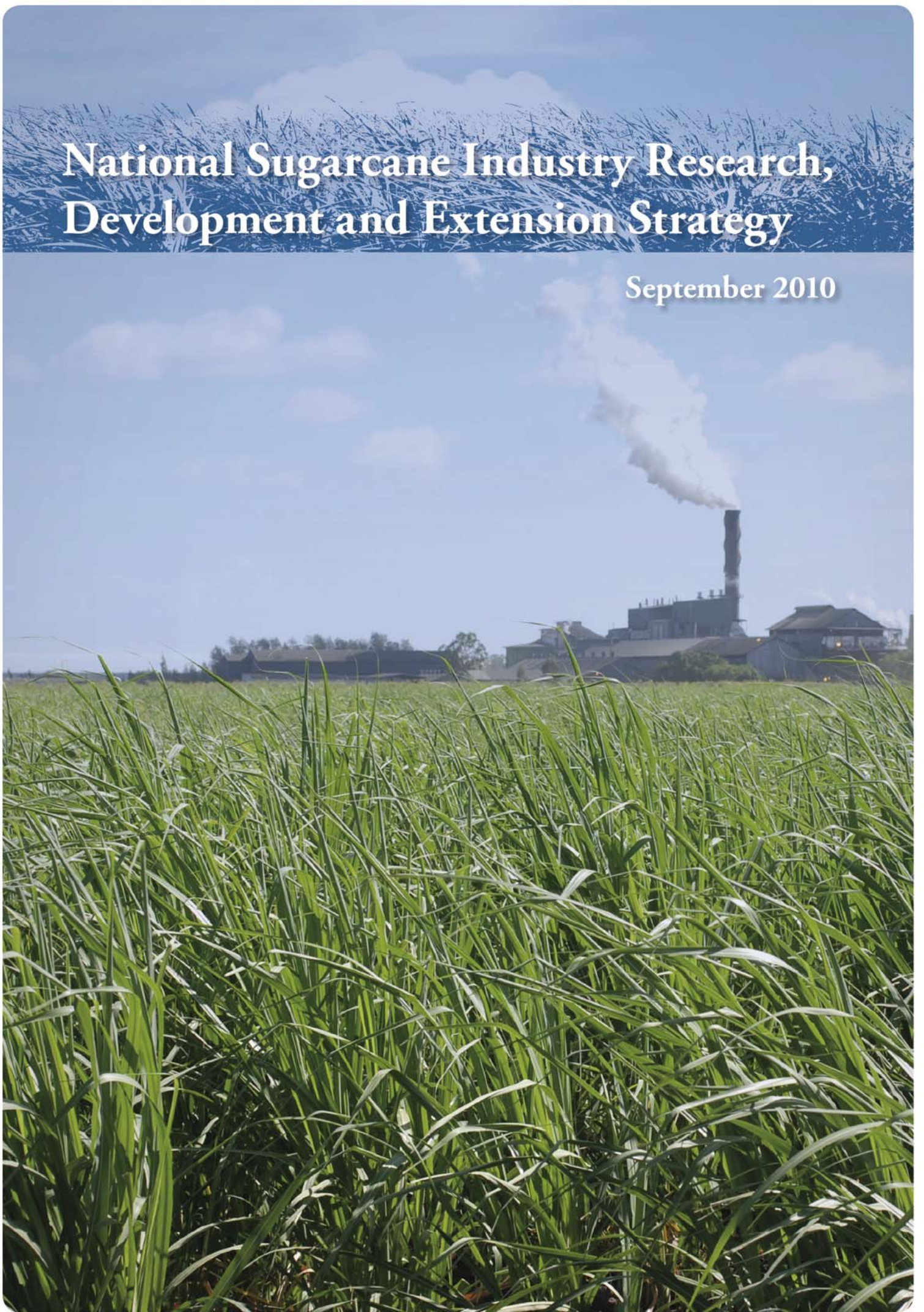


National Sugarcane Industry Research, Development and Extension Strategy

September 2010



This strategy was developed under the auspices of the Primary Industry Standing Committee, Research and Development Sub-committee on behalf of the Primary Industries Ministerial Council.

Development of the National Sugarcane Industry RD&E Strategy has been led by staff from the Sugar Research and Development Corporation together with the Department of Employment, Economic Development and Innovation.

Enquiries to:

Sugar Research and Development Corporation
PO Box 12050
George St
Brisbane
Queensland 4003
Telephone: +61 7 32100495.

Contents

Executive Summary	1
Introduction	2
National Primary Industries RD&E Framework.....	2
National Sugarcane Industry RD&E Strategy	3
Strategy rationale.....	3
Strategy development.....	4
Industry overview	5
Opportunities and pressures	6
Consultation.....	7
Guiding principles for change	7
Existing RD&E capability	9
Major providers and funding bodies for RD&E.....	9
RD&E investment 2007–08.....	10
Current RD&E capacity and strengths	10
Capability gaps	11
Defining RD&E priorities	13
Future priority setting and implementation process	18
Actions	21
Research committee.....	21
Operational plans and agreements	21
Abbreviations and acronyms	22
Appendix A. The seven Primary Industries Ministerial Council (PIMC) operating principles	23
Appendix B. Sugarcane industry RD&E provider capability statements	25
BSES Limited.....	25
Sugar Research Institute (SRI)	27
CSIRO	27
Department of Employment, Economic Development and Innovation (DEEDI)	29
Australian universities	29
Appendix C. Detailed full-time equivalent (FTE) capacity analysis*	31

Executive Summary

In 2008, the National Primary Industries Research, Development and Extension (RD&E) Framework was endorsed through the Primary Industries Ministerial Council (PIMC) by the Commonwealth and all state governments. This framework supports the development of 14 commodity and seven cross-industry RD&E strategies.

The National Sugarcane Industry RD&E Strategy (the strategy) is part of this framework and sets the vision for sugarcane RD&E. It aims to:

- improve the focus, efficiency and effectiveness of sugarcane industry RD&E
- create a system of sugarcane industry RD&E that better integrates the priorities of industry and industry organisations, all levels of government and RD&E providers for industry benefit
- enhance RD&E capability through increased collaboration, specialisation and critical mass
- provide an RD&E system that is responsive and accountable to industry needs and which improves industry sustainability and competitiveness.

The strategy has the support of the sugarcane industry's representative bodies and key RD&E stakeholders. In conjunction with sugarcane industry stakeholders, staff from the Sugar Research and Development Corporation (SRDC) and the Department of Employment, Economic Development and Innovation (DEEDI) have developed the strategy. In developing the strategy, SRDC and DEEDI have consulted with numerous sugarcane industry representative organisations, RD&E funders and RD&E providers. To make sure industry and research providers accepted the strategy, a working party was formed with membership from DEEDI, SRDC, CANEGROWERS, Australian Sugar Milling Council (ASMC), BSES Limited, National Centre for Engineering in Agriculture (NCEA), CSIRO, The University of Queensland (UQ) and Queensland University of Technology (QUT).

The strategy includes an industry overview, and a capability assessment. It describes four industry goals and an agreed set of 10 industry RD&E themes, which relate closely to current and proposed investment plans of industry, university and government RD&E providers and the Australian Sugar Industry Alliance (ASA). The strategy also outlines the agreed processes for industry-led RD&E priority setting and resource allocation, which will improve information sharing and collaborative investment on behalf of industry, government and RD&E providers.

The ASA will lead the implementation of the strategy, with additional representation from other industry organisations, DEEDI and SRDC via a research committee.

Introduction

Research, development and extension (RD&E) is critical for increasing productivity and profitability and ensuring sustainability in primary industries. RD&E across Australia comprises a varied group of research providers and investors who are generally independent operators with strong linkages. The 15 rural research and development corporations and industry-owned companies (RDCs) are an important part of this group, which includes the Australian, state and territory governments, CSIRO, universities and private providers.

If Australia's primary industries are to improve their productivity and sustainability, fragmentation and duplication of RD&E systems must be removed, both across and within commodities. Nationally, RD&E investment in primary industries needs to be focused, and needs to be used efficiently, effectively and collaboratively.

In response to these considerations, the National Primary Industries RD&E Framework is being developed under the auspices of the Primary Industries Ministerial Council (PIMC). Once the framework is fully implemented:

- research capability will become more collaborative, specialised, have larger critical mass and be less fragmented across the nation
- the national research capability will be an important part of a wider innovation agenda, supporting development and extension. To encourage rapid uptake of new technologies, research developed in one location would be available nationally for the whole industry
- it will be supported by primary industries and all levels of government.

By ensuring the substantial resources invested in RD&E by government and industry are managed cooperatively, a more efficient, effective and comprehensive capability will be possible.

