

SUGAR RESEARCH AND DEVELOPMENT CORPORATION

An Economic Analysis of Investment in Research Relating to Farm Management Systems for Sugar Cane

Background

SRDC has had a continuing investment for a number of years in research activities aimed at integrating various aspects of farm management, and the management of other industry sectors, in a systems approach. There has also been an effort in packaging such approaches for extension to cane farmers and the industry.

A systems approach and continuing training for growers are both seen to provide benefits to individual growers and the industry, through cost reductions and improved productivity.

The Projects

There were eight projects funded in this cluster between June 2002 and June 2008. The codes, titles, research organisations, period of investment and principal investigators for these projects are shown in Table 1.

Table 1: Project Codes and Titles for SRDC Investment in Management Systems for Sugar Cane

Project Code and Title	Research Organisation, Period of Investment and Principal Investigators
CG008: Targeted Planning for Profit – A grass roots program to build grower skills to manage change and implement integrated future planning	Canegrowers, BSES Limited and Isis Central mill 2005 to 2007 Wayne Stanley, Judy Skilton and Paul Nicol
CSE005: Integrating and optimising farm-to-mill decisions to maximise industry profitability	CSIRO Sustainable Ecosystems 2002 to 2006 Andrew Higgins
BSS217: Coordinated farm business management for the Australian sugar industry	BSES Limited 1999 to 2002 Eoin Wallis
FMS001: Farm Management Systems for the Sugar Cane Industry, Sub-program 1: Interactive web-based material to support FMS	Agrecon 2004 to 2005 Don Chambers and Simon Holloway
FMS002: Farm Management Systems for the Sugarcane	Agrecon 2004 to 2006

Industry, Subprogram 2: Environmental and economic performance indicators	Don Chambers and Simon Holloway
FMS003: Farm Management Systems for the Sugarcane Industry, Subprogram 3: FMS training course	Agrecon 2005 to 2007 Don Chambers and Simon Holloway
FMS004: Farm Management Systems for the Sugarcane Industry, Subprogram 4: Options for auditing and certification of FMS	Agrecon 2004 to 2008 Don Chambers and Simon Holloway
FMS005: Farm Management Systems for the Sugarcane Industry, Subprogram 5: Evaluation of FMS	CSR Sugar 2004 to 2007 Lisa McDonald

Table 2 presents the objectives for each of the eight projects in the cluster.

Table 2: Project Codes and Titles for SRDC Investment in Integrated Management Systems

Project Code and Title	Objectives
CG008: Targeted Planning for Profit – A grass roots program to build grower skills to manage change and implement integrated future planning	<p>To demonstrate improved capacity of growers to:</p> <ul style="list-style-type: none"> • Have confidence and capacity to accept change and adapt to change. • Implement action learning and continuous improvement processes. • Implement whole-of-farm planning and goal setting processes. • Use business performance monitoring processes to improve decision making processes. • Utilise existing human resources (such as women, children, business advisors, industry extension services etc) to improve decision making processes. • Develop business acumen in financial monitoring and planning.
CSE005: Integrating and optimising farm-to-mill decisions to maximise industry profitability	<ul style="list-style-type: none"> • Provide the capacity to integrate and optimise the management of the growing, harvesting and cane transport sectors in mill regions across the Australian sugar industry, to decrease costs of sugar production and increase industry profitability.
BSS217: Coordinated farm business management for the	<p>Raise the profitability of Australian cane growers by:</p> <ul style="list-style-type: none"> • Linking closely with sugar industry and financial professional staff to coordinate and deliver the Farm

<p>Australian sugar industry</p>	<p>Business Management (FBM) Program into all cane growing areas.</p> <ul style="list-style-type: none"> ● Implement a farm scale, whole system strategic planning approach to farm business management information and training using adult learning techniques. ● Train core sugar industry personnel in the FBM Program through a developed Train the Trainer package. ● Closely link the FBM Program to other extension activities including natural resources, productivity and family. ● Increase demand for the FBM Program in the Australian Sugar Industry. ● Develop and adopt new farm business management technology into the FBM Program.
<p>FMS001: Farm Management Systems for the Sugar Cane Industry, Subprogram 1: Interactive web-based material to support FMS</p>	<ul style="list-style-type: none"> ● To compile an interactive web-based database on legislation and current best management practices and develop web-based regional natural resource management risk assessment tools and generic sugar FMS templates and guides.
<p>FMS002: Farm Management Systems for the Sugarcane Industry, Subprogram 2: Environmental and economic performance indicators</p>	<ul style="list-style-type: none"> ● To determine key performance indicators for each cane production district to assess changes in economic and environmental criteria arising from the application of FMS risk assessment methodology.
<p>FMS003: Farm Management Systems for the Sugarcane Industry, Subprogram 3: FMS training course</p>	<ul style="list-style-type: none"> ● To raise awareness in cane growers of the economic and environmental benefits of incorporating and integrating a range of previous industry initiatives within a management framework that concurrently facilitates increased productivity and better environmental outcomes. ● To increase the capacity of cane growers to implement FMS within their own cane farming businesses.
<p>FMS004: Farm Management Systems for the Sugarcane Industry, Subprogram 4: Options for auditing and certification of FMS</p>	<ul style="list-style-type: none"> ● Evaluate the overall success of the FMS program by providing easy to use auditing guidelines and tools. ● Develop guidelines and tools for farmers to be able to conduct a low cost, accurate, yet unbiased self-audit. ● Assist farmers to be able to understand the process and advantages of auditing by a second party, and to enable farmers to proceed towards third party accreditation if required.
<p>FMS005: Farm Management Systems for the Sugarcane</p>	<ul style="list-style-type: none"> ● Assess impacts (benefits and disbenefits) to the industry and the wider community from adoption of FMS. ● Assess outcomes in relation to project costs.

<p>Industry, Subprogram 5: Evaluation of FMS</p>	<ul style="list-style-type: none"> • Determine any changes in attitudes to FMS as a result of project activities. • Determine satisfaction of stakeholders, growers, millers, R&D organisations, SRDC and community groups (with an environmental focus) with the FMS projects. • Examine efficiencies and effectiveness of internal project processes. • Provide learning's on what makes a successful program to get adoption of more environmentally friendly farming practices. • Provide information throughout the project timeline in a participatory, action learning environment involving the evaluation and project teams to allow evolving research strategy. • Ensure an open and transparent participatory process. • Communicate information about effective project management. • Communicate information to the wider research public on the social aspect of adoption/non-adoption of FMS.
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Project Backgrounds

CG008

CG008 was funded to build grower capacity to adapt to change and financially analyse farm decisions. The project was located in the Isis mill area in order to build on the activities already being undertaken by the Isis Target 100 group. A number of other projects were also funded by SRDC in connection to the Isis group including CG009 which was directly aimed at studying soybeans and other break crops. The Isis Target 100 group has been very successful in achieving its aims and has won a number of awards.

