Evaluation of SRDC investment in Travel and Learning Opportunity Projects

Prepared for

Sugar Research and Development Corporation

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F I N A L   R E P O R T

Prepared by

Hassall & Associates Pty Ltd
Level 4, 52 Phillip Street
GPO Box 4625
Sydney NSW 1004
Tel 02 9241 5655

AU1-547

Contact Information

	Hassall & Associates Pty Ltd
Address	GPO Box 4625 Level 4, 52 Phillip Street Sydney NSW 2001
Telephone Number	02 9241 5655
	0421 274076
ABN	95 001 211 007

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1 Introduction

Hassall & Associates has been contracted to conduct a cost benefit evaluation of SRDC investment in selected Travel and Learning Opportunity Projects (TLOPs). This project uses instructions from the Rural Research and Development Corporation and a cost benefit template developed by ACIL Tasman.

The project includes an assessment of:

- two detailed case studies examining costs and benefits associated with the learning opportunities; and
- description and assessment of the social and other benefits accruing across the TLOP program as a whole.

Case Study 1
Building biosecurity capacity to enable rapid response to pest incursion. This will draw on the following projects:

1. BSS274 - Sugarcane-oriented quarantine training program and
2. BSS280 – Overseas sugarcane quarantine and emergency response

Case study 2
Practice change by landholders: This will draw on the following project:

1. BSS272 - Controlled traffic study tour of the Birchip cropping group by the NSW farming systems steering committee

2 The TLOP program

The TLOP program is ***"an initiative aimed at helping sugar industry people and organisations to build their capacity for leadership, learning and/or change by conducting a targeted activity, or through travel[1]."***

While the TLOPs were primarily focussed on building human capacity within the sugar industry, they have also been expected to lead to changes that will contribute towards at least one of the six key outcomes of the SRDC R&D Plan 2003-2008:

1. an **increasing and more reliable cane supply**, primarily through the implementation of robust farming systems that enhance economic and environmental performance, and are less vulnerable to the impacts of adverse factors such as disease and climate variability;
2. **facilitation of change** which promotes adoption of whole-of-system solutions to **enhance revenue and cost efficiency across the value chain** at mill area and regional levels;
3. demonstration of environmental sustainability to the satisfaction of all stakeholders;
4. diversification of the income stream from products derived from sugarcane;
5. **enhancement of human capacity and partnerships** between industry, research and regional communities to underpin change, learning and innovation; and
6. **an effective R&D capability** underpinning industry futures.

2.1 Investment

SRDC has invested **$703,544** in **108** of these projects in the five years from 2002/03 to 2006/07 (Table 1). The investment in each project is capped at $5,000 for an individual or $10,000 for a group. Projects are selected through a competitive round.

Table 1 SRDC investment in TLOPs 2002-03 to 2006-07

	Financial year					Total
	02/03	03/04	04/05	05/06	06/07	
Number of TLOPs	4	4	27	43	30	108
Total SRDC funding	$16,285	$26,410	$178,735	$275,771	$206,343	$703,544
Average SRDC funding	$4,071	$6,603	$6,620	$6,413	$6,878	$6,514
Total other contributions	$20,000	$21,560	$359,488	$220,646	$231,300	$852,994
Average other contributions	$5,000	$5,390	$13,314	$5,131	$7,710	$7,898

[1] TLOP Application Kit, SRDC

2.2 Project types and focus

A variety of different types of travel and learning activities have been funded, including:

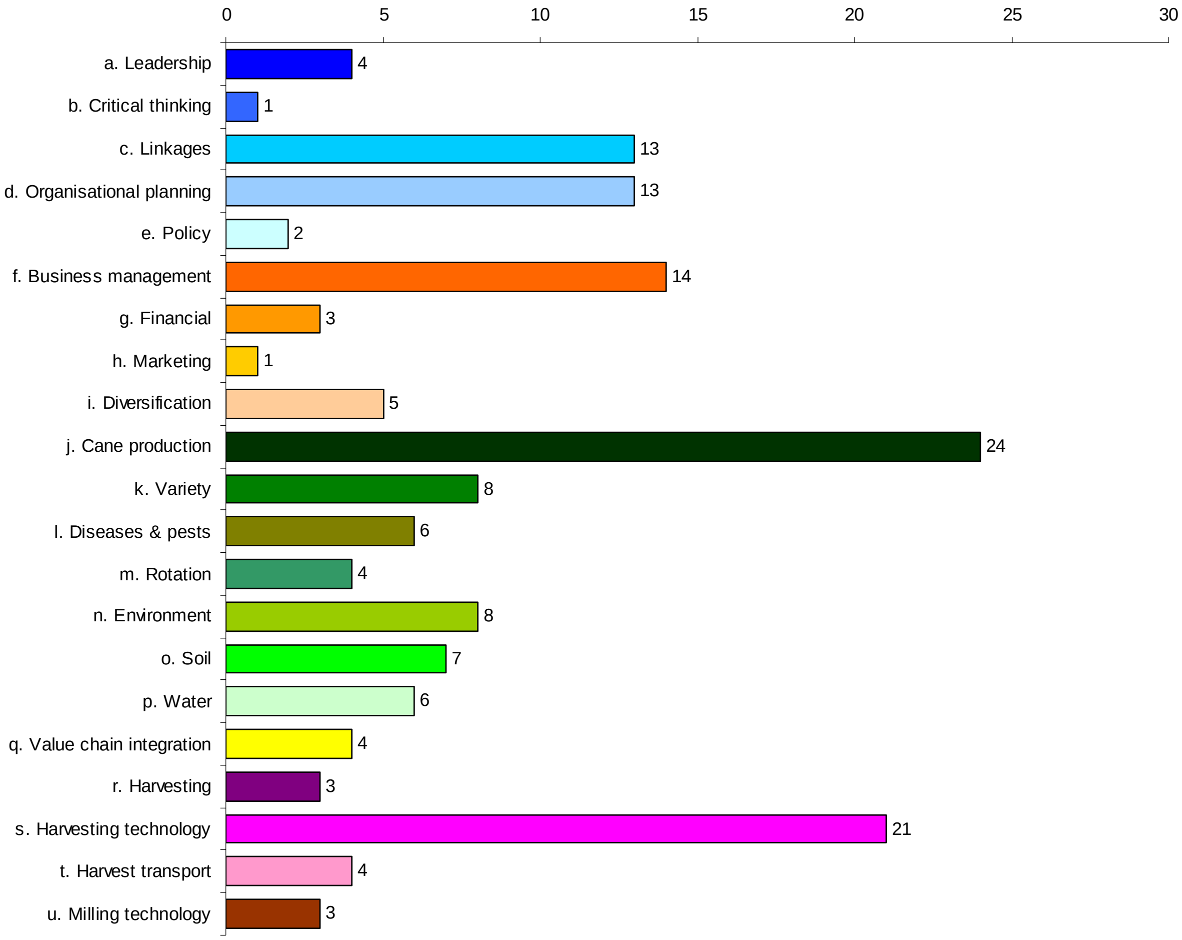
- travel;
- conference attendance;
- conference organisation or hosting;
- training attendance (where the participant receives TLOP funds to attend a course, usually delivered away from their own region);
- training provision (where the project funds a trainer to deliver a course to the project participants, usually in their own region)
- learning workshop (participatory workshop, no trainer);
- tours;
- site inspections;
- hosting a guest specialist.

Tours and conferences were the most popular forms of learning opportunity, together accounting for 75% of the TLOPs.