National Primary Industries RD&E Framework

In 2005, the concept of a National Primary Industries RD&E Framework was endorsed by the Australian Government and all state governments through the PIMC. The principle of the National Primary Industries RD&E Framework is that basic and strategic research (R) can be provided from a distance (but can be adapted within regions) and applied research or development (D) is required to test, refine and demonstrate the technology. Finally, local extension (E) allows ready transfer of the now locally tested innovation to users in a region.

The National Primary Industries RD&E Framework requires stakeholders to work together to ensure that within their respective industry or cross-industry sector's:

- RD&E strategies and priorities are focused on industry and cross-sectoral issues where desired outcomes can be achieved cost-effectively
- current infrastructure is consolidated and modernised to achieve greater capability, flexibility, efficiency and effectiveness
- RD&E strategies are collaborative and more strongly driven by industry and government needs
- the overall level of national funding is sustained with savings from efficiency gains redirected to further high-value priorities.

Under the framework, there will be a more coordinated and collaborative approach to rural RD&E, national research capability will be focused and used efficiently and effectively to achieve the best outcome and uptake by primary industries.

National Sugarcane Industry RD&E Strategy

This document outlines the national RD&E strategy for the sugarcane industry. This strategy aims to:

- improve the focus, efficiency and effectiveness of sugarcane industry RD&E
- create a system of sugarcane industry RD&E that better integrates the priorities of industry and industry organisations, all levels of government and RD&E providers for industry benefit
- enhance RD&E capability through increased collaboration, specialisation and critical mass
- provide an RD&E system that is responsive and accountable to industry needs and which improves industry sustainability and competitiveness.

Ultimately, the strategy aims to continue the sugarcane industry's position as a dynamic and productive sector, supporting rural communities as well as state and national economies. It is directed towards providing a national RD&E system that supports industry priorities to maximise economic, environmental and social outcomes.

The ASA will lead the implementation of the strategy, with additional representation from other industry organisations via a research committee (which will be established upon acceptance of this strategy).

Strategy rationale

The rationale for the National Sugarcane Industry RD&E Strategy is to:

- determine the RD&E strategic objectives that will deliver the long-term vision for the sugarcane industry
- provide a mechanism for industry, research providers, research funders and research deliverers to interact to optimise the effort in RD&E
- determine the current national RD&E capability for sugarcane, assess future capability requirements and identify future capability gaps
- provide accountability to industry for RD&E outcomes that support industry development.

Flowing from this National Sugarcane Industry RD&E Strategy will be an implementation process supported by operational plans and agreements. These subsidiary plans will address issues of industry and government cooperation and collaboration, information sharing, funding, access to capability and reporting. An agreed process for industry-led RD&E priority setting and resource allocation is presented as part of the RD&E strategy. The processes outlined in the strategy will provide improved mechanisms for information sharing and collaborative investment on behalf of industry, government and RD&E providers.

Many of the National Sugarcane Industry RD&E Strategy's objectives are already being addressed through existing cooperative and independent research activities. Because of the nature of the sugarcane crop, industry research is largely concentrated in one state (Queensland) and principally delivered by two industry research organisations with well-defined areas of expertise (BSES Limited and Sugar Research Institute). There are good linkages between industry stakeholders and research organisations through ownership and consultation and these organisations link with other research providers in seeking to make RD&E more efficient.

One existing example of enhanced RD&E capability through collaboration, specialisation and critical mass is the BSES–CSIRO joint venture for variety improvement. This joint venture has

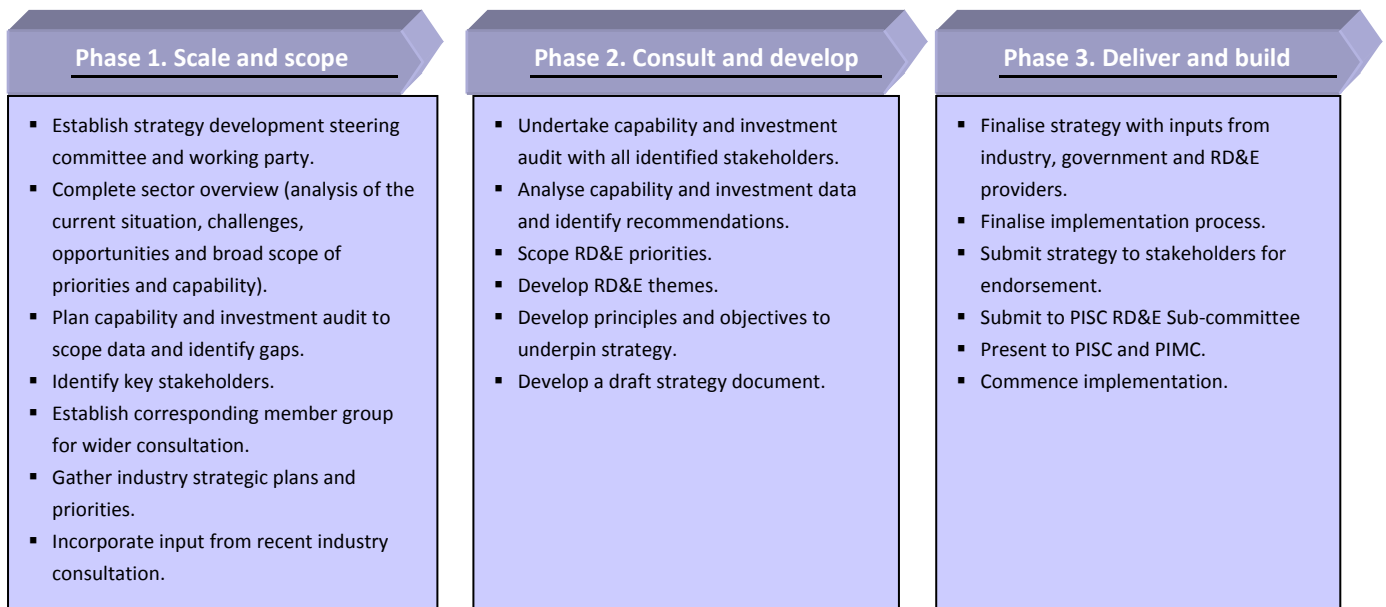
reduced duplication and unnecessary competition for funds, has concentrated available expertise in this area, and has extended industry capacity through researcher exchanges and links with international research agencies.

Strategy development

Development of the strategy has been coordinated by staff from the Sugar Research and Development Corporation (SRDC) and the Department of Employment, Economic Development and Innovation (DEEDI). In developing the strategy, SRDC and DEEDI have consulted with numerous sugarcane industry representative organisations, RD&E funders and RD&E providers, through a multi-stage formal and informal consultation process. A full list of organisations consulted during the development of the strategy is shown on page 10.

In order to develop a strategy with industry acceptance, the following strategy development process was undertaken:

Figure 1. Strategy development process



Industry overview

Sugar is a nationally significant commodity contributing an annual gross value of production of up to \$1.5 billion to the economy. Growing sugarcane and the associated processing into raw sugar is one of Australia's largest and most important rural industries and underpins the economic stability of many coastal communities in Queensland and northern New South Wales.

Annually, around 4000 farming enterprises supply, on average, 35 million tonnes of sugarcane to 25 sugar mills. Most sugarcane farms are owned by sole proprietors or family partnerships, although corporate ownership of farms is increasing. Sugarcane is transported to the sugarcane mills on either rail or road systems.

Australia is a low-cost producer and a major exporter. The Australian sugarcane industry is world renowned for having efficient, innovative producers with demonstrated capacity to respond to changing conditions. On-farm productivity is among the best in the world. The environmental report card for the sugarcane industry is generally positive with a number of continuous improvement strategies in place (in both the field and sugar mills).

As most Australian sugar is exported, industry success has been built on, and continues to require, world's best practice in production, handling and marketing, as well as a reputation for quality, supply reliability and service. At the farm gate, the Australian sugar industry has maintained export competitiveness by innovation, particularly through mechanisation, new farming practices and diversification.

The long-term sustainability of the Australian sugarcane industry depends on continued high-quality raw sugar production, and capitalising on the energy potential and other products we can obtain from sugarcane. This will involve a range of products utilising sugarcane biomass, and the capacity to maintain production in a sustainable fashion with limited impact on the environment.

In addition to innovative improvements in sugarcane growing, harvesting, milling and sugar manufacturing, industry stakeholders support initiatives that identify and foster innovation and diversification opportunities, which provide for a forward-looking and 'broader' sugarcane industry.

While fuel ethanol, electricity co-generation and other products (such as furfural) are presently a small part of industry production, these present alternatives could contribute to industry diversification and profitability while attracting positive environmental outcomes.

