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# Economic Evaluation of Investment in the Farming & Fishing Health & Safety R&D Program

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RIRDC Innovation for rural Australia


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# Economic Evaluation of Investment in the Farming& Fishing Health & SafetyR&D Program

by Peter Chudleigh, Sarah Simpson and Jessica Lai

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# Foreword

The Farming& Fishing Health & Safety program aims to undertake R&D and research application activities that improve the:

- Physical health of farming and fishing workers and their families,
- Mental health of farming and fishing families, and
- The safety of the work environment and practices in farming and fishing industries.

The Programis funded by RIRDC, the Australian Government Department of Health and Ageing, Grains Research and Development Corporation, Fisheries Research and Development Corporation, Sugar Research and Development Corporation and Cotton Research and Development Corporation.

In May 2008 an Evaluation Framework for RIRDC was finalised. This framework, among other things, sets out a process for reviewing each of RIRDC's programs in the final year of its five year plan. One of the three programs selected for assessment in 2011 was the Farming& Fishing Health & Safety Program. A part of each specific program review is to select randomly three independent investments within the program for an impact evaluation through cost benefit analysis.The three economic analyses provide specific case studies that will demonstrate the extent and distribution of benefits that have been, are being, or will be, captured in future. Such information is valuable to not only RIRDC management, but also to the members of the industry (or industries) at which the investment has been targeted.

Another purpose of the economic analyses is tocontribute to a process being undertaken for the Council of Rural Research & Development Corporationsthat aims todemonstrate through examples the outcomes and benefits that have emerged or are likely to emerge from the 15 Rural Research and Development Corporations (RDCs). Valuation of these benefits, along with identification of investment expenditure, is required in order to demonstrate the RDCs' contribution to Australian rural industry as well as environmental and social benefits to Australia.

The projects evaluated demonstrated predominantly economic and social benefits, a number of which were quantified in value terms. Funding for the three groups of projects analysed totalled $0.92 million (present value terms) and produced aggregate total benefits of $3.92 million (present value terms). The analyses found all three investments provided positive returns with benefit-cost ratios ranging from 2.2 to 5.6.

The impact assessments serve the main purpose of providing accountability to government and industry/community stakeholders that research funds have been managed appropriately and are producing positive impacts and benefits to Australia.

This project was funded by the Collaborative Partnership for Farming and Fishing Health and Safety. This report, an addition to RIRDC's diverse range of over 2000 research publications, forms part of our Collaborative Partnership for Farming and Fishing Health and Safety Research and Development Program, which aims to improve the physical and mental health of farming and fishing workers and their families, and the safety environment and work practices in farming and fishing industries.

Most of RIRDC's publications are available for viewing, free downloading or purchasing online at www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

**Craig Burns**
Managing Director
Rural Industries Research and Development Corporation

# Contents

# Executive Summary

### *What the report is about*

This report presents the results of economic analyses of three investments within the Farming& Fishing Health & Safety Program.

### *Who is the report targeted at?*

The information contained in the report is targeted at Program and RIRDC management, those within the industries that support the Program, and the wider community. Another target audience is the Australian Government and Council of Rural Research and Development Corporations(CRRDC).

### *Background*

In May 2008, an Evaluation Framework for RIRDC was finalised. This framework, among other things, sets out a process for reviewing each of RIRDC's programs in the final year of its five year plan. In the year ending June 2011, three RIRDC programs have been evaluated, and this report addresses the economic evaluation component for the Farming& Fishing Health & SafetyProgram.

The Framework contains two major components, a performance review and an impact assessment. This report is the impact assessment and addresses the economic evaluation requirement under the Framework. This report also addresses the reporting requirements for RIRDC under the joint initiative of the CRRDC.

### *Aims/objectives*

The primary purpose of the report is to demonstrate that benefits have accrued from specific investments. Another purpose of the economic analyses is to contribute to a process being undertaken by the CRRDC that aims to demonstrate through examples the outcomes and benefits that have emerged or are likely to emerge from the 15 Rural Research and Development Corporations. Valuation of these benefits, along with identification of investment expenditure, is required in order to demonstrate the RDCs contribution to Australian rural industry as well as environmental and social benefits to Australia. The Australian Government is particularly interested in such contributions in order to be assured that public funding of R&D is being used to produce public benefits.

### *Beneficiaries*

The beneficiaries of the report will be RIRDC management, the Australian Government, the CRRDC, the wider Australian community, and those industries specifically benefitting from the research analysed.

### *Methods used*

The methods used in the economic analyses followed the instructions in the RIRDC Evaluation Framework, both in terms of project selection and in terms of the analysis process and reporting. The selection process satisfied the random selection process of the CRRDC as well as the evaluation requirements of RIRDC. This entailed the definition of the population of projects in the program, a random sampling process and a filtering process.

Each investment was evaluated by assembling information from the three projects or projectgroups from original project proposals, final reports, and any progress reports or other relevant publications. Assistancewas rendered by Program personnel, project principal investigators, industry personnel and others. The potential benefits from each investment were identified and described in a triple bottom line context. Some of these benefits were then valued.