CSE005

CSE005 was the most recent in a long line of projects on this topic. It involved CSIRO and BSES bringing together a series of relevant models. Relevant models included:

- Model developed by CSIRO and CRC Sugar from 1996 to 2002 that examined options for increasing net revenue through optimising the harvest date of individual farm paddocks, through exploiting the geographical and crop differences that occur in sugar yield at harvest date.
- BSES examined options for harvester pour rate, fan speed and billet length for decreased costs of production, cane/sugar losses and impacts on rations.
- BSES developed the Harvest Transport Excel spreadsheet model, designed to measure the costs of harvesting individual farm paddocks for a given set of inputs.

BSS217

At the time this project was funded, there had already been a number of activities to improve business management skills in the sugar industry. Grower interest in these activities was high, and the success of the projects seemed to indicate demand for such activities. However, those efforts had been fairly isolated, and this project was seeking to coordinate efforts and provide better linkages of FBM activities with extension efforts in natural resources, production and family.

FMS001 to FMS005

The FMS suite of projects was developed in response to an increasing need for grower resources and demonstrated capacity to manage the environmental pressures of cane farming. In total five projects were raised through contracts with SRDC through funding from the Natural Heritage Trust (NHT), and a further 3 independently funded by SRDC. Only five are considered in this cluster. The three independently funded projects in this series were not included in this cluster. They were:

- FMS006: Travel to WWF Sugar Dialogue meeting and South African sugar industry for learning about other experiences of FMS (included in Cluster 35: Travel and learning activities to enhance individual capacity: industry personnel)
- FMS007: Land and Water Management Plan drafting tools for the FMS framework (included in Cluster 14: Managing water more sustainably)
- FMS008: Farm health and safety tools for the Sugar FMS framework (included in Cluster 4: Improved health and safety of industry, people and community)

The focus for the projects was to develop online resources and tools to assist growers to manage economic and environmental outcomes, as well as discussion papers and various specific applications. The NHT funding was part of the Commonwealth Department of Agriculture Fisheries and Forestry Pathway to Industry Environmental Management Systems (EMS) Programme (Pathways Programme).

Project and Cluster Investments

Estimates of the SRDC and other funding for the eight projects are shown in Tables 3 and 4. The funding for Projects FMS001 to FMS005 has been combined into one column.

Table 3: SRDC Investment in Cluster for Years ending June (nominal \$)

Year ending June	CG008	CSE005	BSS217	FMS001 to FMS005	Total
1999	0	0	54,188	0	54,188
2000	0	0	98,230	0	98,230
2001	0	0	95,020	0	95,020
2002	0	0	100,210	0	100,210
2003	0	57,856	17,027	0	74,883
2004	0	167,772	0	0	167,772
2005	32,542	172,657	0	201,494	406,693
2006	67,344	175,950	0	539,014	782,308
2007	35,114	0	0	93,307	128,421
Total	135,000	574,235	364,675	833,815	1,907,725

Source: Project proposals

Table 4: Other (non-SRDC) Investment in Cluster for Years ending June (nominal \$)

Year ending June	CG008	CSE005	BSS217	FMS001 to FMS005	Total
1999	0	0	60,329	0	60,329
2000	0	0	109,361	0	109,361
2001	0	0	105,788	0	105,788
2002	0	0	111,566	0	111,566
2003	0	68,404	18,956	0	87,360
2004	0	198,358	0	0	198,358
2005	105,617	204,134	0	36,042	345,793
2006	218,568	208,027	0	34,420	461,015
2007	113,964	0	0	39,537	153,501
Total	438,149	678,923	406,000	109,999	1,633,071

Source: Project proposals

Table 5 shows the total investment for each year for the Cluster.

Table 5: Total Investment for the Cluster for years ending June (nominal \$)

Year	SRDC	Other	Total
1999	54,188	60,329	114,517
2000	98,230	109,361	207,591
2001	95,020	105,788	200,808
2002	100,210	111,566	211,776
2003	74,883	87,360	162,243
2004	167,772	198,358	366,130
2005	406,693	345,793	752,486
2006	782,308	461,015	1,243,323
2007	128,421	153,501	281,922
Total	1,907,725	1,633,071	3,540,796

For the eight projects reported above, SRDC has contributed 54% of resources in nominal terms.

Outputs

A summary of the principal outputs from each of the five projects is reported in Table 6.

Table 6: Summary of Principal Outputs by Project

Project	Principal Outputs
CG008: Targeted Planning for Profit – A grass roots program to build grower skills to manage change and implement integrated future planning	<ul style="list-style-type: none"> • Baseline evaluation techniques were implemented at the start of the project to assess baseline grower attitudes/capacity to coping with changes, feelings/emotions about the future and farm/business practices. • The Targeted Planning for Profit mentoring service commenced in late 2005, with at least 10 growers undertaking the process of one-on-one mentoring. • A FutureCane tool known as Farm Economic Analysis Tool (FEAT) that was developed by QDPI was used and tested by Isis growers as part of the project. • Other tools delivered as part of CG008 include the BSES Paddock Journal, Isis Landcare Group Bug Checking Guide, Isis Target 100 Gross Margin Analysis tool, and DPI&F IPM Reference Manual. • Between 60 and 70 growers participated in the project and have used FEAT. An additional 40-50 growers have been exposed to FEAT through neighbours and other activities.
CSE005: Integrating and optimising farm-to-mill decisions to maximise	<ul style="list-style-type: none"> • Contributed a unique framework that allowed previously developed individual models to be used collectively to address several big picture options in harvesting and

