevant to the needs of industry. Based on results from the expert reviewers and industry panel, the SRDC Board selects those projects suitable for funding. The project applicant then works with SRDC staff to prepare a more detailed project plan.
- Scholarship Projects support postgraduate study and are assessed by the SRDC Scholarships Committee (which consists of two SRDC Directors and a member of the SRDC staff). SRDC also invests in scholarships targeted to specific fields to address emerging gaps in R&D capacity.
- Capacity Building Projects (CBP) are small projects which support specific learning opportunities for individuals or groups. Applications for CBPs are assessed by a panel of SRDC staff.
- Grower Group Innovation Projects (GGIP), are conducted by grower groups and are an initiative aimed at helping grower groups build their capability to conduct their own research. GGIP applications are assessed by a panel of members with industry and research expertise and SRDC staff.

SRDC strives to ensure that its assessment process is transparent, robust and defensible and facilitates the selection of the best projects to meet the priorities of industry and government within a prescribed budget.

SRDC has formal policies and procedures for monitoring and managing SRDC project investments. SRDC has an on-line policies and procedures database referred to as the Business Process Management System (BPMS). The BPMS folds active quality assurance into the daily management of SRDC. It is an essential tool in ensuring consistency in

process and managing risk and is central to SRDC's corporate governance activities. The Audit Committee oversees an annual audit of the BPMS.

SRDC's project investments are required to submit progress reports (milestone reports) to SRDC at significant points in the project in order to receive project funding payments. These milestones may occur at any time of the year, with most projects reporting at least once every six months. The use of milestone reports facilitates good project management and provides SRDC with ongoing insight into its investments.

3.5 Facilitating Adoption of R&D Outputs

The sugarcane industry faces some significant barriers to the adoption of new ideas and technology. Unpublished information indicates that the average age of sugarcane growers is above that of the national average farmer age of 52. In addition it is understood that fewer sugarcane growers have undergone tertiary education compared with the agriculture sector as a whole. Many sugarcane famers do not rely solely on income from sugarcane to provide for their family, instead many also rely on off-farm income. In addition, a large portion of sugarcane growers operate small farming operations and the capital required to implement a change can often be a barrier to adoption for these small operations. As such there are particular challenges in the sugarcane industry for ensuring the uptake of improved practices demonstrated by R&D.

Extension services in the sugarcane industry are largely provided by industry-owned companies, BSES Ltd and the productivity services companies in each region. There is limited provision of advice by the private sector (mainly by product retailers) and no ongoing involvement by State government agencies. The availability of services from the industry-owned sector has limited the development of private advisory services but SRDC believes that future needs for additional services should be met by the private and industry-owned sectors responding to industry demands, rather than by increased involvement from SRDC.

Recognising the particular circumstances and barriers to adoption in the sugarcane industry, SRDC encourages all project leaders to consider appropriate methods of extending research outputs to industry and relevant stakeholders as part of the project planning phase. These extension methods commonly include scientific publications, industry manuals and factsheets, workshops, presentations at industry conferences and events such as field days.

SRDC also directly facilitates the adoption of SRDC funded research outputs via its communications channels. These channels include the SRDC website, SRDC publications (Annual Report, technical reports) and electronic newsletters. There is limited investment in long term adoption studies of particular project outputs.

Two new initiatives to enhance awareness of SRDC investments and to facilitate adoption of outputs are the SRDC seminar series and regional expos. In 2009, SRDC began its seminar series which involves a presentation about an SRDC funded project by a project leader to an open-invitation audience. SRDC is finding this to be a good method of informing non-industry related individuals (for example state governments, universities and researchers in other commodities) about R&D being conducted in the sugarcane industry. In 2010, SRDC also conducted two regional expos (Mackay Qld and Ballina NSW) aimed at informing local stakeholders about the outputs of some of the SRDC R&D projects that have recently been completed or that are close to completion. Both of these event-based methods of communication have been positively received by participants and are expected to become part of SRDCs standard methods of stakeholder engagement.

The SRDC Board believes that there is room for improvement in the sugar industry's extension, knowledge brokering and sharing, education and extension processes. As an initial step in informing the SRDC Board as to how to improve this, SRDC has commissioned a review into the investments SRDC has made since 2000 in the investment arena "People Development". This review will provide SRDC with recommendations to improve investment in People Development in the years to come. As well, SRDC's recently-announced call for Expressions of Interest for new projects from July 2011 explicitly seeks projects targeting improvement in the uptake of new technologies and decision-making tools by industry participants.

In summary SRDC believes that the RDC model as operated by SRDC is fundamentally sound and that it has delivered synergies for industry and government stakeholders in the targeting, selection and outcomes of R&D investment. Contribution of R&D funds by both industry and government ensures that these stakeholders take an active interest in the selection and results of R&D investments. The skills-based Board ensures that no one stakeholder dominates decision-making, but that input from industry and other relevant expertise is taken into account.

Since government directors were removed from RDC Boards, SRDC has taken active steps to ensure that input from government was still available to contribute to Board decisions. However SRDC believes that the consistent participation of the nominated government director was more effective than the more ad hoc input that has occurred more recently. The Government's National and Rural R&D Priorities do ensure that R&D investments are made across a broad spectrum of topics, and these have provided an appropriate balance between the interests of the industry and government as providers of R&D funds. The government priorities enable SRDC to pursue a range of public good outcomes, often embedded in projects which also deliver benefits to industry. SRDC will continue to strive for greater collaboration among stakeholders to deliver continuous business improvement.