Opportunities and pressures

In the short term, world production of sugar was forecast to be 167.5 million tonnes in 2009–10, nearly 8 million tonnes higher than in 2008–09. Increases in production are forecast for most major producing countries, but the increases are likely to be particularly large in Brazil. The level of sugar production in Brazil depends on the extent to which sugarcane is diverted to ethanol production. Lower world oil prices have been causing weaker demand for Brazilian ethanol, both domestically and in export markets. In Brazil, there has been a rapidly growing fleet of flexifuel cars that run on any mix of ethanol and petrol, leading to increased substitution between these fuels. Also, the global economic downturn has caused a marked slowdown in new investments in ethanol production capacity in Brazil. While the Australian global sugar market share is currently slightly reduced, international market and production fluctuations give the Australian sugarcane industry opportunities to regain market share.

Domestically, the industry is operating in an environment of changing government policy. For example, the sugarcane growing sector has recently experienced changes to the *Queensland Environmental Protection Act, 1994* and the *Chemical Usage (Agricultural and Veterinary) Control Regulation 1999*. These changes seek to reduce the risk of sediment, nutrients and herbicides leaving coastal farming operations and affecting the health of the Great Barrier Reef. In addition, the renewable energy target announced by the Australian Government has seen a renewed interest in sugarcane co-generation operations. Research and development are increasingly important to help growers and millers adapt to, comply with, and realise opportunities arising from changes to government policy.

An opportunity for the sugarcane industry lies with diversification into biofuels, other products from sugarcane, and complementary uses of sugarcane land. Diversification brings with it opportunities for exploring new markets and new products. The Australian sugarcane industry is already producing raw and refined sugars, ethanol, furfural, molasses, liquid fertiliser, compost, fodder, and landscape mulch, and co-generating electricity from the sugarcane crop. The industry is also investigating opportunities for the production of paper products, bioplastics, nutraceutical compounds, value-added foods, industrial proteins and high fibre varieties for biomass production. Some of these opportunities may take many years to eventuate.

The industry is faced with several challenges and opportunities, which will incorporate both research and development and other solutions. Some of these issues are:

- restructuring of mills and mill operations
- closure of mills putting pressure on transport systems
- opportunities for diversification with co-generation and ethanol
- development of genetically modified (GM) sugarcane varieties
- developmental pressure on sugarcane land in popular coastal regions
- declining terms of trade and the increasingly volatile sugar price, in combination with other factors external to the industry, continuing to affect farm viability
- margin pressure is likely to lead to larger farms, corporate farming and increased sugarcane farming by mill owners (vertical integration) to manage costs
- needs for productivity increases to improve cost competitiveness with Brazil and to maintain viability
- environmental pressures and climate change will further impact input costs and farm availability
- Australian sugarcane industry must be positioned to take advantage of ethanol/butanol/ other revenue streams from sugarcane

- environmental impacts, particularly water use and quality, are paramount concerns of the industry.

Consultation

In order to undertake the task of developing the National Sugarcane Industry RD&E Strategy, a steering committee was formed with representation from the Queensland Government through DEEDI, federal government through SRDC and industry through ASA. This group provided the high level operating framework for developing the strategy.

The steering committee was supported by a working party with membership from DEEDI, SRDC, ASA, CANEGROWERS, Australian Sugar Milling Council (ASMC), BSES Limited, National Centre for Engineering in Agriculture (NCEA), CSIRO, The University of Queensland (UQ) and Queensland University of Technology (QUT) to ensure industry and research provider acceptance of the strategy. The working party gathered together existing industry strategic plans and priority setting documents and, in consultation with members of the steering committee, developed a draft strategy document.

The steering committee convened a one-day National Sugarcane Industry RD&E Strategy workshop in June 2010 to review and refine the draft Strategy with further input from industry, government and RD&E providers. At that workshop, specific RD&E themes were determined and a basic structure for future industry-wide RD&E collaboration, priority setting and monitoring was agreed.

The National Sugarcane Industry RD&E Strategy workshop included representation from the following organisations:

- Australian Cane Farmers Association (ACFA)
- ASMC
- BSES Limited
- CANEGROWERS
- CSIRO
- Department of Agriculture, Fisheries and Forestry (DAFF)
- James Cook University (JCU)
- NCEA
- DEEDI
- SRDC
- Sugar Research Ltd (SRL)
- UQ.

The strategy was finalised under the guidance of the steering committee following the industry workshop. The National Sugarcane Industry RD&E Strategy is endorsed by the sugarcane industry's representative bodies and key RD&E stakeholders.

Guiding principles for change

Industry stakeholders recognise that commercially focused, innovative research and development are critical to industry development and are committed to ensuring that support for RD&E continues in order to secure the industry's future productivity and sustainability.

This National Sugarcane Industry RD&E Strategy addresses the seven PIMC's operating principles (shown in full at Appendix A).

1. PIMC agencies should cooperate and work with industries to encourage the establishment of a more efficient and effective RD&E system capability nationally for

2. PIMC agencies should share information, plans and priorities for investment in RD&E to facilitate a collaborative effort.
3. RD&E funding levels should at least be maintained for primary industries, and investments—including from savings—should be re-directed to improve the capability of the national system in priority areas.
4. PIMC agencies should facilitate access to national research capability (people, infrastructure and information) by industry and RD&E partners across Australia.
5. PIMC agencies should support processes involving all the main participants in primary industries research to refresh the rural RD&E priorities and to encourage more consistent and rigorous monitoring of performance of RD&E targeting and delivery.
6. The important role of regional development and local extension is recognised as facilitating rapid uptake of innovation.
7. Primary Industries Standing Committee (PISC) should report regularly on progress in the development of the national RD&E system and priorities for action.

The seven PIMC principles for interaction of agencies under the National Primary Industries RD&E Framework have been endorsed by the agencies consulted in developing this strategy. Inter-agency working arrangements will be defined as part of the implementation process for the strategy supported by operational plans and agreements.

Existing RD&E capability

One of the key elements of this strategy is an analysis of RD&E capability, to inform planning and to address capability gaps to enhance the RD&E outcomes for the industry. This assessment aims to:

- define current capability and strengths
- identify where capability gaps exist that may constrain the implementation of new RD&E priorities.

Major providers and funding bodies for RD&E

There are several organisations making up the sugarcane RD&E ‘mosaic’ as illustrated by Figure 2. However, most sugarcane RD&E activities are based around two internationally renowned industry-owned research organisations—BSES Limited and Sugar Research Limited trading as Sugar Research Institute (SRI). These organisations are primarily funded by the sugarcane industry and receive additional funding support from SRDC and DEEDI. Appendix B describes the principal RD&E organisations and their expertise.