industry profitability	<p>transport.</p> <ul style="list-style-type: none"> • Provided the capacity to comprehensively address these big picture options (e.g. siding rationalisation, increased group size, logistics optimisation) without missing any important knock-on effects associated with simplistic ‘back-of-the-envelope’ approaches. • The framework developed is not a physical computer model itself, but rather a process of necessary inputs/outputs between the models and a strategy for using the models collectively. • Additional component models developed in CSE005 were: <ul style="list-style-type: none"> ○ Harvest Haul Model (redevelopment of paddock level BSES model to regional scale) ○ Transport Capacity Planning Model ○ Siding Location Optimisation Model ○ Road Transport Scheduling Model (in conjunction with CSE010) • The project involved case studies for Mourilyan, Herbert, Plane Creek and Mossman regions, although the Mourilyan and Plane Creek cases studies ended prematurely due to reasons beyond the control of the project team. • In all regions, the social capacity of various sectors of the industry was developed through increased communication and understanding between sectors through working groups comprised of growers, harvesters and millers. • Adoption of options to improve efficiencies at the harvesting/transport interface has been achieved in Mossman, Mourilyan and the Herbert.
BSS217: Coordinated farm business management for the Australian sugar industry	<ul style="list-style-type: none"> • Development of a marketing plan for the delivery of improved FBM to the industry. • Development of a template that includes production and financial inputs (SugarBiz) to determine monthly and yearly budgets, and an associated training manual. • Development and delivery of ‘Farming in Low Income Environment’ Workshops. • A total of 851 growers participated in FBM activities. • Workshop programs/materials were developed and extension staff trained to deliver training beyond the life of the project. All regional coordinators and 90% of BSES extension staff undertook and completed 5 days training in Certificate IV in Assessment and Workplace and Training.
FMS001: Farm	<ul style="list-style-type: none"> • Database of Legislation, Codes of Practice and Best

<p>Management Systems for the Sugar Cane Industry, Subprogram 1: Interactive web-based material to support FMS</p>	<p>Management Practices relevant to Australian sugar cane production.</p> <ul style="list-style-type: none"> • Risk assessment framework incorporating an initial database of regional-specific risk factors. • Generic FMS templates for sugar cane production. • An interactive web-based interface providing growers with easy access to generic and regional FMS information. • Incorporation of feedback from growers who reviewed the online tools. • A sugar cane production information module has been designed and is currently being integrated with the generic AgrePRECISE system prior to the commencement of the training program (in FMS003). • Potential to integrate a range of other grower-oriented initiatives (such as Land and Water Management Plans, GPS records and tracking, precision farming applications, mill production statistics, regional NRM information exchange, customised information services and decision support tools from research and commercial providers etc) has been widely canvassed.
<p>FMS002: Farm Management Systems for the Sugarcane industry, Subprogram 2: Environmental and economic performance indicators</p>	<ul style="list-style-type: none"> • A standard list of environmental and economic performance indicators relevant to the sugar industry. • A fact sheet for each indicator with most fact sheets including regional specific information. • Current baseline conditions for each indicator in each region where available from regional NRM plans. • Relevant regional targets as specified in regional NRM plans to guide sugar growers and the industry on what is being expected of them. • Indicator list and fact sheets added into the online sugar FMS tools database. • Indicators and associated risks being incorporated within the FMS Tools risk assessment procedure. • Advanced growers being used as presenters in some regional FMS awareness/training programs, including highlighting benchmarks being achieved by better performing growers.
<p>FMS003: Farm Management Systems for the Sugarcane Industry, Subprogram 3: FMS training course</p>	<ul style="list-style-type: none"> • Project website incorporating all tools developed under the FMS projects. • Development of FMS Check – a voluntary self assessment questionnaire that covers all aspects of farm business practice at a broad level of detail. It scores the grower against a 3 level scoring system; benchmarks scores against other registered users in the region; a

	<p>recommendation report for the grower based on the results, and a regional services database.</p> <ul style="list-style-type: none"> • Development of the 8 step guide – a process by which growers can participate in the FMS activity to the degree they feel is relevant or advantageous to their business. The guide includes templates for farm policy documents; a document register; risk assessments; action plans; and monitoring guides. • Search tools for the database of legislation, codes of conduct, Best Management Practice and other content is available for search by management categories. • A discussion paper on the opportunities for FMS Certification. • A library of formatted documents available for download as templates to assist growers in managing process and management issues. • Preparation of 10 case studies of growers responses and outcomes using the FMS Check resource and associated tools.
<p>FMS004: Farm Management Systems for the Sugarcane Industry, Subprogram 4: Options for auditing and certification of FMS</p>	<ul style="list-style-type: none"> • A Sugar FMS auditing and accreditation proposal in the form of a systems-based approach. The proposal includes the process to be undertaken by growers using the Sugar FMS program tools; four levels of adoption that can be achieved by growers; a three-tiered audit structure; and some industry issues that need to be addressed. • The realisation that the industry is far from ready for a certified and auditable process based system. • Realisation that basing an accreditation system on a process does little to encourage implementation of best management practices needed to farm in a sustainable manner. • The understanding that there is confusion and no consensus on the preferred approach, however there has been feedback and support for various inclusions or considerations. • A discussion paper titled “Sustainable Sugar” reviewing the issues and providing innovative recommendations on the way forward for the sugar industry.
<p>FMS005: Farm Management Systems for the Sugarcane Industry, Subprogram 5 :Evaluation of FMS</p>	<ul style="list-style-type: none"> • Three surveys of growers in five regions in the Australian sugar industry conducted between 2005 and 2007. • The actual carrying out of the surveys resulted in an increased awareness of FMS and related concepts such as environmental risk assessments. • Project produced several key lessons, which will be of

	<p>great value if FMS is taken up by the industry.</p> <ul style="list-style-type: none">● The results of the survey include:<ul style="list-style-type: none">○ In March 2007, 50% of growers were aware of the Sugar Industry FMS project.○ The level of awareness of the term FMS was 88%.○ The level of sophistication in the understanding of the FMS concept increased significantly during the project.○ Different components of the FMS tools developed are being used in different regions of the industry for the purposes of helping growers to develop and implement FMS type plans.○ The Canegrowers Organisation was seen by growers as the main source of information on FMS.○ There was a significant increase in the understanding of environmental risk assessment over the life of the project, including of the environmental risks associated with farming.○ During the course of the project the number of growers with farm plans increased, however the majority of these plans are not recorded formally.○ The period also saw an increase in the number of growers who completed COMPASS training.○ Growers largely agreed the industry needs an FMS – the main reasons being that eventually the government will require it and that the industry could improve its performance through an FMS program.○ Growers were interested in undertaking an FMS but they didn't feel strongly that an industry FMS would improve their image with the wider community or have any significant benefits for their farming enterprises.○ Growers would prefer to audit their own plans for their own benefit. They are not interested in paying anyone to help them do an audit and they have very little interest in taking their audit reports to industry or government.● The outputs produced from other FMS projects (FMS001 to 004) have not been widely utilised by the Sugar Industry at this stage.
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Outcomes

A summary of the principal outcomes from each of the five projects is reported in Table 7.