In looking overseas to see if there are superior models, the experience is that agricultural R&D continues to be largely funded by government in most major agricultural producing countries. Therefore funds are declining in the face of competing pressures for public spending from other priorities, in the face of increasingly difficult challenges to the agricultural industries to feed an expanding world population and maintain or achieve sustainability of production methods. The Australian RDC model, by which industry contributes significantly, together with government, to fund research (perhaps as distinct from funding product promotion), has been held up as an example to which other countries might aspire. It is a model that has served Australian primary industries, and the research community, well. While the system can be improved, the benefits that can continue to flow from it should not be diluted by unjustified changes.

4 Funding level issues

SRDC believes that the amount of funding going to sugarcane industry R&D is at a reasonable but not abundant level, given the following considerations:

- The level of industry funding of R&D may be higher in the sugarcane industry than in other rural industries, because of the role of the industry-funded research and advisory organisations, and also because R&D levies cover both growing and processing.
- In most years more R&D project proposals are assessed as meeting SRDC's funding criteria than SRDC is able to fund. It is difficult to precisely estimate the level of unmet demand for R&D that would satisfy SRDC's investment criteria, in part because of the two stage process used to assess new research proposals. In recent years approximately 25% of Expressions of Interest are shortlisted for more detailed assessment. Around half of those not shortlisted are attractive R&D topics but funding limitations prevent further assessment. While not all of these would be ultimately successful, it is likely that a significant number would be if funds were available. At the second, more detailed assessment stage, between 30 and 50% of proposals are unsuccessful depending on the year. The majority of these satisfy SRDC's assessment criteria but are not funded due to limited funds.
- SRDC's reserves provide capacity for funding of critical emerging issues when a delay would cause significant detriment to industry and/or loss of continuity in a concluding project. SRDC's reserves are higher than some RDCs as a proportion of budget but the absolute level is not high given SRDC's relatively small size and the potential requirement for emergent R&D.

SRDC believes that a uniform cap on government matching funds, such as that provided by the use of a consistent proportion of the gross value of production (GVP), provides an appropriate means of allocating funds across industries. Considerations such as longer term competitive prospects or potential for productivity improvements are impossible to forecast accurately and liable to change over time, particularly as most rural industries are competing in international markets.

The calculation of GVP is dominated by the value of raw sugar production. With increasing contributions from other sources of value derived from harvested sugarcane, such as bioenergy, biofuel, fertiliser products and higher value compounds, there will be a need to ensure that these products are appropriately taken into account in determining the gross value of production. Similarly, sugarcane processed directly for these products and not also for raw sugar will not be subject to the RDC levy as it is currently enacted.

Of some concern in regard to funding is the tendency for more government programs to provide funds directly to industries and organisations for activities that may be

closely associated with innovation and change. One example is the *Researcher in Business Grant* which offers up to $50,000 towards research salary costs of individual companies that needs to be matched by the client organisation. Such grants are designed to benefit individuals and firms directly without achieving any of the public benefits that much of the research funded by the RDCs does create. In an environment where competition for government funds is increasing, SRDC would rather see scarce public funds allocated through the RDC system with its recognised methods for determining industry priorities, managing investment spending, reporting and accountability.

Changes to the R&D tax credit system recently introduced into the Australian Parliament should not disadvantage contributions to rural RDCs inadvertently. In the sugar industry, both growers (some of which are structured as companies) and mills (most of which are now structured as companies) contribute to SRDC's levy income. Recent comments from the Senate Economics Committee report seem to suggest that "Too much support under the current scheme is going to large established firms undertaking routine spending only tangentially related to research and benefitting only themselves" (*Australian Financial Review*, 17 June 2010, p10). While is seems unlikely that contributions by companies to rural RDCs would be affected by this legislation, it would be prudent for appropriate checks to be made to safeguard against unintended outcomes before the new legislation comes into effect.

5 Improving the RDC model

5.1 Governance and administration

SRDC does not believe that governance arrangements for RDCs are inappropriately light-handed. The key functions of RDCs are to select the most appropriate mix of investments, and to oversee the conduct of those investments and the delivery of benefits from them.

The fundamental platform for an RDC's operations is established by the five-year R&D Plan, and that is where the greatest potential lies for stakeholder consultation and input. The process of developing an R&D Plan is not hurried as all stakeholders have plenty of notice when a new Plan is due. It is not unusual in SRDC's experience for consultation for a new R&D Plan to occupy 12 months to allow for both the initial gathering of information and progressive refinement of drafts of the Plan. Both the Minister and the industry Representative Bodies are required to approve a new R&D Plan. Therefore existing governance and accountability arrangements should enable all stakeholders to have adequate input into the development of R&D Plans, although of course all views may not be able to be equally accommodated.

A somewhat different situation applies to the development of the annual R&D portfolio. Most RDCs conduct an annual process to identify new project investments. In SRDC's experience the total process requires around 15 months, so some part of the process is always underway and every annual cycle overlaps with the next. SRDC's timetable begins around April with consideration of strategies that should be targeted, and ends in July 15 months later when the new projects commence. Details of the intermediate steps were outlined previously. Consultation with stakeholders is more process-driven and succinct given the sequential procedures required to assess new proposals. The Corporation's Board plays a major role in oversight of the process and is accountable for the investment decisions that are taken. Government input to this process was more direct when there was a government director. Input by stakeholders once the process is completed and an annual plan developed has limited value.

5.2 Single commodity model

SRDC believes that there are significant advantages in the single commodity RDC model. The single commodity RDC provides the optimal mechanism for accurate representation of industry R&D needs and delivery of outputs that cater to the adoption characteristics of the sugar industry. SRDC projects deliver applied research outputs with a cross-sectoral focus that often have the most suitable adoption pathways built into the project design and have the active engagement of the beneficiaries during and after the research phase. One of the great strengths of the industry specific RDCs is their linkage to their constituents. SRDC's Brisbane location

ensures regular interaction with industry and key research organisations, as well as ease of access to all of Australia's sugarcane-growing regions and to Canberra. The sugarcane industry receives transparent accountability for its levy funding and enjoys governance arrangements that enable funds to be spent on high priority issues.