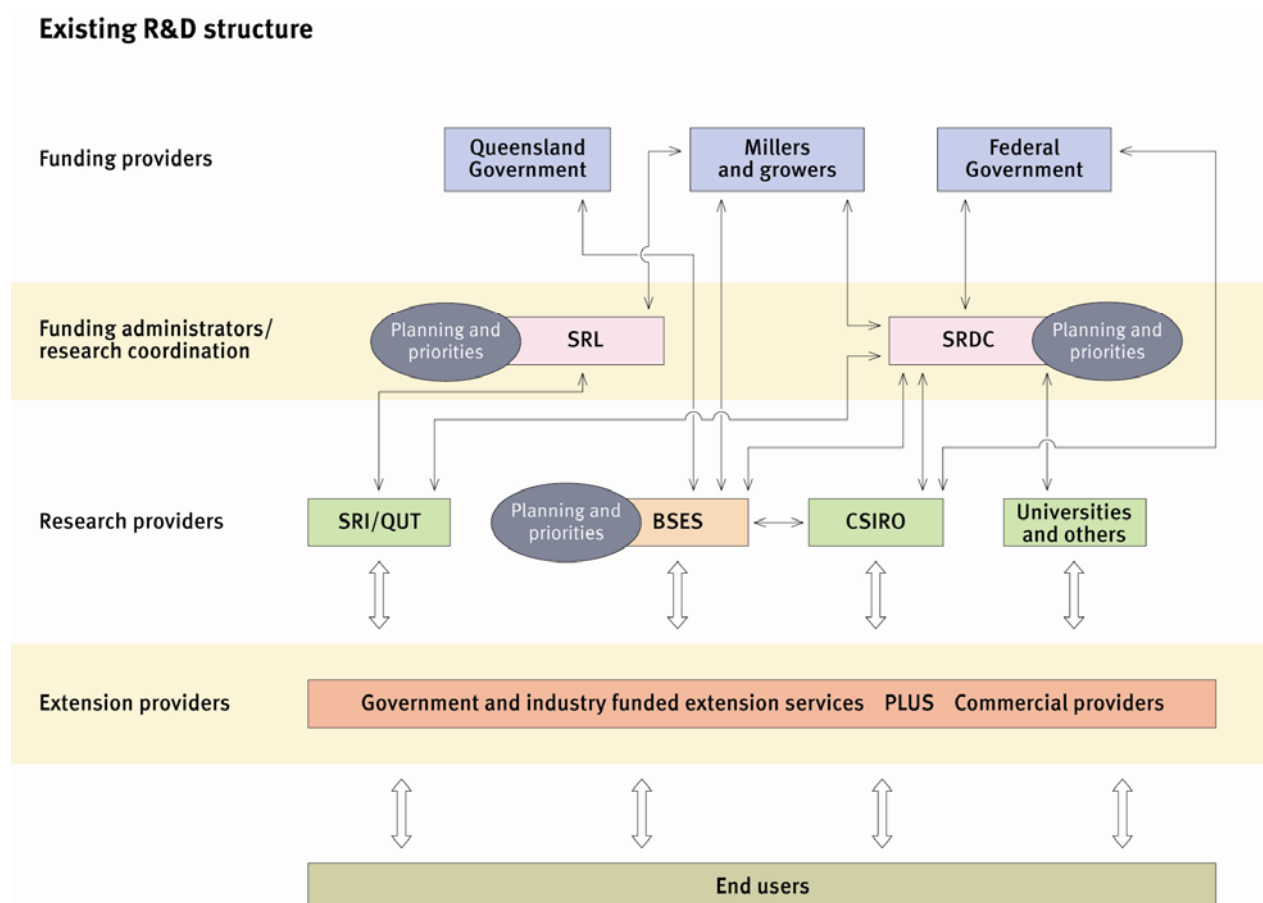


Figure 2: Relationships between existing sugarcane industry RD&E organisations

RD&E investment 2007–08

Over the period 2001–02 to 2007–08, annual sugarcane industry RD&E investment varied between \$46.2 million and \$57.4 million. The total RD&E investment in the sugarcane industry budgeted for 2007–08 was approximately \$57.4 million. Table 1 outlines the source of RD&E investment for 2007–08.

Table 1: Total RD&E investment in the Australian sugarcane industry budgeted for 2007–08 financial year

Funding source	Through	Amount \$ million
Australian Government	SRDC, CRCSIIB, CSIRO	10.60
Queensland Government	BSES, DEEDI, CRCSIIB	6.80
Growers	BSES, SRDC, Productivity services	11.60
Millers	SRI, BSES, SRDC, Own, Productivity Services	13.40
Universities	JCU, QUT, UQ, SCU	0.92
Generated revenue	CSIRO, SRI, CRCSIIB, BSES	8.40
Other ¹		5.68
Total		57.40

¹ Most of this funding is from individual milling companies and specific industry groups.

Figure 3 shows this information in a pie chart and illustrates that the Australian sugarcane industry (millers and growers) contributed 43% of the RD&E funds invested during 2007–08. Contributions from the Australian Government (18%) and the Queensland Government (12%) made up the bulk of the non-industry contribution. This situation is still reflected in industry funding.

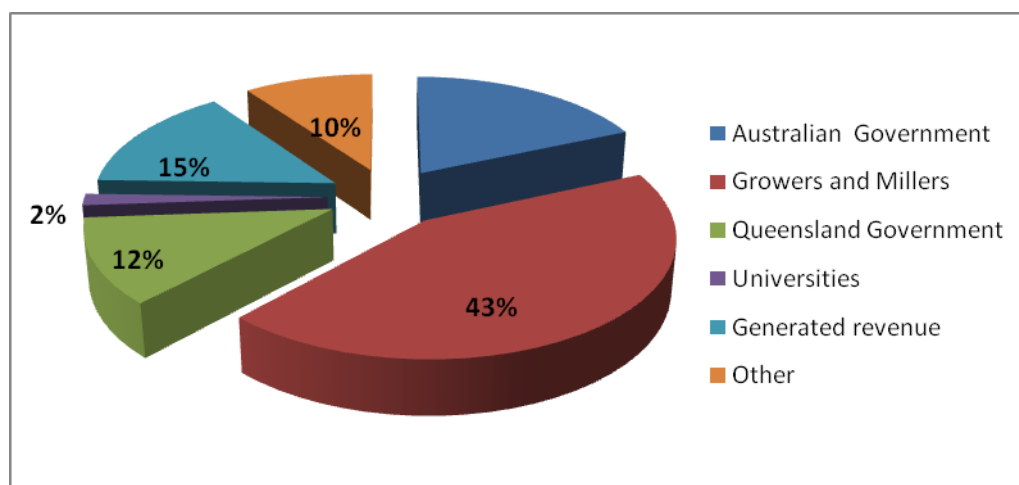


Figure 3: Sugarcane industry RD&E funding sources, 2007–08

Current RD&E capacity and strengths

The working party surveyed current RD&E providers through telephone and written surveys and they provided the following information on research capacity and strengths. The compiled data on researcher and extension officer full-time equivalents (FTEs) is provided in Appendix 3.

Plant breeding: The current industry needs for sugarcane varieties are being met by a joint breeding program with contributions from CSIRO and BSES Limited. The outputs for this program have met industry needs and, with the adoption of new technology, should continue to meet these needs for the production of sugar.

Plant attributes: Plant pathology, physiology, weed control, pest management and agronomy are areas of current investment. These skills are adequate for current industry needs but the changing face of the industry may require specialist skills.

Farming, harvesting and milling systems: Research and development includes improved cropping systems, chemical analysis, harvest, transport, milling of sugarcane, remote sensing, by-product utilisation and disposal, modelling, engineering and irrigation science. Significant investment in these areas adequately covers the needs of sugarcane production for sugar—apart from harvester research, which will be dealt with in a forthcoming research program.

Technology transfer: A significant proportion of current investment supports the extension of research findings to achieve industry change. The current models for extension have been successful and in recent years industry uptake of new practices and technology has been rapid. The most important of the extension services is provided by BSES Limited which has a sector specific extension service that addresses BSES Limited research and research from other sources.

Research infrastructure: The RD&E activities for the sugarcane industry are underpinned by a suite of research stations, laboratories and offices. These facilities are customised for investigation into the use of sugarcane for sugar production. The height of the sugarcane crop means it requires very specialised research laboratories and breeding facilities and those in Australia provide a benchmark for international facilities.

Post-harvest processing: Focuses on fundamental and applied research on issues specific to the entire sugar processing industry and aims to enhance clients’ overall operational efficiency and market competitiveness. In addition some research activity is being undertaken in value adding processes for sugar in food and energy production.

Table 2 Summarises the R&D Capability via FTEs.

Table2: Current R&D capability (FTEs)

Discipline	Capability (FTEs)	Organisations
Plant breeding	30	BSES, CSIRO
Plant attributes	38	BSES, UQ
Farming, harvesting and milling systems	52	BSES, NCEA, SRI
Technology transfer	32	BSES, DEEDI
Post-harvest processing	11	SRI, DEEDI

Capability gaps

As shown by the survey responses, research providers think additional skills are needed in the following areas.

Plant breeding: The current emphasis in the breeding program is on producing resilient varieties for sugar production. With the interest in developing other products (such as biofuels and bioplastics) from sugarcane, a shift in the focus of the breeding program may be required along with sourcing appropriate skills to accommodate this shift. In addition, the increased use of sophisticated breeding methods and computer-based technologies will create a need for highly skilled biometrics and database development personnel.

Plant attributes: Plant physiologists play an important role in breeding programs and crop production. Production of sugarcane for products other than sugar may require further investment in plant physiologists. However, these skills are not readily available in the agriculture industry. An emerging need for field pathologists and entomologists has been identified through the survey and will be addressed by a joint scholarship program between SRDC and UQ.

Farming, harvesting and milling systems: New areas of research into diversified uses of sugarcane will require a shift in skills and technologies. Modelling and economic analysis of alternative production systems will provide an opportunity and need for investment in staff with these skills. Maintenance of core technical skills is increasingly difficult due to competition from other sectors.

Technology transfer: As farming enterprises become more reliant on computer packages and soft systems for farm management, ways of providing advice and recommendations to primary producers will need to change. The uptake of new technologies may require a different skill set than is currently available. Research and development to facilitate extension is lacking for the sugarcane industry.

Research infrastructure: Significant new infrastructure investment has occurred in the sugarcane regions to investigate alternative uses for sugarcane and sugar production waste streams. Additional investment may be warranted as alternative industries develop around the sugarcane farming system.

Cross industry expertise: The suite of skills needed to manage a diversified farming business where sugarcane is one element of the farming systems will be far greater than needed for the production of a single commodity. In order to support growers, the suite of skills needed in RD&E will also need to expand. These skills may be available from other industries, which will increase the emphasis on supporting cross-industry initiatives.

Engineering skills: Engineering RD&E skills will underpin new technologies and innovation across the value chain. In particular, there is an immediate need for engineering support in the improvement of farming and harvesting systems. Currently, access to these skills is limited although they exist through a number of organisations including consultants, research providers and training institutions. Engineering skill sets need to be collected from within and outside of the industry to target specific problems.