Table 7: Summary of Principal Outcomes by Project

Project	Principal Outcomes
<p>CG008: Targeted Planning for Profit – A grass roots program to build grower skills to manage change and implement integrated future planning</p>	<p>The outcomes of the project for the Isis region, particularly for a proportion of those 70 growers who participated in the project, are:</p> <ul style="list-style-type: none"> • Development of an industry culture based on strong grower capacity to adapt to change, combined with action learning and goal setting skills to enable growers to objectively assess their businesses from an economic and lifestyle perspective. • Active application of principles of action learning and continuous improvement to day to day farming decisions. • Overcoming issues between grower lifestyle and business priorities through goal setting practices and farm planning tools that incorporate lifestyle-family priorities into whole of farm planning and performance monitoring. • Active involvement of spouses in farm planning. • Use of whole farm planning principles in cane farming businesses as a matter of course. • Powerful use of productivity records and farm recording tools to drive profit-focused decision making. • Creation of a collaborative learning culture focused on continuous learning that encourages stronger synergies between growers. • Improved ability to foster the ability of other industry partners (e.g. financial advisors, commercial industry advisors, bank managers, contractors) to influence positive change in the sugar industry. • This increased capacity, together with other efforts in the Isis region, has led to the uptake of a number of changed practices, including more growers managing soybean crops to food grade (as opposed to stock feed grade, or green manure). • The increased capacity helped growers adapt to changes necessary to cope with the smut disease incursion in the district.
<p>CSE005: Integrating and optimising farm-to-mill decisions to maximise industry profitability</p>	<ul style="list-style-type: none"> • Industry participants in Mossman and Mourilyan have agreed the options implemented have led to improved efficiencies and reduced delays in transport and

	<p>harvesting.</p> <ul style="list-style-type: none"> • Pathways to implementation have been prepared for the options developed in the project for the harvesting and transport interface. For example extended time window of harvest; harvesting group amalgamation; delivery timetable and roster logistics; and siding rationalisation. • Follow-up value chain projects have been developed in the Mourilyan and Herbert regions by the case study groups. • An analysis developed in the project on the benefits for rationalisation/upgrading of the transport network was used in a successful proposal to the federal government for \$3.6 million to build upgraded sidings (expected completion of 72 sidings by 2008). • Adoption of increased time window of harvest (from about 12 hours to 18 hours per day) in Mourilyan from 2003 onwards led to some reductions in waiting times for bins and improved utilisation of mill's bin fleet. • Adoption of increased time window of harvest combined with optimal siding rosters in 2004 onwards, leading to an ability for the Mossman mill to transport the cane to the mill given its declining limited locomotive and bin capacity and no budget for increased capacity. • Adoption of optimised harvester rosters in both mills of the Herbert region during the 2005 harvest season, which improved daily balances of cane supply to each of the mills and along the branch lines. • Research outputs, including the models, approach and networks developed have been utilised in other SRDC and CSIRO projects.
<p>BSS217: Coordinated farm business management for the Australian sugar industry</p>	<ul style="list-style-type: none"> • 12% of sugarcane growers participated in a range of FBM workshops (851 growers). • Most growers participating in the workshops agreed the workshop would influence their decision-making, which should translate to increased profitability. • No follow up on participants has been undertaken to determine the level of changed practices adopted by participants. • At the time the project was completed, it was difficult to evaluate whether the program had improved individual participant's profitability as a number of other factors were affecting profitability over the years of the project, including low sugar prices, rat damage, orange-rust, replacement of Q124, and drought. • Very few of the original extension staff who received the Certificate IV training are still in the industry.

	<ul style="list-style-type: none"> • The workshops are no longer delivered, however the training material has been retained and FBM has developed into the Farm Performance Improvement Program which stretches across the sugar industry.
<p>FMS001 to FMS005: Farm Management Systems for the Sugar Cane Industry Subprograms 1 to 5</p>	<ul style="list-style-type: none"> • A compatible framework for an integrated whole of industry approach providing a common link for interaction of mills, harvesters and growers with industry stakeholders, government and the community. • Greater awareness of environmental risks from cane farming, and indicators of how well they are being managed by individual growers and industry representatives. • Adoption of the tools developed are expected to lead to the following outcomes: <ul style="list-style-type: none"> ○ Improved industry practices ○ Clear opportunities to fund, invest in and provide improved regional technical and advisory services ○ Improvement of existing regional services programs ○ Identification of gaps and instances where duplication or inefficiencies exist ○ Opportunities for industry led programs to bypass or obviate the need for statutory compliance ○ A demonstration of an industry wide determination to raise productivity, lift profitability, improve farm practice ○ Increased confidence in the general community that sugarcane farming is conducted in a responsible manner using best practices • The adoption of the FMS tools developed as part of the projects is not apparent. In fact as a part of projects FMS003 and 004, there was some significant concern and resistance to the FMS approach. Changes were made in the direction of the project because of this; however, adoption has still not occurred. • The originally proposed process-based system is not believed the most effective path to industry sustainability and FMS004 recommended a different approach that links the sectors in an integrated manner. • Conclusions of the report for FMS005 with respect to the entire FMS program and its management include: <ul style="list-style-type: none"> ○ The specific objectives specified for each of the sub-projects were not drawn into an overarching framework (e.g. a supporting framework that

	<p>includes R&D, incentives, promotion and support of participating landholders, stakeholder endorsement, training of extension and support staff to assist growers and education campaigns.</p> <ul style="list-style-type: none"> ○ Limited consultation with industry throughout the project, particularly in respect to complementing existing programs. More regional interaction and cooperation may have brought the FMS concept greater acceptance. ○ Many FMS type programs take a long time to become widely accepted and adopted, for example the cotton BMP program has been in development for 10 years. <ul style="list-style-type: none"> ● The FMSCheck tool is now available for use by growers on the SRDC website. ● The Canegrowers organisation is in the process of developing an alternative FMS process for the industry which is broader and less-prescriptive in nature. The findings of FMS005 have been useful in developing the new FMS approach, and some of the tools developed as part of projects FMS001 to FMS004 may at some stage be incorporated into the Canegrowers FMS approach.
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Benefits

A summary of the principal types of benefits and related costs associated with the outcomes of the projects is shown in Table 8.

Table 8: Summary of Principal Benefits by Project

Project	Principal Benefits
CG008: Targeted Planning for Profit – A grass roots program to build grower skills to manage change and implement integrated future planning	<p><u>Economic:</u></p> <ul style="list-style-type: none"> ● Optimisation of farm income due to: <ul style="list-style-type: none"> ○ improved quality of soybeans grown to food grade, and therefore higher prices ○ capacity to implement change to adapt to smut disease in the region ○ adoption of other practices aimed at optimising income <p><u>Environmental:</u></p> <ul style="list-style-type: none"> ● Increased capacity for change and planning skills may contribute to the adoption of natural resource management practices. ● Use of soybeans, even when harvested for grain, contributes to reduced fertiliser use.