Arguments for amalgamation across RDC's include reduced overhead costs, enhanced cross industry collaboration and reduced R&D duplication. Possible savings in overhead costs would be diluted by the additional costs of travel over the longer term and integration of staff, systems and processes over the short term. Coordination and collaboration are already strong among RDCs, although there are additional costs of travel and time for non-Canberra-based entities that need to be considered in determining future administrative frameworks.

5.3 Cross-industry RDC collaboration

Cross-sectoral RDC collaboration is already occurring under the current RDC model. It promotes collaboration when there is a benefit. Forced collaboration for its own sake may be counter-productive to the already well established collaboration channels between the RDCs. SRDC has direct collaboration with Grains RDC because of the crop rotations between sugarcane and grain legumes, with new possibilities arising for cotton production in the Burdekin. Previously SRDC has engaged in collaborative projects with other RDCs where needs arose, for example with Fisheries RDC to investigate floodgate management in the NSW industry and with Horticulture Australia Limited to investigate nutrient flows in north Queensland soils supporting sugarcane and other crops with high nutrient demand such as bananas and pawpaws.

In addition to these process-driven arguments, the nature of the different crops should be considered. Sugarcane has many contrasts with other field crops. It has one of the most complex genomes of crop plants and there are long (10-15 year) timelines involved in development of new varieties; a single crop rotation lasts 5-6 years with perhaps a single short-term rotation crop to break the monoculture; and it is geographically confined to coastal areas of Queensland and the far north of New South Wales.

SRDC has willingly participated in the current three-year evaluation process of the CRRDC but in the longer term SRDC believes that for a smaller organisation an annual process is unnecessary and absorbs staff and funding resources disproportionately to the benefit. SRDC has gained considerable value from its series of thorough five-year evaluations of R&D investments. There are options for more collaborative work across RDCs without sector specific analysis as well.

References

Alston, JM, Anderson, M., James, J, and Pardey, PG (2010). Persistence Pays: US agricultural productivity growth and the benefits from public R&D spending, Springer, New York.

Coelli, TJ and Rao, DSP, (2005). Total Factor Productivity growth in agriculture: A Malmquist Index analysis of 93 countries, 1980-2000, *Agricultural Economics*, 32(s1), 115-134.

Cox, MC, Stringer, JK and Cervellin, RJ (2005). Productivity increases from new varieties in the Queensland sugar industry. Proc Australian Society of Sugar Cane Technologists 27: 124-132.

Haines, MG and Attard, SJ (2010). WaterSense: Web-based irrigation scheduling and climate interpretative tool supports adaptive management strategies approach, Proc Australian Society of Sugar Cane Technologists, 32:322-332.

Haines, MG, Inman-Bamber, NG, Attard, SJ, and Linedale, AI, (2008). Enhancing irrigation management planning with enviroscan and WaterSense, Irrigation Australia Limited Conference, Melbourne. Web publication S82, 10. http://www.irrigation.org.au

Inman-Bamber, NG, Webb, WA, and Verrall, SA (2006). Participatory irrigation research and scheduling in the Ord: R&D. Proc Australian Society of Sugar Cane Technologists 28:155-163.

Inman-Bamber, NG, Attard, SJ, Verrall, SA, Webb, WA, and Baillie, C (2007). Participatory irrigation research and scheduling in the Ord: R&D. Proc Australian Society of Sugar Cane Technologists, vol 29, on CD-ROM.

Inman-Bamber, NG, Attard, SJ, Haines, MG, Linedale, AI, 2008. Deficit irrigation in sugarcane using the WaterSense scheduling tool, Irrigation Australia Limited Conference, Melbourne 2008. Web publication S79, 9 http://www.irrigation.org.au

Mullen, JD., Scobie, GM, and Crean, J (2008). Agricultural Research: Implications for productivity in New Zealand and Australia, New Zealand Economic Papers, 42(2), 191-211.

O'Donnell, CJ (2009). Measuring and decomposing agricultural productivity and profitability change, Presidential address, 53rd Conference, Australian Agricultural and Resource Economics Society, Cairns, February 2009.

PricewaterhouseCoopers (2009). Review of research and development program. Unpublished report to the Sugar Research and Development Corporation.

Renouf, MA, Pagan, RJ and Wegener, MK (2010). Environmental benefits and trade-offs of producing bio-energy and bio-materials from Australian sugarcane. Proc Australian Society of Sugar Cane Technologists 32:28-37.

Webb, WA, Inman-Bamber, NG, and Mock, P (2006). Participatory irrigation research and scheduling in the Ord: Extension. Proc Australian Society of Sugar Cane Technologists 28:164-172.

Wood, AW, Schroeder, BL and Dwyer, R (2010). Opportunities for improving the efficiency of use of nitrogen fertiliser in the Australian sugar industry. Proc Australian Society of Sugar Cane Technologists 32: 221-233.

Appendix 1 *Total factor productivity analysis in Australian sugarcane production*

Total Factor Productivity (TFP) is defined as the ratio of aggregate output to aggregate input. Traditionally, index numbers that measure changes in TFP can be expressed as the ratio of an output quantity index to an input quantity index (a measure of growth in output divided by a measure of growth in inputs).