The Present Value of Benefits (PVB) and Present Value of Costs (PVC) were used to estimate investment criteria of Net Present Value and Benefit-Cost Ratio at a discount rate of 5%. The Internal Rate of Return was also estimated from the annual net cash flows. The PVB and PVC are the sums of the discounted streams of benefits and costs. All dollar costs and benefits were expressed in 2010/11 dollar terms and discounted to the first year of the investment being analysed. A 40 year time frame was used in all analyses, with the first year being the initial year of investment in the R&D project. Costs for the R&D project included the cash contributions of the Program (includes both RIRDC and industry investment), as well as any other resources contributed by third parties (e.g. researchers or additional industry funds).

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions. Sensitivity analyses were undertaken in most cases for those variables where there was greatest uncertainty or for those that were thought to be key drivers of the investment criteria.

### *Results/key findings*

There was a range of expected economic and social benefits identified in the projects, and a number of these benefits were valued. Funding for the three projects/project groups analysed totalled $0.92 million (present value terms) and produced aggregate total expected benefits of $3.92 million (present value terms). The Programshare of the total investment was 62%. The analyses found all three investments provided positive returns with individual benefit-cost ratios ranging from 2.2 to 5.6.

As only 3projects out of apopulation of 17projects were analysed, these results cannot be used to infer anything about the likely range of results for the population of projects as a whole.

### *Implications for relevant stakeholders*

The positive results in terms of both the number and range of benefits identified and valued demonstrate that the Program is delivering significant impacts and is providing a healthy return on investment. The overall result should be heartening for RIRDC, the industry, and policy personnel responsible for allocation of public funds.

### *Recommendations*

There were no recommendations made.

# 1. Introduction

In May 2008, an Evaluation Framework for RIRDC was finalised. This framework, among other things, sets out a process for reviewing each of RIRDC's programs in the final year of its five year plan.

These reviews are aimed at serving two broad purposes:

- providing accountability to government and industry/community stakeholders that research funds have been managed appropriately and are producing positive impacts and benefits to Australia

- identifying research areas and processes that may prove fruitful in terms of future investment and ongoing program management

More specific purposes are:

- reporting against the program's five year plan

- identifying lessons learnt from past investment

- reporting to the Council of Rural Research & Development Corporations (CRRDC) on impacts as part of the overall reporting framework of the Research and Development Corporations (RDCs)

In broad terms, the Evaluation Framework encompasses a cohesive framework for evaluating research investment at project, program and portfolio levels for both accountability and future investment planning purposes.

The Framework contains two major components, a performance review and an impact assessment. The scope of this report is the impact assessment (or economic evaluation) requirements under the Framework, and the reporting requirements for the CRRDC.

In the year ending June 2011, three RIRDC programs have been evaluated, and this report is the economic evaluation component forthe Farming& Fishing Health & Safety Program.

The impact assessments provide specific case studies that will demonstrate examples of the extent and distribution of benefits that have been, are being, or will be, captured in future. Such information is valuable to not only RIRDC management, but also to the members of the industry (or industries) at which the investment has been targeted.

Section 2 of this report describes the methods used to select the projects for analysis, and how the analyses were undertaken. Section 3 summarises the results of the analyses, and Section 4 presents some findings and conclusions. Details of the three individual analyses are presented in Appendices 1 to 3.

# 2. Methods

## 2.1 Project Selection

The RIRDC Evaluation Framework has clear instructions for how projects to be economically evaluated should be selected. The guidelines for project selection were adapted following the completion of the 2009 economic evaluations, and the following are the revised guidelines for project selection.

*The selection of projects for impact assessment must be random to satisfy the requirements for the CRRDC. However, as it is important for successful projects to also be chosen the approach to random selection is as follows:*

1. *Assuming the Five Year Plan (FYP) has been completed; list all projects that have been completed in the period of the FYP, and also include those that were/are due for completion up to six months after the completion of the FYP. If the FYP has not yet been completed, then all projects that have been completed at the time of the analysis should be included, as well as projects that have had a significant milestone and accomplishment, or are very close to completion.*
2. *Delete postgraduate scholarships, travel grants, general communications and reviews (special extension and some reviews with impact could be retained), conference support, program support and special events.*
3. *Delete projects of low value. The appropriate minimum value of projects to be included in the population will vary by program. This can be determined by the percentage of the total value of the population that is being excluded by setting the minimum value. One method is to list all the projects in descending value, determine the total value, and then determine how many projects at the bottom of the list make up say 2.5% to 5% of the total funding in aggregate. This rule of say 5% of total value could be applied across all programs, which would result in a different minimum value for each program.*
4. *The individual projects in the population should be stratified by program goals. Each project should be allocated to addressing a specific goal, and the total program funds invested in the projects addressing each goal should be summed. Then, if say, 80% of program funds are directed at Goal 1, the stratified sampling process can ensure that two projects from Goal 1 are selected for analysis.*
5. *All projects in the population should be assigned a random number using the random number generator in Windows Excel. The projects are then placed in order from highest random number to lowest and each project is considered in turn until an appropriate sample of three projects is identified. The factors for considering appropriateness are described in points (7) to (8) below.*
6. *In consultation with the Advisory Committee and Program Manager the analyst will discuss the impact of the selected project and the availability of information for undertaking an impact assessment. The assessment should consider not only the individual project selected, but also the project group as a whole if the selected project can be identified as forming part of a set of projects that collectively have contributed to an output or outcome. These can include projects completed prior to the current FYP, or outside of the population. Projects that together contributed to achieving an outcome are assessed as a set to avoid attributing the outcome to only a sub-set of the projects. Following the grouping, this assessment should classify each set as:*
    a. *too early: the projects have follow-on R&D that has yet to come to fruition*
    b. *low: there is little or no indication of outputs being adopted or likely to be adopted, or the project(s) failed to deliver the outputs expected, or other output that was serendipitous*
    c. *medium: there is evidence of adoption but uncertainty about how big the benefits are*