Table 2 Proportion of SRDC TLOP funds used towards travel costs

	02/03	03/04	04/05	05/06	06/07	Total
Average SRDC funding	$4,071	$6,603	$6,620	$6,413	$6,878	$6,514
Average travel funding	$4,071	$6,190	$5,430	$4,477	$5,017	$4,913
Total SRDC funding	$16,285	$26,410	$178,735	$275,771	$206,343	$703,544
Total travel funding	$16,285	$24,760	$146,610	$192,506	$145,491	$525,652
Travel as a % of SRDC funds	100%	91%	85%	75%	76%	79%

TLOPs addressed a range of different types of issues (Figure 1).



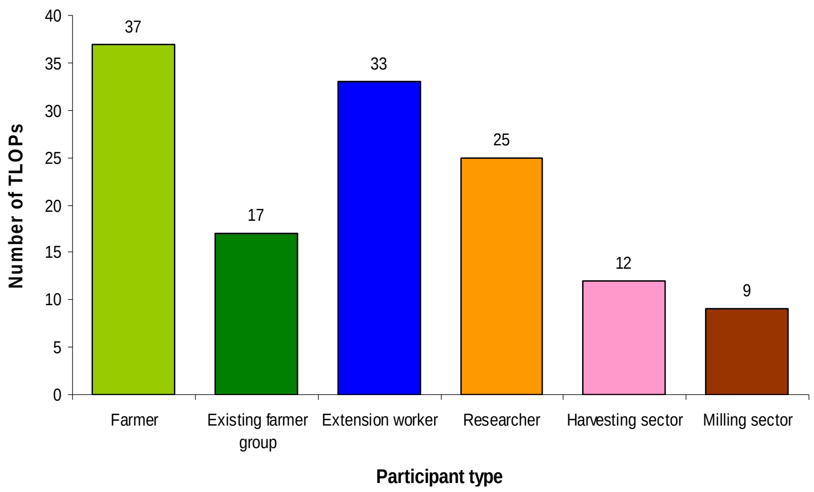
2.3 Program reach

Projects have been from all regions in which cane is grown. In total there have been 51 direct recipients (project leaders) for the 91 projects undertaken until mid-2006/07. Each project had between 1 and 92 people (on average, 14 people) as direct participants. The cumulative number of people involved in TLOPs (based on estimates from project leaders) is:

- approximately 1,000 direct participants;
- direct communication to around 10,000; and
- indirect communication to approximately 50,000.

However, there is a large degree of double counting in this estimate as many projects reach the same audiences. For example, 45% of recipients have been involved in more than one TLOP.

TLOPs directly involved a wide spectrum of industry participants (Figure 2). Forty four percent of TLOPs involved growers or grower groups, often together with extension staff.



Number of TLOPs
40
35
30
25
20
15
10
5
0
37
17
33
25
12
9
Farmer
Existing farmer group
Extension worker
Researcher
Harvesting sector
Milling sector
Participant type

3 The Cost Benefit Analysis Process

3.4 Introduction

This cost benefit analysis has been conducted in line with the instructions set out by the Rural R&D Corporation, and by using a template developed by ACIL Tasman. The three critical factors that have been addressed in the preparation of the analysis are:

- clear identification of the net public and private benefits produced;
- identification and reporting of all direct costs; and
- a test of the counterfactual.

Ultimately the cost benefit will be used to better understand:

- the scale and scope of the returns to levy funds invested by the RDCs;
- whether the public funds committed to the RDCs induce sufficient spillover benefits to make the funding worthwhile; and
- whether changes in funding – up or down – would increase or decrease the induced net private and spillover benefits.

Two critical points for this study are the counterfactual and attribution.

3.5 The counterfactual and attribution

Testing the counterfactual is sometimes difficult when the SRDC contribution to a process forms one input into an ongoing process. To test the counterfactual several scenarios are considered:

- would the R&D have been undertaken and/or would the benefits have been gained in the absence of RDC involvement?
- has the RDC brought forward a benefit?
- would an outcome have been produced eventually by foreign research? If so, when might this have occurred?
- are other groups working on substitute technologies?

The process also considers: what incentive would individuals or voluntary groups of individuals have to make a similar investment themselves? Is the RDC involvement likely to increase adoption rates beyond what otherwise would be the case?

In the cases studied, the counterfactual is generally a longer time frame for adoption. The joint nature of contribution to efforts undertaken in the TLOP also provides challenges with attribution.

The resulting total benefits identified will have to be apportioned to the organisations that funded the project. For example, some weighting may be necessary due to the level and importance of in-kind support for the project from other organisations.

3.6 Discussion of the Benefits of TLOPs

TLOPs provide a combination of financial, environmental and social outcomes. These outcomes are dependent on the focus of the study. A large number of projects have focussed on a specific technical area and seek to make a change in relation to that issue through building the capacity of people to make the change.

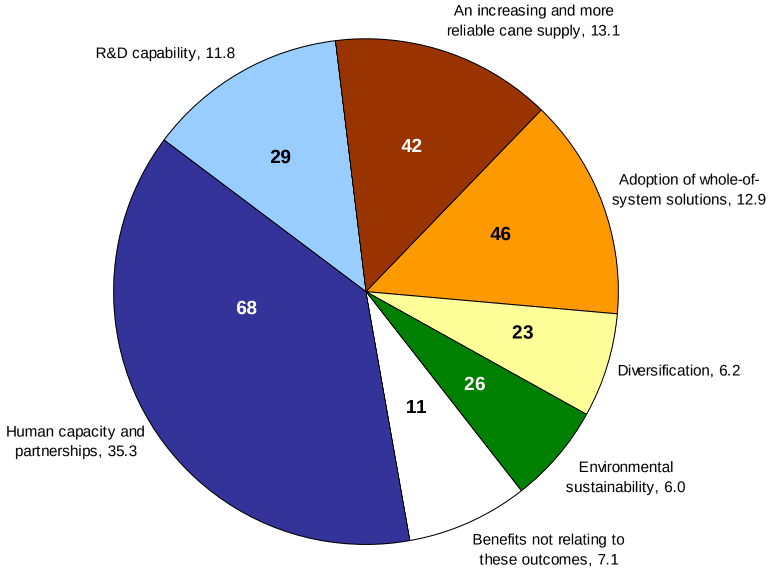
3.6.1 Industry and Environmental Benefits

As a result of increasing industry awareness, knowledge and confidence, TLOPs have resulted in some changes to management practices or decisions which in turn have benefits for the industry and/or environment, depending on the issue in question. These have provided benefit in varied ways, for example:

- increased rate of adoption of farming practices that have been in place elsewhere and shown to improve productivity and/or benefit the environment;
- development of new, innovative approaches that have potential to reduce costs, increase productivity and / or reduce environmental impact;
- learning from others' experience to minimize risk and maximize efficiency in adopting new technology – this was particularly relevant for a major technology investment in a mill which can't be tested by 'trial and error';
- identifying management options for extending season length that can work for both millers and growers; and
- avoided the cost of pursuing value adding products which did not have a viable market.

As projects have focussed on a range of broad and specific topics, each have led to a range of different scales and issues of change and potential benefit. Figure 3 illustrates project leaders' averaged views of the contributions their TLOPs have made towards SRDCs intended outcomes.