While there have been studies of changes in TFP for Australian agriculture (Mullen *et al.*, 2008) and Australia's position has been compared with other countries internationally (O'Donnell, 2009), there has been no comprehensive study of productivity growth in the Australian sugar industry. Alston *et al.* (2010) describe a number of partial productivity measures, such as yield per hectare, which have risen more or less consistently for Australian sugarcane over many years. However, there was considerable concern in the sugarcane industry in the late 1980s-early 1990s when yields appeared to have reached a plateau. That subsequently led to the formation of the Sugar Yield Decline Joint Venture for which SRDC provided significant finance and a project which is described in some detail later in this report.

Coelli and Rao (2005) used data envelopment analysis to prepare Malmquist TFP indices to show changes in agricultural productivity in 93 countries from 1980 to 2000 while O'Donnell (2009) used Moorsteen-Bjurek TFP indices for 88 countries and slightly shorter time series, 1970 to 2001. Data were available for two outputs (crops and livestock) and five inputs (land, labour, livestock, tractors, and fertiliser). He noted that in 1970 and 1971, Australian farmers were technically and scale efficient, and were producing a productivity-maximising combination of outputs. However, they used an inefficient input mix. Then as now, Australian agricultural production is generally characterised by large land to labour and land to capital ratios except in the case of sugarcane farms which are smaller than average size and use much more intense production systems. Because of this, there is little that can be deduced about productivity changes in the sugarcane industry from more general studies.

Statistics are not readily available from sugarcane farms for all of the inputs used in the previously mentioned TFP studies but area statistics are available, the number of farms and farm workers has declined rapidly, and there is anecdotal evidence to show that the number of significant farm machines (tractors and sugarcane harvesters) has also been reduced.

Over the past 20 years, the number of cane farmers and area harvested for cane has declined as shown by figures in **Figure 6**. There has been a drop in area harvested from a peak of over 420,000 hectares in 1999 in Queensland, the main production area, to less than 344,000 hectares at present. However, the average area harvested per farm was 56 hectares in 1989 and that had risen to 65 hectares in 1999 and 67 hectares in 2005. Farm numbers have dropped from around 6,500 in 2000 to under

4,000 now. There has been a 43% reduction in the number of growers in the industry since 2000 and a 20 percent reduction in area farmed.

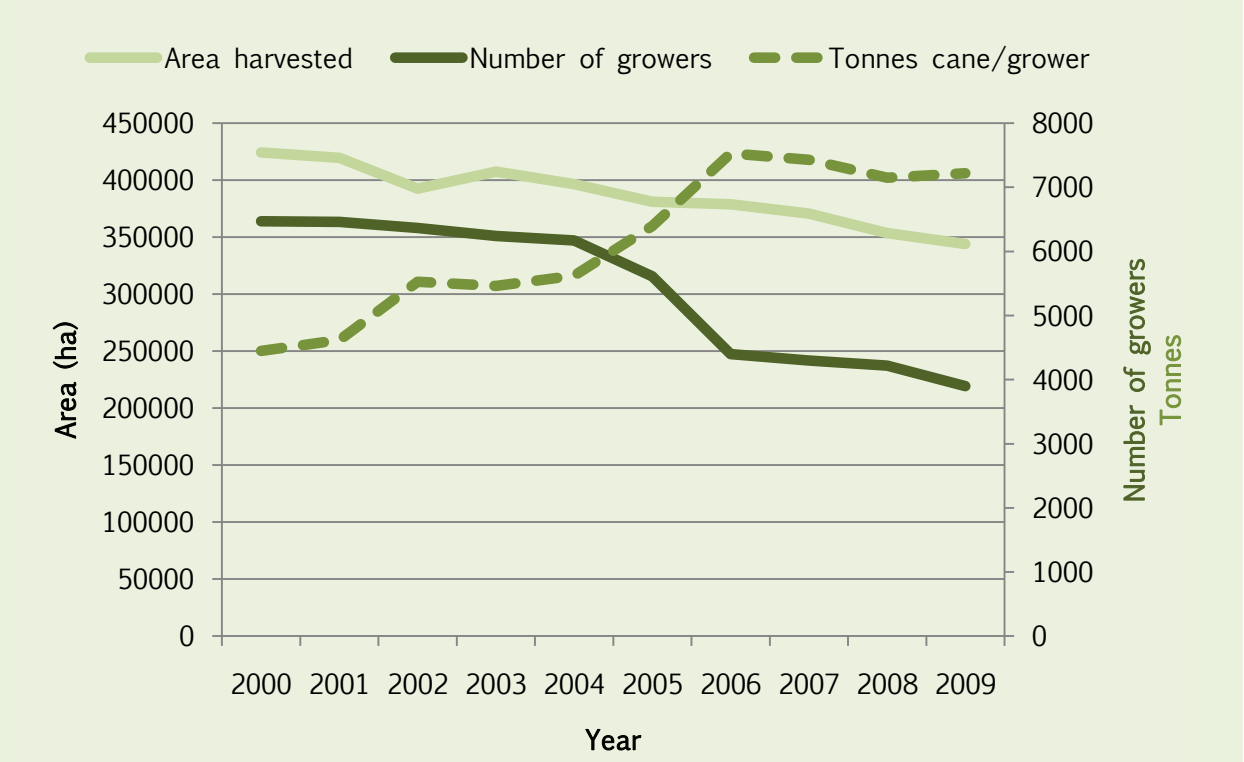

Figure 6 *Number of growers, area of cane harvested, and cane production in Queensland*

Source: CANEGROWERS annual report 2009, ASMC annual report, various issues

Figure 7 *Australian sugarcane yields (tonnes per hectare) 1997-2009*

Source: ASMC statistical database

Output

The estimation of TFP for sugarcane farms is made easier by the fact that most farms produce predominantly sugarcane and only small quantities of other produce. Therefore, tonnes cane crushed for milling is an effective measure of industry output.