	<p><u>Social:</u></p> <ul style="list-style-type: none"> • Increased individual and social capacity to manage change. • Increased capacity to balance life/work pressures.
<p>CSE005: Integrating and optimising farm-to-mill decisions to maximise industry profitability</p>	<p><u>Economic:</u></p> <ul style="list-style-type: none"> • Expected cost savings of at least \$2 million per year to the Herbert region upon completion of the siding upgrades/rationalisation and extended time window of harvest to 6pm finish (expected from 2008 onwards). • Detailed analyses have not been undertaken by CSIRO to determine the scale of benefits from adoption of recommended options in other regions, such as increased time of harvest window adopted in Mourilyan and Mossman. <p><u>Environmental:</u></p> <ul style="list-style-type: none"> • No known environmental impacts, although if transport costs are reduced, there may be some implications for reductions in greenhouse gases. <p><u>Social:</u></p> <ul style="list-style-type: none"> • Social objectives can be incorporated into the models, for example restricting rostered harvesting near a hospital to day-light hours (achieved in the Mourilyan project). • Legacies of the participatory action research process including improved communication and understanding between industry sectors and also between research providers.
<p>BSS217: Coordinated farm business management for the Australian sugar industry</p>	<p><u>Economic:</u></p> <ul style="list-style-type: none"> • While no follow-up studies on the impact of these specific courses have been undertaken, generally, increased management skills of cane farmers lead to increased farm profitability <p><u>Environmental:</u></p> <ul style="list-style-type: none"> • While not a specific focus, some of the on-farm changes adopted as a result of a farm systems approach may lead to improved natural resource management on the farm. This may arise either through specific practice changes (harvesting etc.) or through having additional time and resources available to devote to NRM issues. <p><u>Social:</u></p> <ul style="list-style-type: none"> • Improved capacity of growers with respect to farm management; improved capacity of BSES staff with respect to training skills.
<p>FMS001 to 005: Farm Management Systems for the Sugar Cane Industry,</p>	<p>Benefits of the series of projects to date include:</p> <ul style="list-style-type: none"> • Development of a process by the sugar industry to inform growers of their obligations and direction for

Subprograms 1 to 5	<p>improvement.</p> <ul style="list-style-type: none"> • Demonstration of a proactive approach to environmental stewardship by the sugar industry, with at least some measurable and defensible benchmarks and targets based on the broadly-consultative regional NRM plan process. <p>While adoption of FMS in the form developed by these projects will likely not be adopted, the projects may contribute in some way to an industry FMS approach currently being developed by the Canegrowers organisation. Some of the benefits of FMS when adopted include:</p> <p><u>Economic:</u></p> <ul style="list-style-type: none"> • Identification and remediation of deficiencies in growers current practices. • More efficient and economic cane production. • An objective defence mechanism for any unfounded criticisms of individuals' farm operations. • Improved accountability of the sugar industry through better coordinated information exchange. • Greater assurances for banks and insurance companies. • Potential avoidance of increased Government regulation and sustained access to increasingly demanding markets. <p><u>Environmental:</u></p> <ul style="list-style-type: none"> • Improved environmental sustainability and healthier communities <p><u>Social:</u></p> <ul style="list-style-type: none"> • Clear demonstration of grower and industry commitment to the sustainability of cane farming. • Improved social and community capacity. <p>There is potentially a short-term cost to growers for the adoption of FMS, for which there are often regional financial incentive programs and other technical support.</p>
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Public versus Private Benefits

The benefits from CG008 are mostly private in nature, in terms of increased income and on-farm natural resource benefits (reduced fertiliser use and improved soil structure). Some benefits would be distributed through the value chain in terms of soybean production and marketing. There may be some public benefits in the form of improved capacity of individuals and the community to adapt to change, and off-farm natural resource benefits.

The benefits from CSE005 are mostly private benefits to various sectors in the sugar cane value chain in the form of cost reductions. As most sugar is exported (85%) cost reductions may stimulate supply but will not significantly change the price as domestic users of sugar pay prices equivalent to the export price.

The benefits from BSS217 would be mostly private in nature, with cost reductions on-farm. There were also some public benefits from the improvement in institutional capacity (e.g. training of trainers to deliver the courses).

While there have been few benefits to date, the benefits from the FMS series of projects will be mostly private in nature, with flow-through of benefits through the value chain. There will also be some flow-on benefits throughout sugar communities. Public benefits would once again take the form of some reduced impact of the industry on the environment, and improved capacity of individuals and the community.

Additionality

If SRDC were to receive less money from the Australian Government, project CG008 was likely to have been funded anyway. Such an approach was a high priority for the industry, and seen as an important investment. However, the Australian Government funding may have led to the project being funded sooner than it would have been otherwise. Project CSE005 is unlikely to have been funded with a reduction in funding from the Australian Government. This is because this type of approach was seen as high risk by the industry. Project BSS217 is also unlikely to have been funded if SRDC received no funding from the Australian Government. At the time a predecessor project to BSS217 was funded, there was some significant debate regarding whether SRDC should be supporting projects linked to individual businesses of the growers. Because the issue the projects would seek to address impacted on profitability, it was eventually accepted that it was reasonable to have a project in that area. Part of the argument for proceeding was that SRDC was using public money to fund it, rather than industry money .

The FMS series of projects would not have been funded by SRDC in the absence of specific government funding. In fact, the FMS series of projects analysed in this report (FMS001 to 005) were funded by a special grant through the Australian Government's Pathways to EMS program. The subsequent SRDC-funded projects FMS006 to FMS008 would not have been funded without the initial grant involved in FMS001 to 005.

Match with National Priorities

The Australian Government's national and rural R&D priorities are reproduced in Table 9.

Table 9: National and Rural R&D Research Priorities 2007-08

Australian Government	
National Research Priorities	Rural Research Priorities
<ol style="list-style-type: none"> 1. An environmentally sustainable Australia 2. Promoting and maintaining good health 3. Frontier technologies for building and transforming Australian industries 4. Safeguarding Australia 	<ol style="list-style-type: none"> 1. Productivity and adding value 2. Supply chain and markets 3. Natural resource management 4. Climate variability and climate change 5. Biosecurity <p><i>Supporting the priorities:</i></p> <ol style="list-style-type: none"> 1. Innovation skills 2. Technology

Project CG008 addresses rural research priorities 1, 2 and 3. It also addresses national research priority 1, through the possibility of participants improving their natural resource management.