Figure 3 Contributions of TLOPs towards SRDC outcomes

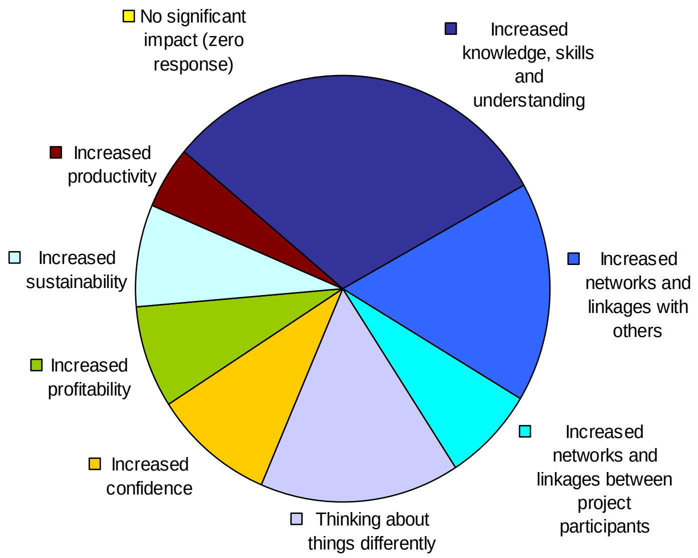


Numbers after labels denote average % contribution to each outcome indicated by project leaders (from total 100% per project)
Numbers on chart indicate % of projects that indicated some contribution to this outcome

3.6.2 *Social benefits*

A review of the TLOP program undertaken by Hassall & Associates in 2007[1] identified that the primary benefits of the travel and learning projects lay in building knowledge, know-how, awareness, networks and confidence, which in many cases led to participants adopting new ways of doing things, undertaking further research and development activities or being better prepared for risks. Project leaders' consider the immediate benefits of TLOPs to be primarily social (Figure 4).

Figure 4 Project leaders' perceptions of the most significant impacts of their TLOPs



With respect to the analytical framework, the social benefits relate primarily to:

- building innovation skills for industry;
- creation of resilient regional communities;
- biosecurity; and
- building research skills.

Building innovation skills for industry

Expanding participants' horizons, exposing them to new ideas or ways of thinking and encouraging innovators is a key benefit of the TLOPs. Many projects have led to changes in the way people think, interact or plan.

Creation of resilient regional communities

As well as building individual's preparedness for change, TLOPs have helped to create and strengthen social linkages. Networks built through TLOPs, often amongst the participants in the TLOP as well as with others outside of their region or industry, are often maintained after the project has completed.

Some TLOPs focussed specifically on developing participants' leadership and team skills that help them to more effectively participate in their industry and community.

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[1] *Review of SRDC Travel and Learning Opportunity Projects Final Report to SRDC, April 2007.*

Biosecurity
Some projects have focussed specifically on building the industry's preparedness for potential pest incursion. These have helped to build research capability and communication with industry and other agencies.

Research capability
TLOPs have contributed towards the three identified elements of research capability:

- attracting and retaining researchers;
- building technological capability relevant to Australia; and
- building research skills.

While research capability has mainly been for researchers and extension agents (referred to here as 'researchers'), several projects have also led to trials and projects being undertaken by growers. A number of projects have strengthened linkages between industry and research and some involved joint planning of research and extension strategies.

Researchers gain exposure to the wider research world and broader networks with their peers, which can help to contribute to research quality and skills. Many of these networks have been maintained and some have led to collaborative research projects. In cases like biosecurity, travel is the only way to provide researchers with a first hand experience of the pest or issue they are working on.

For some researchers, receiving a TLOP is valued as something of a reward that helps to motivate them and strengthen their commitment to the industry while also exposing them to new ideas. This helps to retain and reinvigorate researchers working with the industry.

4 Case Study 1: Building biosecurity capacity to enable rapid response to pest incursion

Case study number one draws on two TLO projects:

- BSS274 - Sugarcane-oriented quarantine training program and
- BSS280 – Overseas sugarcane quarantine and emergency response.

Of 36 exotic moth borer species recorded feeding on sugarcane, 22 have the potential to invade Australia and cause damage to sugarcane crops. Australia and Fiji are the only two sugar producing countries that don't have exotic moth borers present as an economic pest.

BSES has seven species listed as posing high threats to the Australian Sugar industry as they are in close proximity (found in PNG and through SE Asia) and have a 'significant pest status' as pests of sugarcane in these countries. The introduction of any of these into Australia would result in significant losses not only to the sugarcane industry but also to other industries such as maize and wheat. Other hosts of moth borers are *Oryza sativa* (rice), *Poaceae* spp. (grasses), and *Sorghum bicolor* (sorghum). These borers may affect other industries.

The seven high-threat borers are generally capable of colonizing central and northern QLD, with some possibly extending as far south as Bundaberg and also into the northern territory (Sallam and Allsopp 2005c).

In 2004, Dr Mohamed Sallam, BSES Meringa, gained funds from SRDC to hold biosecurity training workshops in Far North Queensland during late 2004 through to early 2005. This involved:

- biosecurity workshops for growers (some were linked to in GrubPlan/New Farming Systems workshops);
- a biosecurity workshop that was attended by BSES extension officers, farm managers, Cane Productivity staff, AQIS and DPI&F Northwatch staff;
- a survey and training tour of Cape York communities (to survey for pests and diseases and to educate the community);
- attendance at the AQIS/DPI&F Joint Operations Group meeting; and
- future planning on biosecurity initiatives in the industry.

The grower workshops focused on pest identification and what to do if something unusual is found. The industry workshop covered hands-on training on exotic and endemic pests and diseases, the National Australia Quarantine Strategy, Plant Health Surveillance and Monitoring Program, emergency response planning and exotic incursions, and identification of different host plants.

Specific benefits of the TLOP were:

- increased understanding of sugarcane for AQIS and DPIF Northwatch staff (identification of varieties);
- staff within BSES developed a stronger knowledge of biosecurity and quarantine which will increase their awareness;
- the workshops increased understanding of the Pest Incursion Management Plan and to strengthen BSES' ties with AQIS and DPI Northwatch;
- increased grower awareness of pests and courses of action to take if one is found; and

- first-hand experience in handling pest detection (stem-borer on northern islands).

This TLOP also resulted in the development of the following TLOP, BSS280.

In 2005, Dr Mohamed Sallam, BSES Meringa, was assisted by a SRDC travel and learning grant and by BSES to travel to the USA and Kenya. This study tour focused on stem borers and included:

- 10 weeks working at the Louisiana State University with entomologists, quarantine workers and grower groups;
- visits to research stations in Texas;
- meeting with a team of entomologists at the Institute of Food and Agricultural Sciences at the University of Florida who worked on control of invasive insect and plant pests, including the sugarcane pests whitegrubs, wireworms and sugarcane aphid; and
- presenting a paper at the International Conference on Lepidopterous Cereal Stem and Cob Borers in Africa, held in Kenya at the International Centre of Insect Physiology and Ecology.

Dr Sallam was able to travel to areas that are currently battling with approaching populations of exotic borers (e.g. Mexican Rice Borer approaching Louisiana). The trip enabled him to appreciate the seriousness of the potential threat of exotic moth borer species and gain knowledge on preparedness and management of the pests. He was able to transfer this knowledge to the industry in Australia. The Sugar Industry Biosecurity Plan is largely based on Pest Incursion Management Plans done by BSES. The assessments and priorities within the Biosecurity Plan are reviewed annually. Knowledge gained in TLOP will ensure that these are correctly updated.