Defining RD&E priorities

To specify and define RD&E priorities, we need to understand the broader goals and requirements that drive research and development in the Australian sugarcane industry. At present, these drivers include public policy, as described in general and rural specific national R&D priorities; the RD&E priorities for individual research bodies, such as SRDC or BSES; and critically, the broad goals held by industry members for the future direction of the Australian sugarcane industry.

The ASA, a key representative body for the Australian sugarcane industry, has described the goals of the Australian sugarcane industry. These four goals have arisen from broad industry and government consultation and are accepted as being representative of industry requirements. The four industry goals are:

Goal 1: A growth industry, successfully competing in the world market, through profitable businesses

A major risk to the sugarcane industry is a decrease in sugarcane production, affecting the viability of all industry participants. The sugarcane industry should strive for sustainable growth to ensure its ongoing viability. An ambitious target of 40 million tonnes of sugarcane production is realistic given existing capacity, and current and emerging opportunities for the industry.

To achieve this tonnage, the economics of the industry need to be such that all sections of the sugarcane value chain earn returns above those that can be achieved from alternative uses of assets and above the long-term cost of capital.

Goal 2: Successful diversification into related sugarcane products, using world class research and development

Raw sugar remains the highest value product produced at a sugar mill. However, focus on one commodity exposes the Australian sugarcane industry to the price volatility of the global market. The Australian sugarcane industry will build on its ability to foster and promote innovation in order to generate a diversified product suite, including biofuels, co-generation and other sugarcane-related products.

Consequently, the Australian sugarcane industry has a goal of ensuring a coordinated, reliably funded and industry-driven RD&E approach, which will continually seek new opportunities across the value chain and help the industry to manage its risk profile through product diversification and innovation. This approach will benefit not only local industry participants, but will provide another export capability in knowledge, processes and innovative practices to the world market.

Goal 3: Global leaders in environmental sustainability

The community expects a high level of performance in relation to environmental sustainability and the sugarcane industry is in the spotlight with respect to its impact on local environments, especially the Great Barrier Reef. The industry, through its commitment to the environment, will ensure that it is known for being sustainable in every product it produces and is mindful of its responsibilities to the environment.

Goal 4: Dynamic and cooperative industry leadership

The Australian sugarcane industry recognises that success in the future will be built on coordinated and dynamic leadership, to enable the industry speak as one on issues affecting its viability.

The four industry goals, in addition to the draft strategy document developed by the steering committee, were discussed at the National Sugarcane Industry RD&E Strategy workshop in 2010. The workshop discussions were distilled into the following 10 key RD&E themes. These 10 RD&E themes are considered essential to enable the industry to maintain competitiveness, improve profitability and successfully solve current and future challenges. The 10 RD&E themes are:

- improving farming, harvesting and milling systems
- variety development
- biosecurity
- resource input efficiency
- adopting best practice
- enhancing environmental and social performance
- value chain efficiency
- alternative and complementary products from existing production systems
- analysis and benchmarking of business practices
- adaptability and risk management.

Table 3 outlines the role that the key RD&E providers will play in delivering on the 10 key RD&E themes

Table 3: Major, support and link role of key RD&E providers to RD&E themes

RD&E themes	BSES	SRI	CSIRO	Universities	Other
Improving farming, harvesting and milling systems	Major	Major	Support	USQ (NCEA), JCU, QUT – Major	DEEDI - Support
Variety development	Major		Major	UQ - Link	
Biosecurity	Major			U Adel - Link	DEEDI - Support
Resource input efficiency	Major		Major		
Adopting best practice	Major	Major	Support		
Enhancing environmental and social performance	Major		Major	USQ (NCEA) - Support	DERM, DEEDI - Major
Value chain efficiency	Major (Grower)	Major (Miller)			
Alternative and complementary products from existing production systems	Major	Major	Major	SCU - Support	
Analysis and benchmarking of business practices	Link	Support			
Adaptability and risk management	Support	Support			

Figure 4 illustrates the consistencies between the industry goals described by ASA and agreed upon by the broader industry representatives, the Australian Government's Rural R&D priorities and the 10 RD&E themes established under the National Sugarcane Industry RD&E Strategy.