Project CSE005 addresses rural research priorities 1 and 2, and to some extent supporting priorities 1 and 2. It also addresses national priority 3 due to its use of sophisticated modelling.

Project BSS217 addresses rural priorities 1, 2 and 3, and possibly national research priority 1.

The FMS series of projects addresses national research priority 1, and rural research priorities 1 and 3. It also addresses supporting priorities 1 and 2 through its creation of sophisticated websites.

The assessment of the relative contribution for the cluster as a whole to each of the five Rural Research Priorities is:

- Rural Research Priority 1 (50%)
- Rural Research Priority 2 (30%)
- Rural Research Priority 3 (20%)

Quantification of Benefits

CG008

Project CG008 helped build the ability of the participating growers to adapt to change and financially analyse their businesses. Participation led to a philosophy of profitability (costs vs income returns) and an understanding of the concept of gross margins. Through

this process, and analysing their farming businesses using FEAT and related software, there was a realisation among the growers that managing soybean crops for food grade was the most profitable option in terms of a legume break crop. Soybeans can be either left in the ground as a green manure crop, or harvested for grain. The way the crop is managed, and the resulting quality of the grain, determines which market the harvested soybeans are sold into. The highest quality and highest price market is the food grade market. Soybeans in this market are used for a range of purposes including soy milk, soy flour, tofu/nato production etc. Lower grade markets include the stockfeed market, and the oil market. All soybeans grown for harvesting in the Isis region meet the requirements of either the food grade or stockfeed markets with the bulk of the crop achieving food grade quality.

The skills learnt through participation in the project helped with an understanding of how to control costs and optimise quality to improve profitability through reaching the quality required for the food grade market. However, it is noted that there was another SRDC-funded project being funded at the same time in the district (CG009) that was aimed at investigating opportunities for a grain and legume industry in coastal sugar cane cropping regimes. The Sugar Yield Decline Joint Venture (SYDJV) also had an impact on growers adopting legume break crops, but not specifically managing soybeans to maximise quality and therefore profits. The agronomic information provided by the SYDJV has also been important in assisting cane farmers to make the transition from green manure soybeans to successful grain crops.

The skills developed through participation in CG008 also helped with the growers ability to respond to the smut outbreak in the Isis district in early 2006. The growers were able to take a pro-active approach to considering how to adapt and react to the threat while minimising the financial impact. They developed a strategic 5 to 10 year plan of phasing out smut-susceptible varieties, and introducing less-susceptible or resistant varieties.

For the purposes of this analysis, the quantified benefit relates to the improved gross margin that has been realised due to the decision to effectively manage the soybean crops to achieve food grade quality, as opposed to stockfeed quality, or growing as a green manure crop. It is assumed that without CG008, soybeans would have still been grown in the district as a legume break crop and harvested for grain for either the stockfeed grade market, or the food grade market (adoption would have occurred due to CG009 and YDJV). However by considering gross margins and taking a continuous improvement approach, a larger proportion of those soybeans being harvested for grain achieve the food grade quality, and therefore a price premium. While there may be some additional costs in ensuring the quality of the product, there is still an increase in the gross margin due to the size of the price premium. It is recognised that there are other economic benefits associated with the adoption of a legume break crop such as soybeans, including reduced fertiliser use and increased cane yields. However, since the adoption of the soybeans as a legume break would have occurred even without CG008, the benefits to the cane component of the business would have occurred anyway, and therefore are not valued here. It is also assumed that a proportion of those who were growing soybeans as

a green manure crop make the decision to grow soybeans for harvesting, and meet the food grade quality.

There were approximately 900 hectares of soy beans planted in the Isis district in 2007 (Country Life, 7 February 2008). In the Isis region, approximately 70% of this production went to the food grade market, and about 17% to the feedstock market. The remaining 13% was grown as green manure. The proportion going to the food grade market as opposed to the feedstock market was an increase compared to previous seasons. For example, in the 2004/05 season 39% of the soybeans in the area were food-grade (Plath, J., undated). The increase in the 2005/06 and 2006/07 seasons to 70% of production being food grade is only partially attributable to CG008. For the purposes of this analysis it is assumed that without the project, the proportion reaching food grade by 2008/09 would have increased to only 60%, as opposed to 80%. It is assumed that half of this increase is from those who were previously harvesting and achieving stock feed grade, and the other half is from growers who were previously growing soybeans as green manure. It is further assumed that the total area of soybeans under production in the Isis region will increase over the next three years, to approximately 1,200 hectares. This increase in total area is not due to the project, however the proportions achieving food-grade are assumed to continue in the same proportions (both with and without the research). It is possible the proportion achieving food-grade may increase again in the future, however this would not be attributable to CG008, but could be influenced by other factors including the opening in November 2007 of a soybean storage and handling facility locally, as well as the release of a new soybean variety specifically developed for the edible market, and to be grown in coastal areas.

Table 10 presents the assumptions regarding the proportion of soybeans achieving different grades within the Isis region, both with and without the research.

Table 10: Adoption of Soybean Varieties in Isis Region With and Without CG008

Type of Soybeans	Proportion of Area Without Research (%)	Proportion of Area With Research (%)
Green Manure	20	10
Soybeans Harvested for Stockfeed Grade	20	10
Soybeans Harvested for Food Grade	60	80

Table 11 presents the costs and revenues associated with soybeans harvested for grain (for crushing, for meal, oil and flour), and also for edible soybeans.

Table 11: Costs and Revenue Assumed for Soybean Break Crop when Harvesting for Grain

<i>Revenue</i>	
Price (\$ per tonne) for feedstock grade soybeans	450.00
Price (\$ per tonne) for food grade soybeans	520.00
Yield (t per ha)	3.70
Total revenue (\$ per ha) for feedstock grade soybeans	1,665.00
Total revenue (\$ per ha) for food grade soybeans	1,924.00
<i>Costs when harvesting for grain</i>	<i>\$ per ha</i>
Land preparation	119.75
Planting	156.80
Fertiliser	88.29
Weed control	87.58
Insect control	36.00
Irrigation	217.28
Harvesting	98.00
Freight (\$37 per tonne)	136.90
Levy (1%) for feedstock	16.65
Levy (1%) for food grade	19.24
Dessication	52.72
<i>Total costs (\$ per ha) for feedstock grade soybeans</i>	<i>957.25</i>
<i>Total costs (\$ per ha) for food grade soybeans</i>	<i>959.84</i>
<i>Net revenue (\$ per ha) for feedstock grade soybeans</i>	<i>707.75</i>
<i>Net revenue (\$ per ha) for food grade soybeans</i>	<i>964.16</i>
Sources: Judy Plath (pers. comm., 2008.)	