In particular, the overseas project led to increased knowledge and heightened awareness of the potential threat posed by Mexican Rice Borer (*Eoreuma loftini*) – a pest which was previously relatively unknown and had received little attention.

Specific benefits of the TLOP were:

- first hand experience working with exotic pests (such as sugarcane borer and Mexican Rice Borer);
- interaction with other entomologists from around the world and quarantine workers and growers from Louisiana;
- increased knowledge of pest management and quarantine strategies in the US and Africa;
- increased knowledge of can growing systems and pest management; and
- a Pest Incursion Management Plan for Mexican rice borer was prepared.

4.1 Counterfactual

The counterfactual to this TLOP funding from SRDC is that the knowledge could have been gained remotely. When put to Dr Sallam this was considered very unlikely, as he had limited knowledge of the Mexican Rice Borer, *Eoreuma loftini,* prior to the travel.

4.2 Benefits

4.2.1 Industry

To the levy payers and other industries in the supply chain in Australia

The main benefits gained relate to **biosecurity**, in particular the following:

1. **Improved preparedness to prevent incursion** of pests that would be detrimental to cane productivity levels, should they become established and unable to be eradicated.

The Pest Categorisation Index forms the basis of implementation of the Cost Sharing Agreement between the federal government, state governments and the affected industry being brokered by Plant Health Australia that will provide for grower compensation in case of crop destruction. Mexican Rice Borer and *Diatraea saccharalis* are classified as a Category 2 pests, meaning would cause significant public losses of amenity and or environment and will impose major costs on the industries concerned (Sallam and Allsop 2005c).

2. **Improved response to a possible incursion** of moth borer species, which would limit any pest spread and cost to industry. These benefits come through improved industry awareness, preventative measures and response plans.

Scientists within BSES and the industry had determined rankings for Mexican Rice Borer 'in-house', though a publicly available Pest Management Plan was not in existence and industry knowledge of the pest was not high. This TLOP reinforced the rankings BSES had previously determined, and ensured a Plan Dossier was prepared quickly, published on the BSES website and findings distributed to industry. Such a plan would normally take a number of months to prepare. Without the TLOP, the industry would not have felt it was necessary to produce a dossier and plan for Mexican Rice Borer at that time[1].

The TLOPs also reinforced the quarantine rankings that BSES had determined for *Diatraea*, and enhanced their Pest Management Plans. Updates are done every 5 years, but the trip ensured that this was done in a timely manner incorporating correct information and consideration of new technologies[1].

[1] Mohamed Sallam, September 2007, pers.comm.

Table 3 Risk ratings for Mexican Rice Borer and Diatraea sp. as ranked in the BSES Pest Incursion Management Plan

Name	Entry potential	Establishment potential	Spread potential
E. loftini	Medium[1]	High[2]	High[3]
Diatraea	Medium[1]	High[2]	High[3]

Statistical probability of occurrence is within the range of 0.3-0.7 for medium and 0.7-1 for high.

1 pest entry is likely given the combination of factors including the distribution of the pest source, management practices applied, low probability of pest survival in transit.

2 the pest has potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environmental conditions that prevail in Australia. Based upon its current world distribution, and known conditions of survival, it is likely to survive in Australia wherever major hosts are grown.

3 the pest has potential for natural spread to all production areas.

Source: Sallam and Allsopp 2003a; Sallam 2005b; Plant Health Australia 2004.

Other industry benefits include:

3. Building technological capability relevant to Australia

Research capacity within BSES was enhanced, and researchers were able to update their pest database. The biosecurity training project was carried out in line with the development of the National Sugar Industry Biosecurity Plan, which was launched on 21 July 2004. The TLOPs would have contributed to improving accuracy of this plan.

4.2.2 Environmental

Environmental benefits gained relate to the **avoidance of use of chemicals** and potentially, **excessive irrigation**.

Should moth borers enter and establish, chemical applications used to control them are likely to be applied at a high rate given that borers feed within the plant stem, so are difficult to target. There are limited pesticides that are known to be effective in controlling moth borers; currently, ‘Confirm’, an insect growth regulator, is the only insecticide used against Mexican Rice Borer in Texas (Sallam 2005a).

In addition, BSES Pest Incursion Management Plans also recommend increased irrigation to control water stress damage of plants, should establishment of the pest occur (2005b).

4.2.3 Social

Social benefits that have resulted from the TLOPs are:

1. **increased capacity of industry to participate in, and facilitate change** (act on a pest incursion) due to the increased awareness of biosecurity in the sugar industry, and communities within sugar growing areas
2. **tighter focus for the industry**, in the area of biosecurity.
3. **increased confidence of the researchers involved** .The TLOP has a role in attracting and retaining researchers in the sugar industry. The researcher involved in both TLOPs had very positive feedback, indicating that the knowledge gained was an asset to the industry and his own development (Sallam 2005a).

4.3 Quantification

The period immediately following the detection of a pest or disease is crucial and reliant on a documented emergency response plan that is based on current and accurate information. The TLOP resulted in an increased ability to respond rapidly and effectively to pest incursions.

4.3.1 Costs and benefits

Costs

Table 4 provides a summary of the costs of the TLOP and workshops. Assumptions are also made for ongoing costs of planning updates and workshops.

Table 4 Costs of TLOP and workshops

	Travel	Planning	Workshops & Training
Initial (2004)	$5 000	$24 000	$1 600 + $3 000 for BSS274
Ongoing		$500[1]	$1 600

1 An annualised figure for updating every 5 years.
SRDC costs of approximate $8,000.

Benefits
As previously mentioned, the main benefits resulting from the TLOPs were improved preparedness to prevent incursion and improved response to a possible incursion. Both result in the avoidance or reduction of costs incurred by industry, as follows:

1. Costs avoided through prevention of incursion and establishment

Moth borers as a species are capable of causing level of damage of 5-50% if allowed to enter and establish in Australia, and could not be eradicated[1].

A study based on Texas has shown that the potential level of economic damage to industry that could occur if MRB was able to establish could range from $300 000 – $1 million[1]. Per farm damage in Texas, where both *E. loftini* and *Diatraea. saccharalis* are present, is equal to 20% sugarcane internodes annually. Based on raw sugar value of US$420/t, 20% bored internodes equates to a loss of US$1,181.04/ha. Most of this damage is attributable to *E. loftini*. The affect on sugarcane plants were that sugar per acre, juice purity, stalk weight, cane per acre, sucrose per ton of sugarcane, and sucrose content all were inversely related to percentage of bored internodes. Ash content increased with damage, consistent with a plant displaying symptoms of stress (Legaspi *et al.* 1999).

The rate of spread of MRB is estimated to be 9.3km/year (in Louisiana) (Sallam 2005a).

2. Costs avoided through quicker response

Management of an incursion - costs
The initial stages of managing an incursion (following identification of pest) involve surveying of infected areas, chemical control and destruction of infested fields (harvesting and burning) to reduce pest pressure. Road blocks, restrictions on the movement of planting material, alternative host material and machinery would be required to contain the pest. Machinery would undergo steam cleaning. The Consultative Committee on Exotic Plant Pests determines if eradication is feasible and if so, all infested fields and buffer zones are destroyed by harvesting fields, ploughing cane fields and leaving them to fallow for 12 months (Sallam 2005b).