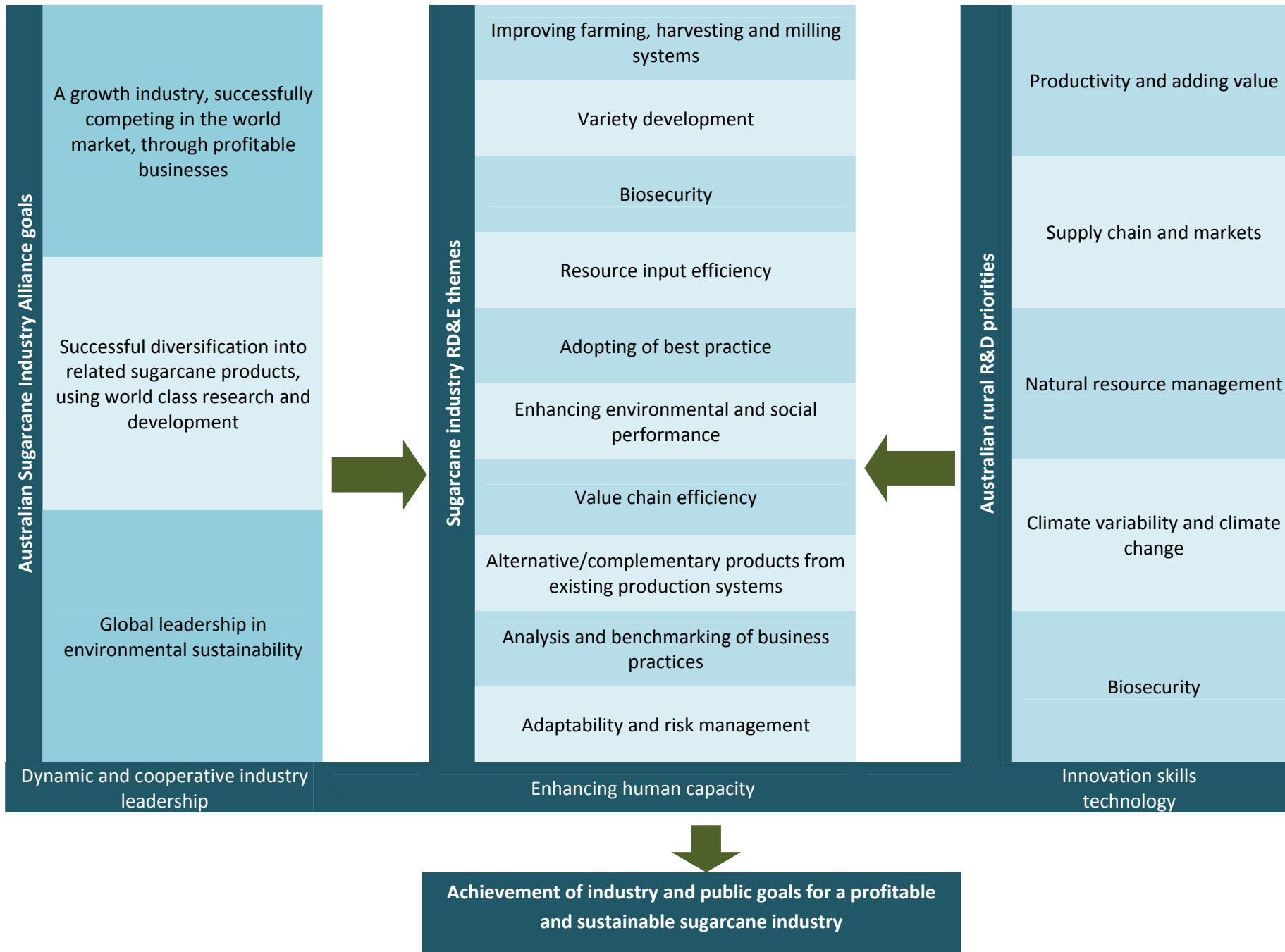


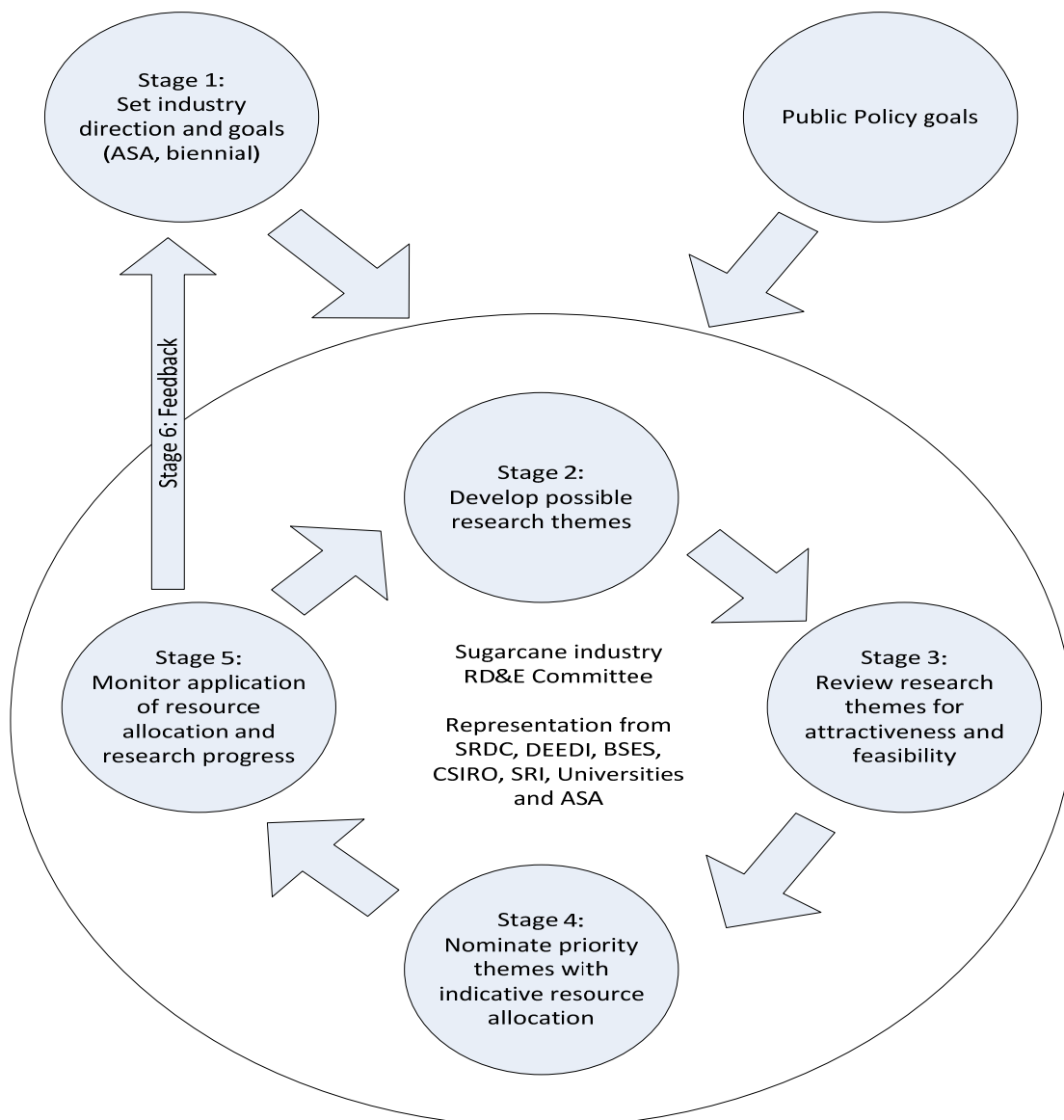
Figure 4: Linkage of industry goals, the Australian rural R&D priorities and the RD&E themes established under the Sugarcane Industry National RD&E Strategy

Future priority setting and implementation process

Flowing from this National Sugarcane Industry RD&E Strategy will be an implementation process supported by operational plans and agreements. These subsidiary plans will address issues of industry and government cooperation and collaboration, information sharing, funding, access to capability and reporting. Details regarding these operational activities do not appear in this strategy document; however, an agreed process for industry-led RD&E priority setting and resource allocation is presented.

This process, illustrated in Figure 5, was developed by the National Sugarcane Industry RD&E Strategy workshop participants and further refined by the Working Party. It outlines the agreed process for industry-led RD&E priority setting and resource allocation and will provide improved mechanisms for information sharing and collaborative investment on behalf of industry, government and RD&E providers. This process represents significant change in priority setting mechanisms, with all stakeholders participating in the process and endorsing the outcomes.

Figure 5. Future priority setting and implementation process



Stage 1 (set industry direction and goals): This stage of the process involves industry direction setting and definition of industry goals. This ASA-led activity will occur biennially and will include an economic review of industry threats, costs and opportunities. Outcomes of the process will include identification of measures needed to reduce costs, improve productivity, improve sustainability and set new directions. Representative bodies will be asked to review and adopt the agreed goals.

A research committee comprising representatives of industry RD&E stakeholders will be established in 2010. It will be essential that the chosen committee representatives are able to allocate time to interact with the RD&E community to understand implications of funding decisions.

The following **guiding principles** have been developed to create a framework for the research committee operations. The committee:

1. articulates an agreed vision and strategic priorities for sugarcane RD&E
2. engages and commits key stakeholders
3. focuses and coordinates investment on strategic priorities to balances time horizons, value chain beneficiaries and emergent innovations
4. prioritises RD&E to achieve strategic outcomes for the sugarcane industry
5. builds and sustains the required RD&E capability, including:
 - facilitating specialisation and resource and knowledge sharing
 - supporting trans-disciplinary RD&E where required
 - building the capacity and career paths to attract and retain people in all sectors of the industry related to RD&E
6. demonstrates impact for accountability and continuous improvement
7. sets the framework to avoid duplication.

Stage 2 (develop research themes): This part of the process involves the research committee meeting annually to define the industry RD&E themes.

In defining the industry RD&E themes, the research committee will consider both the goals set by the industry as well as the public policy goals and take into account research requirements of external funders, especially the Australian Government. The outcome of this process will be identifying the RD&E required to achieve industry and public policy priorities and exposing gaps in current knowledge or technology. This will be a separate process to that used to develop the industry action list to achieve broader industry priorities.

Stage 3 (review and analysis of feasibility and attractiveness): This part of the process reviews and prioritises potential research themes to establish feasibility and attractiveness for R&D. The research committee will engage in dialogue with researcher providers regarding research themes.

Stage 4 (resource allocation): The research providers will be asked to develop broad project areas within themes and indicate the short- and long-term focuses of the project areas. This will allow the research committee to prioritise RD&E themes based on the relative attractiveness and feasibility of the project areas. Once prioritised, the research committee will provide advice on apportioning total available RD&E funding between the RD&E themes. It is anticipated the RD&E providers will respond to the priorities within the governance framework of their organisations. Stages 3 and 4 will occur almost simultaneously and will require consensus across the sector.

Specific initiatives beyond the initial allocation may be required between reviews if urgent issues arise that need to be addressed immediately.

Stage 5 (monitoring): Application of resources and R&D progress will be monitored via annual reviews convened by the research committee. Research organisations will be asked to report to the research committee on funding of projects within each research theme. The research committee will monitor progress of R&D toward desired outcomes. In addition, while the research committee would not be involved in determining funding to individual projects, it will monitor at the theme level, the actual application of RD&E resources against desired allocations. The research committee will produce a research 'prospectus' to indicate areas of industry research interest to external bodies.

Stage 6 (feedback): Feedback is an essential part of continuous improvement and involves providing feedback on the outcomes of the research committee processes back into Stage 1.

The sugarcane industry, as outlined in the section 'Defining RD&E priorities', has identified the industry's goals and, through the strategy development activities, has established an initial set of RD&E themes. The research committee will lead the implementation of Stages 3–6 of the strategy.

Actions

Research committee

The first step is to form the research committee comprising representatives of industry RD&E stakeholders. The following **guiding principles** have been developed to create a framework for the research committee operations. The committee:

1. articulates an agreed vision and strategic priorities for sugarcane RD&E
2. engages and commits key stakeholders
3. focuses and coordinates investment on strategic priorities to balances time horizons, value chain beneficiaries and emergent innovations
4. prioritises RD&E to achieve strategic outcomes for the sugarcane industry
5. builds and sustains the required RD&E capability, including:
 - facilitating specialisation and resource and knowledge sharing
 - supporting trans-disciplinary RD&E where required
 - building the capacity and career paths to attract and retain people in all sectors of the industry related to RD&E
6. demonstrates impact for accountability and continuous improvement
7. sets the framework to avoid duplication.

The committee will convene at a time convenient to the membership.

Operational plans and agreements

The implementation process will be supported by operational plans and agreements. These subsidiary plans will address issues of industry and government cooperation and collaboration, information sharing, funding, access to capability and reporting. These plans and agreements will:

- describe imminent and current RD&E initiatives
- report on current RD&E progress and assess the impact of current and completed RD&E
- provide arrangements for industry participation in RD&E
- provide processes to ensure that RD&E outputs meet priority industry outcomes
- develop other agreements and initiatives to meet emerging national needs
- address mechanisms by which R&D needs are matched to capabilities
- address mechanisms by which R&D funding is matched to R&D needs
- address the relationship between the Australian R&D effort and international collaboration, including countries that may be both commercial competitors and identified under other government schemes as preferred scientific collaborators in areas relevant to sugar industry need
- address the link between the ideal of industry-wide information sharing, and the necessity of commercial confidentiality in technologies that are vital for future industry competitive efficiency.