Average cane yields reached a peak of nearly 100 tonnes cane per hectare (**Figure 7**) in the late 1990s then declined quite rapidly for a few years in response to poor weather conditions, low prices, and the impact of orange rust disease in the dominant variety grown. As this variety was replaced, yields gradually climbed again but growers continued to be under pressure to reduce inputs to remain viable and weather conditions were worse than normal. In 2008, the arrival of smut disease in east coast cane growing districts, and the need to replace varieties again, added another factor that has depressed yield.

The area of cane harvested in Queensland has gradually declined from a peak of 423 147 hectares in 2000 to around 350 000 ha in recent years. The steady decline recorded in recent years was arrested in 2006 because of favourable sugar prices (**Figure 6**) but a return to lower prices for the 2007 and subsequent seasons saw the area continue to decline. The largest production area is located in the Central District with nearly 120 000 ha harvested in recent years, followed by the combined Herbert-Burdekin area where there is a similar area. Both north and south Queensland areas have shown a steady decline over the past decade. Urban development around major coastal centres has always been a competing land use for sugarcane farmland and competition from alternative crops such as horticulture and tree crops, as well as farm forestry, in times of low sugar prices has encouraged farmers to move away from sugarcane.

Inputs – Varieties

Measures of the contribution of new varieties to improving sugarcane productivity are important but have been difficult to obtain. Such estimates are of interest to plant breeders, funding organizations and the industry at large. While the contribution of new varieties is widely acknowledged throughout the Australian sugar industry, both in terms of productivity improvement and in reducing the risk of severe losses due to disease, it has not been easy to provide objective data to demonstrate the size of the contribution. Large seasonal variation, expansion to less suitable soils, and the contribution of improved agronomic practices are some of the problems associated with isolating varietal effects on productivity (Cox *et al*., 2005). They reported on the rate of improvement in productivity of new varieties in five regions of Queensland during 1980 – 2003. Varieties released between 1946 and 2002 were included in the analysis.

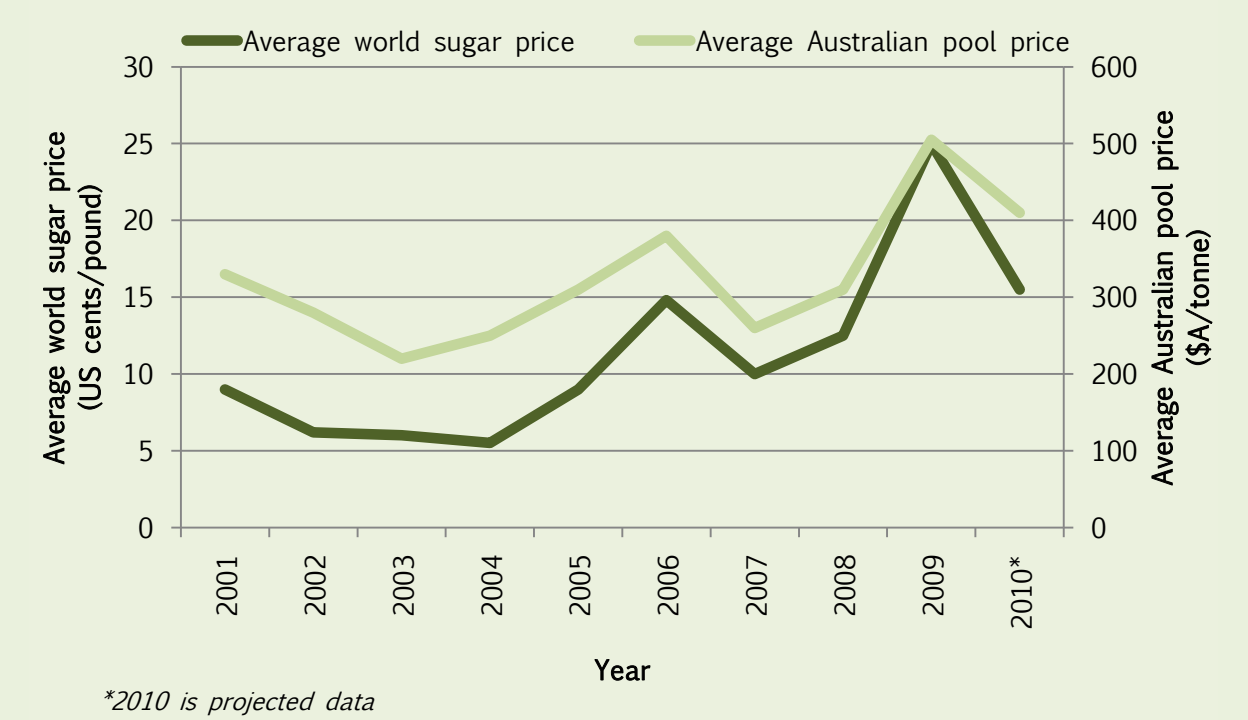

Figure 8 *World sugar price (US cents per pound) and Australian pool price ($A per tonne) 2001-2010*

Source: CANEGROWERS Annual report, 2009

The Cox *et al.* paper includes estimates for improvements in cane yield, CCS, and sugar yield per year for each region but the overall summary is that industry-wide gains are of the order of 11.8 tonnes cane/ha, 0.3 units CCS, and 1.9 tonnes sugar/ha each decade when a range of other factors such as location (mill) and year of release) have been accounted for in the analysis The productivity gains are reported as being constant from year to year (estimated by linear regression) when in reality, this is not the case and they probably tend to be more step-wise. However, they do give a justifiable estimate of the productivity gains coming from this source.