Past attempts to control MRB in the US via biological and chemical means have proved largely unsuccessful. Currently in Texas, where both *E. loftini* and *D. saccharalis* are present, growers simply put up with damage or increase irrigation to minimize water stress damage (Sallam 2005a). Chemical control is recommended if 50% or more are parasitized. ‘Confirm’ chemical is applied at 6-8oz/acre. Integrated Pest Management practices in affected areas in the US focus on regular monitoring (fields surveyed every 2 or 3 weeks) (Sallam 2005a).

Australia has a biological control for borers (*Cotesia flavipes*) which is responsible for about 15 – 20% mortality of the borer species that is found in Australia. However, attempts to establish this in cane fields are not always successful, and this means of control would be insignificant if the pest were to enter Australia[2]. Nevertheless, in the management of the incursion, biological control may be further investigated (Sallam 2005b).

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[1] Mohamed Sallam, September 2007, pers. comm.
[2] Mohamed Sallam, October 2007, pers. comm

Calculations

The main value gained from the TLOPs is that incursions will be more quickly managed, resulting in a reduced spread. In order to put a value on this, we have estimated the cost associated with a likely incursion, and then made an assumption as to what extent this would be reduced with the new knowledge gained from the TLOPs.

For the purpose of this exercise, it is assumed that only a small area (10 ha) is infested. An approximation of likely costs of eradicating one small incursion is estimated to be in the order of $250,000. This is opposed to large scale, long term containment costs and eradication attempts, as this is not as likely a scenario.

Table 5 shows where costs arise. The likely management for this is destruction of these fields, as well as an area of 300 – 500m around these. The 'model' growing region in this analysis has 300 farms, with an average farm size of 100ha. Hence, the proportion of the cane in the area where this applies was only 0.33%. Hence cost of labour and treatment, loss of income and replanting costs are only to this extent. Loss of income is assumed to be for 2 years.

Public land treatment involves removal and subsequent control of 'abandoned' sugarcane within 10km of the incursion (cane growing on road sides etc). This is by ploughing and spraying to ensure complete fallow of these areas for 12 months. Such treatment would only be to the extent of 10% of the area.

Table 5 Costs avoided for a typical incursion

	Value	Comment
Cost of labour and treatment	60 000	For destruction of infested plants. Costs of burning and harvesting estimated to be $600/ha. Over 0.33%of the total area.
Public land treatment	11 288	10 % of the region treated. Costs include slashing, ploughing and spraying at approx $100/ha.
Loss of Income	120 000	Assuming income $600/ha on 0.33% of the total region for 2 years.
Transport controls and compliance	26 600	Includes wages involved in 2 meetings, as well as surveys and transport controls.
Steam cleaning of all equipment	1 066	Assuming 4 items on 5 farms require cleaning.
Replanting costs	60 000	At $600/ha. For 0.33% of the total area
Total	279 000	For one event

Note: Rounded figures.

Management of an incursion in light of the TLOP

Following the TLOPs, should an incursion occur, the specific steps in incursion management that would benefit are:

- the detection of the pest would be quicker, given that information was extended to growers and also community members in the far north (GrubPlan workshops focused on how to tell the difference between the indigenous and the exotic symptoms);
- chance of misidentification would be reduced. Dr Sallam gained first hand experience in Louisiana working with specimens, and collecting species to enrich the borer DNA database. A correct database will reduce the time taken to identify the species from months to weeks to a matter of days (Sallam and Allsopp 2003b);
- emergency response decisions would be made much more quickly, and would be more accurate and coordinated due to improved awareness of roles and responsibilities within industry; and
- following an incursion within a growing area, it is likely that it would take 3-12 months for the extent of the incursion to be determined, and all urgent actions to have been undertaken (Sallam 2005b). With the increased knowledge of the pests, initial steps in managing an incursion would be quicker and more accurate. Costs and time to implement management plans would be less.

The biosecurity measures that resulted from the TLOP ensured that Australia is ready to react promptly to a pest or disease incursion. Following a previous simulation exercise, the estimated the time needed between detection and an emergency response reaction would take no longer than 3 days (Sallam and Allsopp 2003b).

The likely knowledge gained from the TLOPs will result in quicker response to a possible incursion, which would mean a reduction in spread and severity of spread of the pest, should it enter Australia. It is assumed that reduction in spread, and costs associated with this, would be by 50%. Hence the avoided costs are approximately $140,000 (50% of the total costs associated with managing an isolated incursion). When averaged over the farms in the areas and also the 1 in 20 years that an incursion is likely to occur, the typical sugar business in the area will avoid in the order of $25 per year.

Therefore, the total cost avoided by the growing region under the new risk of incursion is $140,000. It is assumed there are 300 farms in a region, so per farm this represents a potential saving of $465. Assuming that this costs is incurred once in every 20 years gives an annual benefit of approximately $25 per farm.

Table 6 Maximum annual benefits specified per adopter[1]

	Value	Comment
Benefits to levy-paying industry	$25	An annualised figure per farm, assuming the event occurs 1 in every 20 years.
Net benefits to other industries	-	May be some benefit to wheat and maize
Social benefits		Preparedness and also research capacity
Environmental benefits		Reduced chemical use to combat any infestation

[1] Note that in this case the adopter is the industry as a whole and each farm is affected by the changes at a regional level.

4.3.2 Number of potential adopters

The potential adopters are the population of cane growers. As the effort is an industry wide strategy the individuals are automatically covered by the activity. There is no need to specify a high or low rate of adoption in this case.

Table 7: Costs assumptions

	Value	Comment
Number of potential adopters	4 500	Base on farm businesses from Canegrowers (2006)
"Capital" cost of adopting or participating (per adopter or participant)	Nil	
Adoption during R&D phase (% of potential adopters)	100%	Covered if plans are instituted in the area.
First-year adopters (% of potential adopters)	100%	
Expected growth in adoption	0%	

4.3.3 Assignment to Rural Research Priorities

The TLOP funding provided by SRDC is directed toward the Biosecurity rural research priority. This does have some benefit towards other priorities such as productivity and also maintaining the pest free status of Australian agricultural industries.

Table 8: Assignment to Rural Research Priorities

	Percentage
Productivity and Adding Value	5%
Supply Chain and Markets	5%
Natural Resource Management	0%
Climate Variability and Climate Change	0%
Biosecurity	90%
Supporting the Rural Research and Development Priorities	0%

4.3.4 Other assumptions

The TLOP project has played a significant role in bringing forward the learning and associated planning for incursions.

Table 9: Various assumptions

	Value	Comment
Probability of success	80%	Based on a possible failure of processes
Number of years that the program has brought a 'solution' forward	5	Researchers commented that the overseas travel have been significant in expediting learning
Chosen year of analysis	2007	Plans updated
Year of milestone (Year zero)	2004	Years that investment took place

4.4 Results - Biosecurity Capacity

The following tables show the results of the cost benefit modeling using the RDC template. As the investment and associated planning are relatively minor and the potential returns may not be eventuate until an incursion incurs.

Table 10: Total investment returns - Biosecurity Capacity

	<--------- Project horizons ---------->					Life of project
	Current year (Year 0)	5-year	10-year	15-year	20-year	
NPV ($)	-50,014	372,110	702,855	962,002	1,165,051	**1,448,800**
BCR						**29.97**

The returns to the investment by the SRDC are dependent on the attribution to the RDC contribution to the success of the overall effort.

There are a number of ways of assigning a share of the overall benefits of the project to the SRDC. This could be based on the contribution to costs, or by assessing the estimated time that benefits were brought forward by the TLOP expenditure. In this case the NPV would approximate the 5-year estimate of benefit above of $372,000. It should be noted that for some of the TLOP projects the activity might not have been undertaken without the additional confidence that the travel provided.