Each organisation will maintain an operational plan that aligns with the objectives of the National Strategy.

Abbreviations and acronyms

ACFA	Australian Cane Farmers Association
ASA	Australian Sugar Industry Alliance
ASMC	Australian Sugar Milling Council
BSES	BSES Limited
CANEGROWERS	Queensland Cane Growers Organisation Ltd
CCS	Commercial cane sugar
CRCSIIB	Cooperative Research Centre for Sugar Industry Innovation through Biotechnology
CSIRO	Commonwealth Scientific and Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
FEAT	Farm economic analysis tool
GM	Genetically modified
JCU	James Cook University
QUT	Queensland University of Technology
NCEA	National Centre for Engineering in Agriculture
DEEDI	Department of Employment, Economic Development and Innovation
PIMC	Primary Industries Ministerial Council
PISC	Primary Industries Standing Committee
RDCs	Rural R&D corporations and industry-owned companies
R&D	Research and development
RD&E	Research, development and extension
SCU	Southern Cross University
SRDC	Sugar Research and Development Corporation
SRI	Sugar Research Institute
SRL	Sugar Research Limited
UQ	The University of Queensland

Appendix A. The seven Primary Industries Ministerial Council (PIMC) operating principles

1. PIMC agencies should cooperate and work with industries to encourage the establishment of a more efficient and effective RD&E system capability nationally for primary industries drawing on industry-led initiatives and government led broader cross-sectoral frameworks as necessary.
 - The long-term (20-year) vision of the sugarcane industry has been determined through industry consultation undertaken by SRDC and BSES and via the process of developing this strategy.
 - RD&E strategic objectives will be revised on a five-year rolling basis, with appropriate RD&E implemented to deliver against the priority industry outcomes.
2. PIMC agencies should share information, plans and priorities for investment in RD&E to facilitate collaborative effort.
 - Joint organisational planning for collaborative RD&E in sugarcane should culminate in production of a cross-agency, national operational plans and agreements.
 - In planning national collaboration and cooperation under this strategy, individual agency independence and freedom of action should be maintained. Commitment will occur with agreement to carry out specific, negotiated RD&E initiatives.
 - Joint arrangements should facilitate and encourage agency collaboration in RD&E for mutual benefit.
 - Arrangements under this strategy should be designed to allow agencies early mutual access to RD&E for purposes of rapid integration of technology into production systems.
 - This strategy provides opportunities for creating better access to information, both nationally and internationally, by the scientific community and industry.
3. RD&E funding levels should at least be maintained for primary industries, and investments, including from savings, should be re-directed to improve the capability of the national system in priority areas.
 - An under-pinning philosophy of this strategy is for agencies to consider joint initiatives for national funding with a view to creating synergies and efficiencies as well as savings and opportunities for re-investment.
 - National priorities for RD&E have been developed under this strategy through industry consultation resulting in priority industry outcomes and RD&E strategic objectives. These will guide future RD&E expenditure.
 - The audit of full time equivalent allocations and expenditure conducted to determine agency capability provides a quantitative baseline for assessment against this principle in future years.
4. PIMC agencies should facilitate access to national research capability (people, infrastructure and information) by industry and RD&E partners across Australia.
 - Systems will be created that allow the national RD&E effort in sugarcane to be accessed amongst national agency partners and industry.
 - Intellectual property arrangements should enhance, rather than constrain, collaboration.
 - Arrangements for sharing of staff and infrastructure that are advantageous to all participants will be developed and implemented.
5. PIMC agencies should support processes involving all the main participants in primary industries research to refresh the rural RD&E priorities and to encourage more consistent and rigorous monitoring of performance of RD&E targeting and delivery.
 - A system of monitoring and evaluation that focuses on RD&E outcomes, with a 'triple bottom line' reporting framework, will be crucial to determining successful outcomes from RD&E.
 - A system of peer review and continuous improvement for ongoing RD&E would enhance RD&E quality.
6. The important role of regional development and local extension is recognised as facilitating rapid uptake of innovation.
 - Operational planning will determine how linking and participating agencies might engage at various points in the RD&E continuum for a particular initiative.

- Consideration needs to be given to national strategies and initiatives that will accelerate adoption and integration of technology.
 - Regional development and local extension will be essential to the success of this strategy.
7. PISC should report regularly on progress in the development of the national RD&E system and priorities for action.
- Participants involved in development of the National Sugarcane Industry RD&E Strategy will report progress to the PISC RD&E Sub-committee.
 - Agencies involved in this strategy will continue to consult with all key national and regional organisational bodies and organisations that will be impacted by implementation of the National Sugarcane Industry RD&E Strategy.

Appendix B. Sugarcane industry RD&E provider capability statements

Sugar Research and Development Corporation (SRDC)

SRDC is an Australian Government statutory authority supported by grower and miller levies and Australian Government funding. SRDC focuses on producing outcomes to benefit the Australian sugarcane industry and the community. It does not conduct research itself but invests in, and manages, a broad spectrum of research by various research providers, with the goal of maximising stakeholder returns on RD&E investment.

SRDC focuses on the following areas:

- improving the competitive position and cost-efficiency of the Australian sugarcane industry
- achieving sustainable use and sustainable management of the natural resource base of the sugarcane industry
- applying industry, scientific and community resources more effectively to RD&E in the sugarcane industry
- managing SRDC resources efficiently to improve the accountability for expenditure on RD&E for the sugarcane industry.

BSES Limited

Thorough research, creative development and effective extension of new knowledge and technology are vital to every agricultural industry. BSES Limited, an industry-owned company, is the principal provider of RD&E to the Australian sugarcane industry. It aims to 'deliver realised value to growers, millers and other customers from targeted research, development and extension'.

BSES Limited employs scientists, engineers, field staff, extension officers and administrative staff who work together to ensure that Australian sugarcane remains a valuable, viable commodity. BSES Limited has several major programs of work and conducts these through its stations, centres and laboratories that are located in 17 sugarcane growing areas throughout Queensland and northern New South Wales.

BSES's strategic plan for 2008–13 identifies nine high-priority actions:

- Develop improved conventional varieties and enhance their adoption.
- Develop and commercialise genetically modified sugarcane varieties.
- Support an effective biosecurity capability for the Australian sugarcane industry.
- Develop farming systems that improve the sustainability and supply security of customers.
- Deliver RD&E-based tailored solutions that improve the sustainability of customers' businesses.
- Develop and deliver alternative processing methods and other products derived from sugarcane.
- Develop systems for sugarcane-based biorefineries.
- Develop and deliver technologies that improve sugarcane factory performance.
- Maximise profit from BSES Limited intellectual property, products and services.

BSES Limited is organised into three RD&E business units supported by corporate services:

- QCanes – variety improvement, molecular breeding, variety adoption, biosecurity, experiment stations
- QCrops – improved cropping systems, technology support, extension
- Sutech Solutions – consultancies.

Variety improvement: The conventional sugarcane breeding and selection program uses optimal genetic-evaluation systems to select parents, crosses and clones to deliver new, more productive cultivars to the Australian sugarcane industry. These cultivars also have adequate disease resistance to endemic diseases and acceptable milling characteristics and sugar quality. Variety introduction (foreign varieties) and variety exchange among regional programs enhance the germplasm used, both for breeding and varietal development. Varieties from this program are protected by plant breeders' rights.

Molecular breeding: Applies plant biotechnology and plant functional biology strategies to develop new sugarcane varieties. It focuses on developing and applying useful gene and other crop improvement technologies to create sugarcane with increased commercial cane sugar (CCS), early maturation, drought tolerance and water-use efficiency, nitrogen-use efficiency and altered shoot growth. Developing automated sugarcane micropropagation technologies (SmartSett[®]) to accelerate variety release and adoption is also a major thrust of this program. Implementing molecular markers for marker-assisted selection is another priority area. Much of this program's research is carried out in collaboration with CSIRO Plant Industry, UQ and CSIRO Sustainable Ecosystems.

Variety adoption: Undertakes operations that maximise adoption of the most suited sugarcane varieties by clients and, in doing so, maximises industry productivity and profitability. The program has an important role in maximising benefits attained from the BSES Limited QCanes operations.

Biosecurity: Diseases and pests represent a significant threat to the continued security of cane supply for the Australian sugarcane industry. Cooperating with federal and state government departments to prevent entry of these pests and preparation for possible incursions is a high priority for this program. Assisting the Variety Improvement program to breed disease- and pest-resistant varieties and conducting quarantine programs to prevent the spread of pests and diseases within Australia is also a high priority.