Inputs – Labour

Figure 6 shows the dramatic lift in labour productivity in the sugar industry over the past decade. From an average output of 5 000 tonnes per grower in 2000, the average output is expected to rise to 9 000 tonnes per grower this year. Both the number of farm owners and employees has declined as the mining boom in Queensland offered workers wage rates against which farmers were unable to compete.

Inputs – Machinery

Only aggregate tractor and machinery sales data for Australia are readily available (see for example, ABARE Australian Commodity Statistics, or Tractor and Machinery Association) showing that annual sales of all tractors declined from about 12 000 to 15 000 per year in the mid- to early 1980s to 6 000 to 8 000 by the year 2000.

After some very low sales years in the early 2000s, sales have recovered in recent years to around 12 000 to 13 000 units. It is not easy to estimate what share of total tractor sales in Australia is absorbed by the sugar industry. While economic conditions in the sugar industry do not necessarily reflect those in broadacre agriculture, much the same trend in tractor purchases is believed to have occurred as cane farmers faced long periods of low sugar prices and could not replace older machinery. With cane harvesters, Australia used to be the centre of world production with two manufacturers located at Bundaberg. However, Massey Ferguson ceased harvester manufacture there in 1984. Austoft reached peak production of 160 units per year, although not all were destined for the Australian industry. After being taken over by Case International in 2004, production of cane harvesters was re-located to Brazil. Mechanisation of sugarcane production and harvesting was one of the most significant achievements in improving efficiency in the Australian industry but what these comments attempt to explain is that there has been a static or declining inputs from machinery into cane production over the past two decades. Fewer cane harvesters are having to be driven faster and worked longer to handle the crop with adverse effects on cane losses in the field.

Inputs – Farm costs

Cane growers have been under intense cost pressure for the past decade. World sugar prices fell below US 10 cents per pound for several years (Figure 8) and although Australia enjoys some premium above the world price, returns were still inadequate for all but the most efficient producers. This forced growers to economise on input costs and while there has been some re-allocation of expenditure from fuel and machinery costs to herbicides for weed control as trash blanket farming was more widely adopted, and the use of irrigation has expanded, input costs in general have been constrained.

Inputs – Irrigation water

Queensland sugarcane farmers have used irrigation for more than 100 years to sustain their economic viability. Over this time, modernisation of the industry has encouraged changes in irrigation systems and practices to deliver greater efficiency in application of water. Industry expansion and recent climate variability placed higher demands on water resources which led to the realisation that available water per hectare was becoming increasingly limited (Haines and Attard, 2010). While the area irrigated has increased over time, and the sugar industry has continued to use a major proportion of irrigation water available in Queensland, the efficiency with which this water is used has increased as research reported elsewhere in this submission indicates. Further information on improvements in water use efficiency is provided in the box on the next page.

Inputs – Fertiliser

The Australian sugar industry faces new levels of scrutiny over its use of nutrients due to recent initiatives by the Queensland Government to regulate nitrogen applications to protect the Great Barrier Reef from nitrogen, phosphorus, sediment and chemicals that are assumed to be derived from agricultural activities along the Queensland coast (statement attributed to Queensland Reef Quality Water Quality Protection Plan Secretariat by Wood *et al.*, 2010). In their paper, Wood *et al.*, 2010 use data provided by the major fertiliser supplier to the Queensland sugar industry to show the trend in nitrogen application rates for the Queensland cane crop from 1997 to 2009 (**Figure 9**). It shows a distinct downward trend from 206 kg/ha for the 1997 crop to 167 kg/ha for the 2008 crop. A further significant fall to 148 kg/ha occurred for the 2009 crop, probably influenced by the very high fertiliser prices in 2008.