The total spillovers for this project are likely to be small. The benefits to other industries and the environment more generally are not explicit. There may be some consumer benefits from protection of a possible price increase if there were a significant outbreak.

Table 11 provides a break down of the net benefits assigned to each rural research priority.

Table 11 Benefits assigned to Rural Research Priorities

	NPV $
Productivity and Adding Value	72,440
Supply Chain and Markets	72,440
Natural Resource Management	0
Climate Variability and Climate Change	0
Biosecurity	1,303,920
Supporting the Rural Research and Development Priorities	0

The SRDC TLOP played a key role in brining forward the potential benefits from this project.

5 Case Study 2: Practice change by landholders following the Birchip Cropping Group tour

Case study number two draws on one project:

- BSS272 - Controlled traffic study tour of the Birchip cropping group by the NSW farming systems steering committee

The cropping tour took a group of NSW cane farmers and research/extension staff to visit cropping systems developed in Victoria by the Birchip Cropping Group. This group is comprised of 8 farmers, 3 extension staff and the project officer.

The Steering Committee leads the implementation of Controlled Traffic Farming (CTF) in NSW sugar industry and was also responsible for evaluating GPS guidance systems for use in the harvest of whole cane for co-generation.

The tour involved visiting farms using controlled traffic principles and grower-initiated field trials in Western Victoria. It aimed to reduce the risk of 'reinventing the wheel', provide positive proof of the approach works commercially, provide practical solutions to problems with changeover when a new farming system is introduced and lead to faster adoption of a more robust system.

Benefits of controlled traffic farming are increased profitability and sustainability through:

- healthy soil;
- reduced weed pressure;
- time savings;
- fuel savings;
- fewer tractor hours (repairs & maintenance);
- fertiliser savings; and
- GPS benefits are automated cane consignment, good productivity data and establishment of KPIs for best practice harvesting.

The benefits of the tour were achieved through:

- increased skills, awareness, knowledge and networks of the group members;
- increased confidence in adopting new farming systems (i.e. faster adoption); and
- encouraged younger members of farming partnerships to stimulate change on farm.

For this report, three growers who attended the trip were interviewed face-to-face to discuss their experience, and changes they have made on farm since, and the associated benefits. Two extension officers who attended the trip were also consulted.

5.1 Counterfactual

When asked, participants suggested that they might have done the tour anyway (some may have, others probably wouldn't have). Most suggested that decision to adopt was brought forward by a number of years.

5.2 Benefits

5.2.1 Industry

To the levy payers and other industries in the supply chain in Australia

The main benefits gained from this TLOP are as follows:

1. Improved sustainability and productivity through adopting the new farming system

The new farming system involves a transition to wider row spacing (1.5m to 1.8m rows) and incorporation of a soy fallow (instead of the ploughout/replant with cane block). Cane is then direct drilled into this stubble. Machinery is being upgraded or modified to match these measurements, allowing for more controlled traffic. This is being further refined throughout the industry by the use of GPS.

Virtually all of the growers who attended have implemented the new farming system on portions of their farms. All are enthusiastic about the change, keen to implement across the whole farm, and have noticed immediate benefits. The main benefits growers are experiencing are:

- fewer tractor hours due to wider row spacing
  - the increased time savings have enabled some participants to expand their businesses through entering into share-farming;
- savings in fuel and machinery repairs and maintenance;
- decreased fertiliser (urea) inputs because of the soy fallow;
- increased yield - trials that compare the new system with the conventional system have reported a 7% increase in yields in the new system[1]. More recent trials have reported an even bigger increase (BSES, 2007). Those growers that have the system in place for some time have reported definite increases in yields; 1-2 ratoon crops have been averaging greater than 100t/ha for the last couple of years[1];
- no overall loss in tonnage despite 10-15% of the farm being under soy fallow a year (Garside *et al* undated);
- trial results and observations from growers who have been in the system for a number of years have indicated that the increase in productivity allows for an extra ratoon crop[2]; and
- the growers also value the decreased in stool damage from having controlled traffic in place, and the fact that direct drilling of the plant cane into soy stubble protects plantlets. Both benefits may contribute in some way to increased vigor.

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[1] Peter McGuire, Chris Shannon pers. comm. October, September 2007.
[2] Peter McGuire, Robert Aitken, Alan Munro, pers. comms October, September 2007.

2. Improved industry capability

The tour has resulted in faster adoption – without the trip, uptake of the new farming system probably wouldn't have occurred for another 3-5 years[1].

Attending the tour confirmed the need to adapt and acquire machinery to operate under the new system. The Clarence Harvesting Cooperative has acquired a new harvester to suit the new system, and some growers have acquired new tillage cane planters capable of direct drilling, or modified existing planters to suit wider rows.

One of the main objectives of the trip was to gain information on requirements for GPS in the system and evaluate different options. Since then, the industry has purchased 3 base stations for the area.

5.2.2 Environmental

There are a number of environmental benefits associated with new farming system. Growers report on a number of observed benefits such as:

- less run off of soil and water given there are decreased tillage applications. A study by trials by Garside *et al* have shown increased soil water (of up to 60mm during some periods of the growing cycle) in cane on direct drilled soy fallow blocks
- less run-off of nutrients given there is more targeted application
- healthier soil following the soybean fallow (soil has more organic matter and is of good consistency requiring no ground preparation for cane planting).

The industry is currently looking to conduct testing of microbial activity of soil of CTF blocks vs. conventional systems as they envisage it will be higher in CTF blocks[2].

Improvements in soil condition using CTF and minimum tillage have been demonstrated more extensively in other cropping industries, as the system is still quite new in the sugar industry.

- Garside *et al* also showed that the number of earthworms per m^2 greatly increases when a soy fallow is introduced; this is further increased when combined with minimum tillage. The presence of earthworms leads to increased water infiltration.
- Given the new system results in less tractor hours and fuel used, there is an overall decrease in greenhouse gas emissions from farm machinery (Table 12).

[1] Alan Munro, pers. comm. September 2007.
[2] Alan Munro, September 2007, pers. comm.

Table 12 Estimated fuel savings of controlled traffic

	Old system	New system	Difference	Reduction in greenhouse gas emission
Fuel (L/ha)	128.57	18.57	110	297 kg CO_2

Source: figures on fuel amounts from presentation supplied by Peter McGuire and 1L Diesel burnt = 2.7kg CO_2 emitted (Source: Australian Greenhouse Office http://www.greenhouse.gov.au/fuelguide/environment.html)

Further, some participants remarked that their experience increased their confidence in the move towards harvesting whole cane for co-generation. A value of $10 per tonne of carbon is assumed which is at the lower range of the European market over its period of operation.

5.2.3 Social

There are a number of social benefits that can be associated with this TLOP**:**

1. Building of innovation skills for industry

Many of the growers who attended were interested in implementing the new system but didn't have the confidence, skills or knowledge to take action. Seeing the benefits and gaining more experience and knowledge in the area confirmed their beliefs, and greatly increased confidence in their own skills and ideas. They left the tour convinced that they wanted to implement the new system immediately. Given that the group was the NSW Steering Committee for the project, 'Implementing an integrated sugar system in NSW'; the trip gave them the confidence to keep driving their strategy.

One participant left the tour with confidence to go forward with an old idea he had for building a more efficient, self-propelled billet planter. Following the tour, he applied and won an SRDC grant and, if used commercially, the upgrade will mean a reduction in labour.