The total cost of planting and growing soybeans not for harvest is about \$172 per ha (Neil Sing, pers comm., 2005). However, in some cases full cultivation is used to prepare land for soybeans (Les Robertson, pers.comm., 2007). It is assumed that this could increase the total cost of planting and growing soybeans not for harvest to around \$300 per ha. The average cost of planting and growing soybeans not for harvest is assumed to be a simple average of \$172 and \$300 or \$236 per ha. Since 2005, soybean preparation costs have risen by about 8%, and therefore it is assumed this cost is assumed to now be \$259 per ha.

When grown as a green manure crop as part of a rotation with sugar cane, the nitrogen fixing characteristic of the soybeans means it is not necessary to fertilise the cane crop in the plant year, and the first ratoon year. However, when the grain is harvested, the nitrogen benefits are not as great, and some fertiliser is required in the first ratoon year. It is therefore assumed that a fertiliser cost of \$80 per hectare is required in that year, that would not otherwise have been required if the soybeans were grown as a green manure crop. This is taken into account as a cost for those growers moving from growing soybeans as a green manure crop, to harvesting for grain.

CSE005

There is evidence that the outputs from CSE005 have been adopted, and will continue to be adopted, by those case study regions involved in the project. The nature of the benefits that can be achieved by the type of modelling developed include:

- Increased sugar yields, from optimising both CCS and cane yield
- Reducing cane loss and sugar losses by operating harvesters
- Cost savings from optimisation of use of harvesters and transporters

The actual potential benefits from the adoption of the recommendations of the project have only been calculated for one of the regions (Herbert). It was calculated by the researchers that there will be cost savings of at least \$2 million per year to the Herbert Region's sugar industry upon completion of siding upgrade/rationalisation, and extended time window of harvest to a 6pm finish. The main benefit of a harvesting time window with a 6pm finish is about a 50% reduction in the time spent waiting for bins. The main benefit from the siding rationalisation is less shunt time and a reduction in locomotive shifts, leading to greater utilisation of locos.

It is anticipated that such benefits will occur from the year ending June 2009 (taking two years to reach the full \$2 million benefit). However, there have been some infrastructure costs associated with achieving these cost savings, including \$7.2 million to build the upgraded sidings (funded by CSR and grant from Federal government).

While it is acknowledged that there will be additional benefits to other regions from this project, they have not been valued in this analysis. It is recognised therefore that this is a potential underestimate of the benefits from CSE005. In addition, the outputs from CSE005 have contributed to other SRDC and CSIRO projects, and potential benefits from these projects have not been valued.

As the framework and models developed in CSE005 build on a significant body of previous work, only a proportion of the benefits can be attributed to CSE005. This is because those in the Herbert region may have adopted some components of the previously existing models anyway, and would have received some benefit from that adoption. It is assumed that 50% of the assumed net benefits can be attributed to CSE005. The attribution factor also applies to the capital costs, as it is possible that the full capital replacement effort may not have taken place without CSE005.

BSS217

Benefits have not been quantified from BSS217 as the workshops developed as part of this project were only delivered for a short time (during the life of the project), and no follow up has been undertaken to identify what changes participants made as a result of undertaking the course. However, there is some evidence that those agricultural producers who undertake this type of training are more profitable.

FMS001-005

Benefits from FMS001-005 have not been quantified as it appears the direct outputs of the work are unlikely to be adopted in their current form. The Canegrowers organisation is currently developing an FMS approach that is less prescriptive than that developed as part of the FMS001-005 projects. The new approach being developed is building on some lessons learnt from the earlier approach, but will largely not incorporate the outputs from FMS001-005. In the future some of the outputs may be incorporated as tools that might be used as part of the approach being currently developed. Therefore attribution of benefits to FMS may be difficult. It may be possible to quantify the benefits of this work in the future when the path to adoption and subsequent benefits becomes clearer.

Assumptions

Table 12 presents a summary of the assumptions used in the analysis

Table 12: Summary of Assumptions

Item	Assumption	Source
CG008		
Gross margin for feedstock grade soybeans	\$707.75 per ha	Derived from Table 11
Gross margin for food grade soybeans	\$964.16 per ha	Derived from Table 11
Costs associated with planting soybeans for green manure	\$259 per ha (saved cost)	Agtrans Research 2007
Fertiliser benefit lost moving from green manure to harvesting grain	\$80 per ha (additional cost)	Agtrans Research, 2007
Total area of soybeans in region in 2006/07 and 2007/08	900 hectares	Country Life Newspaper
Total area of soybeans in region in 2010/11	1,200 hectares	Consultant estimate, after discussion with Judy Plath
Proportion of soybeans achieving food grade without CG008	60%	Consultant estimate, after discussion with Judy Plath
Proportion of soybeans achieving food grade with CG008	80%	Consultant estimate, after discussion with Judy Plath
Proportion of soybeans achieving stockfeed grade without CG008	20%	Consultant estimate, after discussion with Judy Plath
Proportion of soybeans achieving stockfeed grade with CG008	10%	Consultant estimate, after discussion with Judy Plath
Proportion of soybeans grown as green manure	20%	Consultant estimate, after discussion with Judy Plath

without CG008		
Proportion of soybeans grown as green manure with CG008	10%	Consultant estimate, after discussion with Judy Plath
First year of change due to CG008	2006/07	Consultant estimate, after discussion with Judy Plath
Year maximum change occurs	2008/09	Consultant estimate
CSE005		
Annual benefit to Herbert region from adoption	\$2 million per annum	Higgins et al, 2006
Year of first benefit	2008/09	Higgins et al, 2006
Number of years from first benefit to full benefit reached	2 years	Consultant estimate
Capital cost to achieve annual benefit	\$7.2 million	Higgins et al, 2006
Attribution of annual benefits and capital cost to CSE005	50%	Consultant estimate

Results

All past costs and benefits were expressed in 2006/07 dollar terms using the CPI. All benefits after 2006/07 were expressed in 2006/07 dollar terms. All costs and benefits were discounted to 2006/07 using a discount rate of 5%. The base analysis used the best estimates of each variable, notwithstanding a high level of uncertainty for many of the estimates. All analyses ran for the length of the investment period plus 25 years from the last year of investment in the cluster (2006/07) to the final year of benefits assumed (2030/31)).