Experiment stations: Coordinates the management, maintenance and allocation of BSES Limited's considerable investment in resources and infrastructure associated with experiment stations. The seven stations, at Ayr, Bundaberg, Meringa, Ingham, Mackay, Tully and Woodford, provide support in the form of land, irrigation, machinery, offices, laboratories, workshops, sheds, crossing facilities, glasshouses and labour for all programs.

Improved cropping systems: Comprises several sub-programs that collectively aim to develop on-farm packages and technologies to improve productivity, sustainability and supply security on-farm and at district and regional levels. The sub-programs focus on both a wide perspective and component parts of new farming systems, best-practice nutrient management, sustainable weed management, sustainable pest management, and harvesting best-practice and machinery optimisation.

Technology support: Responsible for the provision of chemistry-based R&D, routine chemical analysis and chemical engineering expertise across BSES Limited. The program concentrates primarily on practical outcomes that can be adopted by the industry, but also includes elements of basic and pure research. Program activities are typically multi-disciplinary in nature and include interactions with many other research and commercial partners across areas such as non-sugar products, sugar quality, cane quality, near infra-red technology, chemometric data treatment, separation technologies and the application of these skills to directly benefit the industry.

Extension specialists: Work with researchers and industry participants to increase the adoption of R&D by different customers in different regions. They have good working knowledge of all aspects of cane growing and use a variety of channels such as one-on-one contact, grower discussion groups, field days and media to facilitate change in practice for cane grower and other industry clients. Extension is embedded in BSES Limited QCanes and QCrops and ensures that research is responsive to industry needs and research findings are communicated in a timely manner and effectively. Specific extension centres are located at Mareeba, Childers, Condong, Harwood, Innisfail, Proserpine, Rocky Point, and Sarina. Extension specialists also deliver tailored solutions as part of Sutech Solutions.

Sugar Research Institute (SRI)

Sugar Research Limited, trading as Sugar Research Institute (SRI) delivers world-class technology solutions that underpin the global competitiveness, sustainability and profitability of our stakeholders across the sugarcane industry.

On July 1, 2005, Sugar Research Limited entered into an exclusive affiliation with QUT, providing stakeholders with access to enhanced research and consulting capabilities and facilities. SRI, through sugar research and innovation at QUT, is Australia's premier sugar processing R&D specialist, with capabilities in sugar manufacture, power generation, sugar refining and sugar chemistry.

SRI conducts extensive research programs for clients and offers a broad range of commercially available consultancy services, contract R&D, innovative factory equipment designs, products and computer software to help clients improve productivity and factory performance.

SRI focuses on the following areas:

- sugarcane harvest, transport and cleaning
- sugarcane preparation, milling and diffusion
- by-products (bagasse, molasses, mud)
- sugar manufacturing
- energy (co-generation, gasification, biofuels and ethanol)
- process engineering and design
- computer modelling (computational fluid dynamics, finite element stress analysis)
- sugar chemistry.

CSIRO

CSIRO is working to breed better sugarcane varieties, produce better and more diverse products and improve mill and post mill processing to help support a sustainable and profitable future for the Australian sugar industry.

CSIRO focuses on the following areas:

Wild sugarcane

Existing commercial sugarcane varieties are hybrids of two types. There are, however, many other types of sugarcane or closely related species with useful genes. These genes could provide characteristics beneficial to cultivated sugarcane. CSIRO is investigating sugarcane types in collections held by BSES Limited and in China to identify favourable traits. CSIRO will then try and incorporate these favourable traits into commercial sugarcane varieties without importing unfavourable traits. CSIRO is helping develop alternative sugarcane products and high-yield varieties by developing molecular markers that flag useful and detrimental genes. Scientists have identified a number of markers for high sugar content and disease resistance and are now testing their reliability.

More sugar and new products

Sucrose, better known as sugar, is produced in the sugarcane's leaves and transported to storage tissue in the stem. Sugar is extracted from the stem at the sugar mill. CSIRO is investigating the transport steps involved in moving sucrose from the leaves to storage cells in the stem. CSIRO is also investigating the unique features in sugarcane's storage tissue, which allow high concentrations of sucrose to be stored. Using cultivated and wild varieties of sugarcane, CSIRO hopes to develop sugarcane that is better at storing sucrose. The aim is to breed new varieties of sugarcane with more sucrose, which could result in better profits for cane growers. Sugarcane has the potential to produce a range of other compounds for food or industrial applications. A greater understanding of sucrose transport and storage processes will provide basic information that can be applied to help produce compounds with a greater value than sucrose.

Breeding

In collaboration with BSES Limited, CSIRO performs an important role for the Australian sugar industry by breeding new, hardier and better yielding varieties of commercial sugarcane. CSIRO has variety breeding facilities in Townsville and Brisbane.

Supply chain

CSIRO is working to improve efficiencies in the Australian sugar industry supply chain by creating mathematical models that deal with supply chain complexity and produce first-rate production schedules for complex industries such as the sugar industry.

Department of Employment, Economic Development and Innovation (DEEDI)

DEEDI contributes to RD&E in the sugar industry primarily through the following functions:

Agronomic advice and crop management

DEEDI researchers are active in the areas of agronomy, with particular emphasis on soil health, pests and diseases, new farming systems and the effects of break crops (legume and other). The main strength of this program is that it uses targeted extension from a 'systems' viewpoint, as opposed to working with individual elements that make up a farming system.

Business management

Business management helps growers develop higher-level financial skills, marketing skills, and short- and long-term planning along with analysis of options. Incorporation of these skills and information and advice gained from agronomic RD&E is combined into a plan to maintain an economic, environmentally and socially sustainable enterprise in a rapidly changing environment.

Financial management is provided to growers via the services of the farm financial counsellor who will assist with monitoring current farm activities and evaluating future farm plans to ensure these areas complement each other and provide a better financial and environmental outcome.

Farm economic analysis tool (FEAT) is a gross margin analysis tool developed to help farmers and industry groups analyse their current operation and proposed changes of practice. FEAT used in this manner is an effective decision-making tool for assessing the economic benefit of change in their enterprise.

Market development and trade information

We help growers improve their understanding of 'marketing' versus 'selling'. This is especially important to those growers going into break crops for the first time. Trade information helps growers identify possible opportunities that may exist for them to be involved in an export supply chain.

Australian universities

The university sector represents Australia's largest public investment in research and adult education aimed at enhancing Australian industry. It comprises the largest range of expertise across research and innovation processes that underpin future productivity and sustainability.

Universities within the geographic range of the sugarcane industry have the highest concentration of researchers with long-standing involvement in research aimed at directly helping the industry. But there are many instances of important long-term contributions based on expertise rather than geographic proximity, and many instances where it has been important to dip into the wider pool of academic expertise to form successful teams addressing changing industry needs and opportunities.

Recent areas of 'university-led' collaborative research of particular relevance to the future of Australia's sugarcane industry include the development of sugarcane gene technologies, varieties tailored for the value-added products and biofuels, engineering innovations for sugar mills, and science-based reduction of the industry environmental footprint.

In most cases, university researchers are closely involved with participants in the industry corporate sector including representative bodies (i.e. CANEGROWERS), sugar companies (e.g. Sucrogen), service companies (e.g. BSES Limited, SRI). Many projects involve collaboration with other government-funded research providers (e.g. CSIRO, DEEDI), sometimes through concerted multi-party ventures such as cooperative research centres. Advanced students (particularly higher degree research students) play an important dual role in this process— as productive researchers in high-priority projects and as potential recruits with skills needed for future industry development.

The university charter for research across the whole spectrum from basic studies to commercial delivery makes the sector an important source of insight into emerging technical opportunities and challenges for industry. Similarly, the charter for research across environmental and social issues along with the traditional expectation of independent academic analysis makes the university a vital source of broader (and sometimes challenging) perspectives for a forward-looking industry.

Appendix C. Detailed full-time equivalent (FTE) capacity analysis*

RD&E area	Current FTE capability
Plant breeding	11
Plant pathology	5
Plant physiology	1.5
Agricultural engineering	1
Biotechnology	19
Remote/sensing/GIS	0.1
Extension/education officers	31.75
Research management	4.4
Technical officers	64.5
Pest management	4
Soil science	0.1
Economics	2
Food technology	3
Post-harvest processing	8
Agronomy	6
Environmental science	0.6
Irrigation science	2
Social science	0.4
Chemist	2
Weed specialists	2
Near-infra red technology	4
Biometrics	1
Database developer	1
Research station management	12
Communications	1
Corporate services	28

* Based on a survey undertaken by DEEDI in 2009 as part of the development of this strategy.