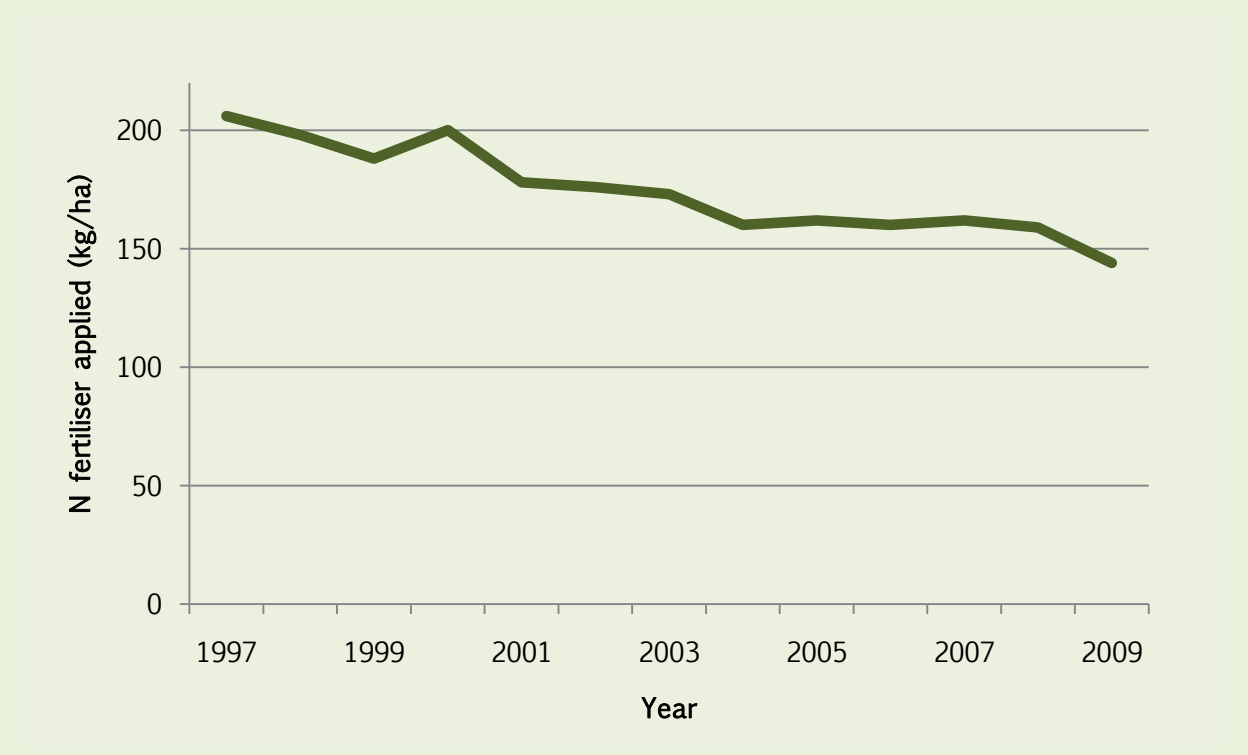

Figure 9 *Average N fertiliser application rates for sugarcane production in Queensland 1997-2009*

Source: Wood et al. ASSCT 2010

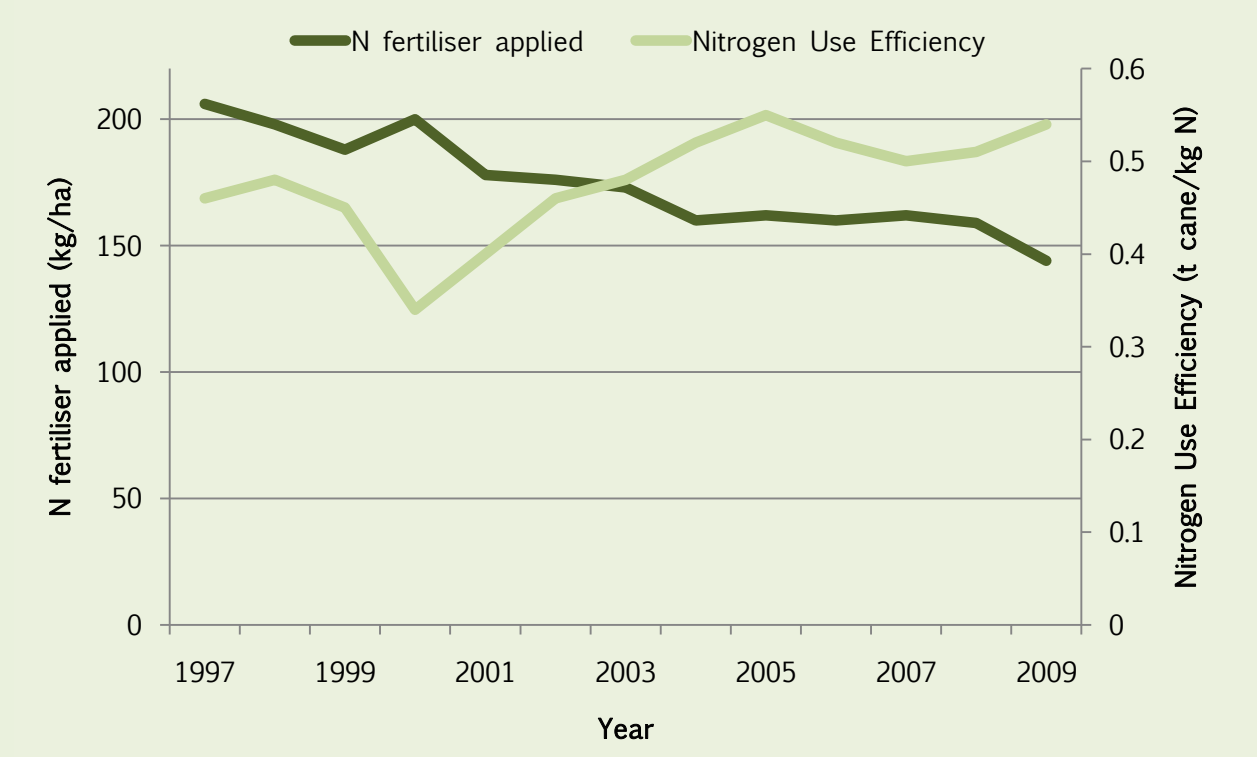

Figure 10 *Fertiliser N use efficiency for sugarcane production in Queensland 1997-2009*

Source: Wood et al. 2010

These authors conclude that no clear trend in nitrogen use efficiency occurred during the period 1997-2003 due to the influence of adverse seasonal conditions and fluctuating crop yields. However nitrogen use efficiency exceeded 0.5 t cane/kg N for the first time in 2004 and has remained above that level since then (**Figure 10**).

In conclusion, sugar industry output has been relatively static over the past two decades, while all major inputs have been declining – some of them markedly so – including land, labour, fertiliser, and capital (machinery). The obvious conclusion is that Total Factor Productivity must have risen substantially during this time. Research has been an important contributing factor including the documented effect of new varieties. Research has also given the growers confidence to reduce inputs that are widely regarded as having a major effect on productivity, for example, nitrogen fertiliser, and improve the efficiency with which other inputs are utilized, for example irrigation water, without causing detrimental losses.

Case study 3 *WATERSENSE: Web-based irrigation scheduling and climate interpretative tools*

Queensland sugarcane farmers have used irrigation for more than 100 years to sustain economic viability. Over this time, modernisation of the industry has encouraged change in irrigation systems and practices to deliver greater efficiency in application of water. Industry expansion and recent climate variability placed higher demands on water resources which led to the realisation that available water per hectare was becoming increasingly limited (Haines and Attard, 2010). WaterSense is an example of the technology that is enabling the efficiency of using irrigation water in the sugar industry to be improved.