Many of the growers who attended were younger and still working in their family farm. For two growers that were interviewed, the confidence gained was a major factor in persuading their fathers' to trial a block of land under the new system (the key obstacle they were experiencing). For both, it took a year to convince them; however, once benefits were apparent, they no longer had a problem. They report that they now have a lot more trust from their fathers regarding decisions made on the farm.

2. Networks

The TLOP resulted in increased networks among the group of participants and also with farmers in other industries. A number still remain in contact with sugar farmers in other regions that they travelled with, and also with one of the Victorian farmers visited on the on the tour.

The knowledge gained on the trip regarding GPS helped to link some of the work the industry was doing to set up base stations with similar work being done in state government.

3. Improved industry morale
The trip also helped to bolster the morale of the community of growers that attended. At the time of the tour, the industry was depressed and many reported that seeing another industry operating in drought and under particularly hard circumstances gave participants perspective and motivation in their own industry.

4. More time with family
Growers interviewed reported that the decrease in tractor hours has meant more time with family and for leisure.

5. Extending benefits to other industries

The potential for this system to extend to other industries may include corn, in addition to the soybean industry. With the uptake of the new farming system, and inclusion of the soy rotation, some growers are now communicating closely with soybean growers in other areas to share information (e.g. on varieties suited to sugar rotations). One grower communicates with, and visits farms in Kyogle for this reason.

5.3 Quantification

5.3.1 Costs and benefits

The costs involved in this activity include the trip to Victoria and a subsequent visit to Mackay. The SRDC contribution to these trips was $19,900 (SRDC 2004). In-kind and other contributions were $70,000. Findings had been communicated mostly via personal communication with participants. Two farming systems days were held in June with 60 attendees. An article was prepared for the BSES Bulletin for industry wide circulation (McGuire 2005).

This project has compared the costs and benefits between conventional farming system and the new farming system; i.e. a plough-out replant system vs. a controlled traffic, minimum tillage farming system with a soybean fallow.

Benefits

1. Increased yield
There is an increase in yield of at least 7% (or more for some of the earlier ratoon crops).

2. Costs saved on-farm
Differences in the costs between the old and new system are as follows:

- **Tractor costs per ha are reduced** with the new system as there are wider row spacings. In the planting of cane, there is no ground preparation as cane is direct drilled into soy fallow.
    - Initial findings have reported a saving of 20% in tractor hours (McGuire, presentation). Growers interviewed for this report agreed with this estimation and the analysis done for this report indicated a similar saving.
- With fewer tractor hours, there are **savings in fuel and machinery repairs and maintenance** – of up to 20% (McGuire, presentation).
- **Planting costs**: remain relatively similar.
- **Fertiliser inputs are reduced** with a cut in the application of urea. In the new system, plant cane following a soy fallow requires no urea; whereas the first

ratoon crop requires only half the rate (125kg/ha as compared with 250kg/ha). Subsequent ratoon crops don't differ.

- **Chemical applications are slightly increased** for plant cane under the new system, as an extra spray is applied instead of a cultivation.
- **Harvesting costs increase** for the new system as they are based on weight, and generally there is an increase in yield in crops of the new system.

For the purpose of the exercise, it was assumed that the cane grown was harvested every year, in order to work through a 'model' farm. Also, previous studies in this field have often focused on a one-year system. However, it is recognised that within the NSW sugar industry, a significant portion (more that half[1]) of the area of cane is harvested every 2 years; particularly in the Broadwater and Harwood areas. Some farms grow all 1 or 2 year cane, and some grow a portion of each.

For the purpose of the report, and based on discussions with extension officers in the industry, it can be extrapolated that the annual benefits under a 2 year system would be similar to that of a 1 year system; possibly slightly less. Any variations would be in relation to: two-year cane crops yield higher (some state that yields double, though this is not often the case); inputs are not applied in the second year (fertiliser is applied in the first year at a rate to cover both years). Another difference would be increased harvesting costs (due to higher yields). It would still take a similar amount of time to introduce the new system, if the system was grown over 2 years, as fewer rations are grown in the 2-year production system.

For the model farm analysed here, under the old system, the crops would undergo four ratoons, and under the new, five ratoons. A farm would typically be introduced to the system on a staggered basis; each year, the block with the oldest ratoon crop would be replaced by the soy fallow crop. Therefore it would take 5 years for each block to be planted under the new system. The system would then reach a steady state.

There are significant costs associated with change as there is a missed cane harvest (soy fallow as opposed to ploughout/replant). These are factored into the estimate of benefits.

Calculations of costs include the following:

- tractor costs per ha (fuel, repairs and maintenance estimates);
- planting costs (contract costs per ha);
- fertiliser;
- chemical applications; and
- harvesting costs ($5.5/t for sugar and $100/t for soy).

[1] Peter McGuire, personal communication, October 2007.

Table 13 Returns and costs under each system

	Average income ($/ha)		Costs ($/ha)	
	Old	New	Old	New
Year 1	1 700	1 524	967	748
2	1 720	1 624	967	860
3	1 700	1 704	967	873
4	1 680	1 744	967	891
5	1 660	1 784	967	909
Steady state	1 660	1 746	967	885

Table 14: Summary of effects on gross margins

	Average gross margin ($/ha)		Difference ($/ha)
	Old	New	
Average during introduction phase	$725	$820	**$95**
Steady state	$693	$861	**$168**

3. Savings in labour through decreased tractor hours

These have been considered separately to the gross margins:

Table 15: Tractor hours under each system

	Tractor hours ($/ha)		$/ha
	Old	New	Difference
Year 1	77	77	
2	97	71	
3	97	71	
4	97	71	
5	97	71	
Average			**$21**
Steady state	**97**	**73**	**$24**

Estimates of cost were sourced from discussions with growers and also Munro and Aitken gross margins budget (2002/03).

Costs

1. Establishment costs

There is also a range of equipment costs. It is assumed that in the region, 1 in 10 growers purchase the GPS and planter.

Table 16: Establishment costs

Equipment costs	Cost per farm ($)	For region ($)
For grower		
Basic costs*	1 000	
Labour (assume 1 week)	830	
Cost of GPS system	36 000	
Cost of new planter	8 000	
Basic total	1 830	1 189 500
With GPS and planter	7 333	4 766 667
Total		5 956 167

Source: discussions with growers and presentation supplied by Peter McGuire.
*New fertiliser box, convert 4-row spray boom, convert hill up boards, convert cultivator.

5.3.2 Maximum annual benefits (per adopter)

Table 17: Benefits specified per adopter (farm)

	Value ($)	Comment
Benefits to levy-paying industry	9 500 then 16 800	100 hectares per farm and additional gross margin of $95 for the introduction phase and $168 once the system reaches steady state
Net benefits to other industries		
Social benefits	2 100 then 2 400	Labour savings of 100 hours per farm during introduction; savings of 114 hours per farm thereafter
Environmental benefits	300	Potentially positives and negatives as fertiliser and chemical use change – location specific and no estimate provided. An allowance made for the carbon value of fuel savings of $10 / tonne CO_2.

5.3.3 Number of potential adopters

The group who attended the tour was comprised of 8 farmers, 3 extension staff and the project officer. Some of the growers also own contract planting businesses. The growers interviewed belong to Clarence Harvesting Cooperative; a group of 180 farmers. Seven have implemented the new system and the other is very close to implementing[1].