Investment criteria were estimated for both total investment and for the SRDC investment alone. The PVC presented is for the investment in the total cluster (all eight projects) while the PVB includes the benefits from the two projects for which benefits are quantified (CG008 and CSE005). Each set of investment criteria were estimated for different periods of benefits. Given the assumptions and discount rate used, the investment criteria are positive between 10 and 15 years as reported in Tables 13 and 14.

Table 13: Investment Criteria for Total Investment
(discount rate 5%)

Criterion	0 years	5 years	10 years	15 years	20 years	25 years
Present value of benefits (m\$)	-1.75	0.14	4.16	7.32	9.79	11.73
Present value of costs (m\$)	4.38	4.38	4.38	4.38	4.38	4.38

Net present value (m\$)	-6.14	-4.25	-0.22	2.93	5.41	7.34
Benefit cost ratio	-0.40	-0.03	0.95	1.67	2.24	2.67
Internal rate of return (%)	negative	negative	4.6	8.7	10.3	11.0

Table 14: Investment Criteria for SRDC Investment
(discount rate 5%)

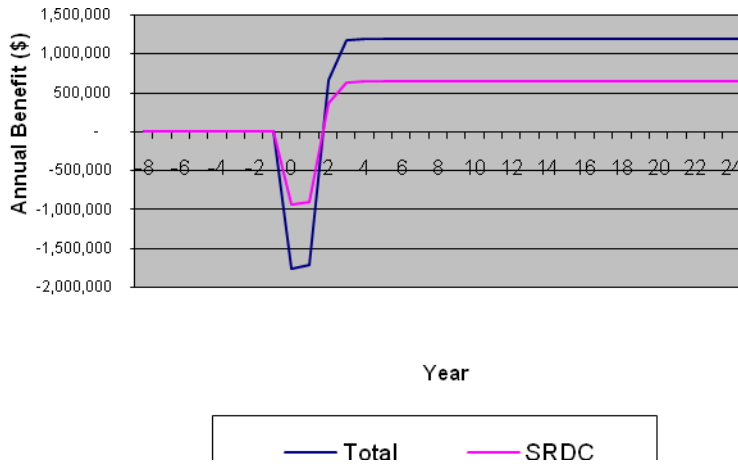
Criterion	0 years	5 years	10 years	15 years	20 years	25 years
Present value of benefits (m\$)	-0.94	-0.07	2.23	3.92	5.24	6.28
Present value of costs (m\$)	2.33	2.33	2.33	2.33	2.33	2.33
Net present value (m\$)	-3.27	-2.25	-0.10	1.59	2.92	3.96
Benefit cost ratio	-0.40	-0.03	0.96	1.68	2.25	2.70
Internal rate of return (%)	negative	negative	4.7	8.8	10.4	11.1

The results show that the benefits of the two projects that were quantified exceed the costs of all eight projects in the cluster. Benefits from CSE005 make up 78.3% of the total PVB, with the remaining 21.7% being from CG008.

In terms of the quantified benefits, 100% could be attributed to the productivity and adding value component of the rural research priorities.

The cash flow of benefits is shown in Figure 1 for both the total investment and for the SRDC investment. The negative annual benefits early in the cash flow are due to the capital investment associated with establishing new sidings as an outcome from project CSE005.

Figure 1: Annual Benefit Cash Flow



Sensitivity Analyses

Sensitivity analyses were carried out on a range of variables and results are reported in Tables 15 to 17. All sensitivity analyses were performed for the SRDC investment only using a 5% discount rate with benefits taken over the life of the investment plus 25 years from the year of last investment. All other parameters were held at their base values. Table 15 demonstrates the sensitivity of the investment criteria to the expected annual benefits to the Herbert Region due to the adoption of recommendations from CSE005. It shows that if the likely benefits are halved, from \$2 million per annum to \$1 million per annum, then the investment for the cluster only just breaks-even, with a significant proportion of the benefits coming from CG008. If the assumed annual benefit increases to \$3 million, then the B/C ratio increases to 4 to 1.

Table 15: Sensitivity to Assumption Regarding Annual Benefit to Herbert Region from CSE005 (SRDC investment, 5% discount rate; 25 years)

Criterion	\$1 million	\$2 million Base	\$3 million
Present value of benefits (m\$)	2.88	6.28	9.68
Present value of costs (m\$)	2.33	2.33	2.33
Net present value (m\$)	0.56	3.96	7.35
Benefit cost ratio	1.24	2.70	4.16
Internal rate of return (%)	6.0	11.1	14.8

Table 16 demonstrates the sensitivity of the investment criteria to the assumed increase in the proportion of growers harvesting soybeans of food grade quality. The base scenario

assumes that an additional 20% of the area of soybeans grown meets food grade (made up of 10% previously stockfeed grade and 10% previously green manure). If this increase is halved to 10% (made up of 5% previously stockfeed grade and 5% previously green manure); then the investment criteria are still positive, due to the influence of CSE005. However, the PVB for CG008 has decreased to \$0.68m from \$1.37m. This means the individual investment in CSE005 would still break-even, as the PVC for CG008 alone is \$0.62 million. If the proportion harvested for food grade increases to 30% (from 20%), then the investment criteria increase, with the B/C ratio increasing from 2.7 to 2.9

Table 18: Sensitivity to Assumption Regarding Proportion of Growers Harvesting Soybeans of Food Grade Quality Due to CG008 (SRDC investment, 5% discount rate; 20 years)

Criterion	10%	20% (Base)	30%
Present value of benefits (m\$)	6.00	6.28	6.97
Present value of costs (m\$)	2.33	2.33	2.33
Net present value (m\$)	3.27	3.96	4.64
Benefit cost ratio	2.41	2.70	2.99
Internal rate of return (%)	10.2	11.1	12.0

No sensitivity to adoption (high, medium, low) has been presented for the cluster as a whole, as this would only apply to the CG008 component of the analysis, which accounts for only 22% of the total benefits.

Conclusions

This cluster of projects has included activities aimed at integrating aspects of the sugar production system, using systems approaches. These projects have been focused at both the farm and industry levels. Benefits have been quantified for two of the projects in the cluster. The benefits from these two projects have more than covered the costs of the entire cluster, with a B/C ratio of 2.7 to 1, when only SRDC investment is considered. The benefits are in the form of saved costs due to efficiencies in cane harvesting and transport, and increased gross margins due to improved quality of soybeans. The extent of any benefits from the projects for which benefits were not quantified is unclear. In one case (FMS series of projects), there is unlikely to be any adoption of the outputs in their current form. In the other case (BSS217) the impact on those growers who participated in workshops is unknown, and the workshops developed are no longer being delivered.

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