WaterSense is a web-based management tool developed over several years by SRDC, CSIRO and the Cooperative Research Centre for Irrigation Futures with support and collaboration from BSES Ltd, Bundaberg Sugar Services, and a large number of individual growers across the Australian sugarcane industry (Inman-Bamber *et al.*, 2006, 2007; Webb *et al.*, 2006; Haines *et al.*, 2008). WaterSense interprets the impact of daily weather factors on sugarcane growth and delivers real-time irrigation recommendations as distinct from applying a set of averages based on past weather patterns.

The benefits of irrigation scheduling with WaterSense have been evaluated in sugarcane production areas in Queensland, including the Atherton Tableland, Burdekin, Mackay, Bundaberg and Maryborough, where cane is routinely irrigated.

The adaptive strategy of using the real time interpretation provided by WaterSense has provided consistently reliable support for irrigation scheduling, which resulted in best use of irrigation water, particularly when supplies were limited, and miximisation of soil water potential by maintaining an appropriate deficit irrigation strategy (Inman-Bamber *et al.*, 2008) while additional features are its record keeping potential and ability to demonstrate inefficiencies in farming practices quickly (Haines and Attard, 2010).

Appendix 2 *Current directors of SRDC*

Ian Knop AM BBus CPA, Chair

Ian Knop is Chairman and Managing Director of Profile Ray & Berndtson an Executive Search & Consulting Business with offices in Sydney, Canberra and Hobart. Mr Knop is Chair of the Sullivans Cove Waterfront Authority (Tasmanian Government). In addition Mr Knop has Chaired or been a senior representative on a wide range of Boards and Authorities including, the Export Finance & Insurance Corporation, Aurora Energy, Austrade, Soccer Australia and Sydney Ports Corporation. Mr Knop was awarded a Member of the Order of Australia in 2007 for his services to industry and his contribution to Sport and Indigenous Affairs in Australia.

Stephen Guazzo, Deputy Chair

Stephen Guazzo is a third generation cane grower from the Herbert River region with over 35 years experience in the industry. Stephen has a reputation for innovative sugarcane production and harvesting practices. He has served on the Herbert Regional Advisory Group (RAG) and other industry bodies and is a Director or CANEGROWERS Herbert River, CANEGROWERS Queensland and Sugar Terminals Limited.

Ian Sampson BComm, LLB. GAICD FAIM

Ian Sampson is currently a Director of Lysaght Peoplecare Ltd and Executive Consultant for Audrey Page and Associates. During 2008 and early 2009 he was Executive General Manager of People and Sustainability at Thiess. Since 2004 Ian has worked as a strategic advisor to several sugar companies, as well as consulting in the mining, manufacturing, aviation, petroleum and services industries in Australia, South Africa, Papua- New Guinea and Fiji. From 1999-2004 he was General Manager Human Resources and Stakeholder Relations for CSR Sugar. He is a Graduate Member of The Australian Institute of Company Directors.

David Campbell B.Agr.Sc. (Hons), M.Bus.Mktg, AFAIM, GAICD

David Campbell has over 25 years of experience in product and business development; commercialisation of technologies; marketing; logistics and general management. His experience spans the life sciences, biotechnology, agribusiness and chemical industries domestically and internationally. He has wide experience with the research sector and with government interaction. David has held senior positions at Stem Cell Sciences plc, Monash Commercial Pty Ltd, Monsanto Australia Limited, Linfox Group, and Pivot Ltd (now Incitec Pivot Ltd). He has run a successful consultancy in strategy and policy development, and commercialisation for the life sciences and agribusiness industries, government and Rural R&D Corporations. He is currently Executive Director, Office of Knowledge Capital in Melbourne.

Michael Braude BBus, ASCPA, SF Fin, MBus

Michael Braude has 25 years commercial experience in management, economics, finance and treasury across three major corporations. He has lead risk management, insurance and corporate treasury functions, and has acted as a company appointed Alternate Director and Trustee. Michael has also been actively involved with professional associations and tertiary educational bodies, as a lecturer, course convenor and presenter. He is a regular presenter on a wide range of finance and business related topics to a number of professional associations.

Michael is a Senior Fellow of the Financial Services Institute of Australia and a Fellow of the Finance & Treasury Association.

Angela Williams B Agr. Sc.
Angela Williams has spent the past 20 years growing and refining her skills in agricultural extension, community development and engagement processes across a range of rural industries and communities across Queensland. Angela runs a successful consultancy business specialising in training and facilitation support, and project managing short-term contracts specifically those relating to organisational change management, strategic and business planning.

Caroline Coppo BSc, PgDip EnvEd, BEd, GAICD
Caroline Coppo has been involved in a sugarcane farming business in the Herbert region for ten years and has actively contributed to community development, sugar industry innovation and environmental issues in the region. She has a background as a marine biologist, teacher and catchment coordinator and has extensive knowledge of water quality, environmental and natural resource management issues.

Dr Anthony Pressland PSM, B Agric Sci, MSc, PhD
Tony Pressland is a consultant with extensive experience in research and development and natural resource management, both as a scientist and administrator. He has worked in the pastoral and agricultural lands of Queensland and has had responsibility for State Government programs in weed and pest management, catchment management, and natural resource planning and management, including those which were community based. He has undertaken various reviews related to agriculture, and has developed and delivered tertiary postgraduate courses. He is a member of a faculty advisory committee on science and technology for a tertiary institution.

Annette Sugden, BAppSci (AppGeo), GradDipAppSci (ResMan), MSustMan, ALIA, Executive Director
Annette Sugden has a background in project management, strategic planning, research and stakeholder relations with recent positions in the Department of Agriculture, Fisheries and Forestry and the Rural Industries Research and Development Corporation.