Within the 3 mill areas that the participants came from, adoption has been widespread. Contractors within the industry have been targeted with the new system. They have been a key factor in implementation of the systems on farms as most cane growers in NSW use contract planters due to small farm sizes. There are 8-10 contractors in the mill area. Two of the contractors in the area plant around six farms each[1].

Table 18 Assumptions on adoption

	Value	Comment
Number of potential adopters	650	Harwood, Condong and Broadwater mill areas[2]
Capital cost of adopting or participating (per adopter or participant)	$7 333	Based on a combination of on farm and contractor investments and GPS establishment
Adoption during R&D phase (% of potential adopters)	0%	
First-year adopters (% of potential adopters)	5%	
Expected growth in adoption	50%	Per year – high as contractors encourage uptake
High growth in adoption	100%	
Low growth in adoption	20%	

5.3.4 Assignment to Rural Research Priorities

The funding provided by SRDC for this TLO project directed toward the Productivity and Adding Value rural research priority. There are also benefits that accrue to the NRM and Climate Change Priorities (Table 21).

Table 19: Assignment to Rural Research Priorities

	Percentage
Productivity and Adding Value	80
Supply Chain and Markets	0
Natural Resource Management	10
Climate Variability and Climate Change	10
Biosecurity	0
Supporting the Rural R&D Priorities	0

[1] Alan Munro, Chris Shannon, Phillip Banier, September 2007 pers comm.
[2] NSW Sugar Milling Cooperative Ltd (2005).

5.3.5 Other assumptions

The TLOP project has played a role in bringing forward the adoption of a proven technology. However, it is considered that this is relatively small (i.e. 3 years) as people were interested in the technology prior to the travel.

Table 20: Various assumptions

	Values	Comment
Probability of success	90%	High – proven technology
Number of years that the program has brought a 'solution' forward	3	
Chosen year of analysis	2007	
Year of milestone (Year zero)	2005	

5.4 Results - Controlled traffic

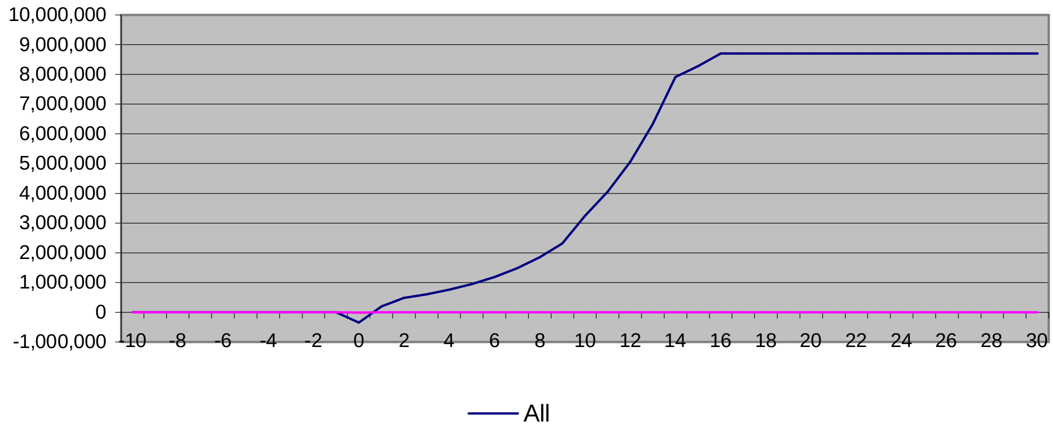
The following tables show the results of the cost benefit modeling using the RDC cost benefit template.

Table 21: Total Investment returns ($ m)

	<--------- Project horizons ---------->					Life of project
	Current year (Year 0)	5-year	10-year	15-year	20-year	
NPV $	-0.34	2.7	10.6	28.9	50.5	80.7
BCR						235.0

The following figures are based on the CBA template outcomes. It should be noted that the NPV do not account for other basic research projects that have examined controlled traffic in sugar cane. The BCR then only relates to adoption costs and the TLOP.

Figure 5: Annual Net Benefit Chart ($ m) - Controlled Traffic



The returns to the investment by the SRDC are dependent on the attribution to the RDC contribution to the success of the overall effort. The SRD contribution was a small contribution to the overall effort that has been invested in this technology.

There are significant spillovers that are directly related through the template to the social benefit of decreased hours working. It may be questionable that these social improvements are spillovers, as they accrue directly to the farm operators. The environmental spillovers relate to fewer emissions though a significant decrease in tractor hours.

Table 22: Total spillovers ($ m) - Controlled Traffic

	Low	Expected	High
Other industry	0	0	0
Social	4.5	11.9	17.3
Environmental	0.6	1.6	2.3

There are likely to be environmental benefits of reduced pesticide run-off and also nutrient due to reduced compaction. These may be significant depending on the location of the operation, for example is run-off that affects town water supply or environmental assets any improvements may be highly valued.

Table 23 provides a break down of the net benefits assigned to each rural research priority.

Table 23: Benefits assigned to Rural Research Priorities - Controlled Traffic

	NPV ($)
Productivity and Adding Value	65.8
Supply Chain and Markets	0
Natural Resource Management	8.2
Climate Variability and Climate Change	8.2
Biosecurity	0
Supporting the Rural Research and Development Priorities	0

There are a number of ways of assigning a share of the overall benefits of the project to the SRDC. This could be based on the contribution to costs, or by assessing the estimated time that benefits were brought forward by the TLOP expenditure. In this case the NPV would approximate the value of an adoption profile that is ahead by three years of the without case. This differential is approximately $17 million. This is a more realistic estimate of benefit of increasing the rate of uptake of a proven practice in sugarcane.

The SRDC TLOP played a role in brining forward the potential benefits from this project. The TLOP also plays a role in ensuring that interaction occurs across growers.

6 The TLOP Program

This detailed cost-benefit analysis has focused on two case studies which relate to just two of the 108 travel and learning projects funded by SRDC in the 5 years up to 2006/07. These case studies were selected as they:

- Represent two different types of industry benefit
- Represent different participant types (i.e. growers vs. researchers and industry members); and
- Have a clear link from the project to a benefit.

Many of the travel and learning projects the benefits are more strongly focussed on social change and industry capacity building. The previous review undertaken by Hassall & Associates identified that there are definite benefits of these projects in terms of capacity building. However, these may not lead necessarily lead too an immediate, tangible change. The two projects assessed did have direct consequences that can be linked to the TLOP.

The cost benefit template has indicated that there are clear benefits that accrue from SRDC's investment in travel and learning. The scale of the investment was assessed to the suitable in line with the benefits and the overall research portfolio in a previous review. However, benefits across the whole program are largely of a social nature and are generally difficult to quantify in a cost benefit analysis.

Some TLOPs help to accelerate the adoption of practices that have been developed through research activities, in this way, the TLOPs 'value add' to other research investments. It is difficult for the SRDC to assess other costs associated with research into practices that has been undertaken outside its programs.

The biosecurity program also suffers from issues of attribution and the 'insurance' nature of its activities. Adoption is at an industry level and not at the individual farm level. This type of activity has industry and community benefits that are wider than the farm scale assumed for the template. Assessing investments in research capacity beyond the changes associated with the management of one pest is also problematic.

The cost benefit framework does allow an assessment of small projects that are carried out by the SRDC. The first step in all of these investments is an articulation of the likely benefits that will arise from *changes* on farm or at an industry level. This project has identified that there are benefits associated with investments of this kind. Returns from investment across the TLOP would be increased if a rapid assessment of these potential benefits were conducted prior to investment.

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