*d. high: there is evidence of adoption and conviction that the benefits have been high and/or good spillovers have been identified.*
*e. difficult to quantify: the project is highly strategic in nature or has some other benefit that is very difficult to value in a quantitative way.*

*7. The previous step should be repeated until there is at least one 'high' project in the full sample, and arethree that meet the medium or high level.*

*Other factors to consider before finalising the sample are that the projects selected are representative of the program goals (as determined by the stratification earlier) and that the individual projects selected are not from the same project grouping (as defined earlier). Projects not meeting the stratification requirements should be excluded and new projects selected and rated in turn until all conditions have been met.*

The first step involved defining the population of projects that were completed, or due to be complete,over the six years from July 2006 to June 2012 as defined in the RIRDC Clarity project database. The population therefore included projects starting earlier than this time period, and some projects that were not yet complete. Projects involving travel grants, general communications and reviews, conference support, program planning and support and special events were excluded in order to ensure that the population only included mainstream R&D projects.

The projects were arranged in descending order by value and the bottom 5% in value terms of projects were identified. This bottom 5% of projects were then excluded, which meant that projects with a value less than $35,000 of program investment were excluded from the population. This was to ensure that very small projects were not selected, and therefore ensure that a higher percentage invalue terms of the population was analysed.

This resulted in the exclusion of 14 projects, and a final population of 17 projects, with a total value of $2.45 million (nominal terms).A decision was made by the Program Manager that it was not necessary to stratify the population of projects by goal.

RIRDC confirmed that they were happy with the population definition andAgtrans assigned a random number between 0 and 1 to each of the 17 projects using the Excel random number generator. The three projects with the highest random numbers were then identified as the initial sample and sent to the Program Manager for rating as either too early, high, medium, low, or too hard to quantify as per the RIRDC evaluation guidelines.

The rating definitions were:

a. too early: the projects have follow-on R&D that has yet to come to fruition
b. low: there is little or no indication of outputs being adopted or likely to be adopted, or the project(s) failed to deliver the outputs expected, or other output that was serendipitous
c. medium: there is evidence of adoption but uncertainty about how big the benefits are
d. high: there is evidence of adoption and conviction that the benefits have been high and/or good spillovers have been identified.
e. difficult to quantify: the project is highly strategic in nature or has some other benefit that is very difficult to value in a quantitative way.

The three projects initially selected were:

- PRJ 004736Capacity building of rural and remote communities to manage their mental health
- PRJ 003083Sustainable Farm Families – Future Directions
- PRJ 000652Testing and delivering media communication strategies for child safety on farms

Project PRJ004736 was considered 'too early' as it was not yet finished, and the next project in line was selected:

- PRJ000541 Farm Safety Studies

All three projects (PRJ003083, PRJ000652 and PRJ000541) were ranked high impact (Table 2.1)

**Table 2.1: Projects Randomly Selected for Analysis**

| No. | Project Codes and Titles | Cost (Program only, nominal $) | Rating |
|---|---|---|---|
| 1 | PRJ 003083Sustainable Farm Families – Future Directions | 199,750 | High |
| 2 | PRJ 000652Testing and delivering media communication strategies for child safety on farms | 94,403 | High |
| 3 | PRJ000541 Farm Safety Studies | 240,686 | High |

The three selected investments making up the final sample analysed have a total nominal value of $0.53 million. The total value of the population (17 projects)was $2.45 million (nominal terms). Therefore, the sample of projects evaluated represent 18% in number and 22% of the population in value terms.

## 2.2 Individual Analyses

Each investment was evaluated through the following steps:

1. Information from the original project proposals, final reports, and any progress reports or other relevant reports and material was assembled with assistance from Program personnel, Principal Investigators and others.

2. An initial description of the project background, objectives, activities, costs, outputs, and outcomes and benefits was drafted. Additional information needs were identified.

3. For most projects, telephone contact was made with Principal Investigators and the draft sent to that person or persons for perusal and comment, together with specific information requests.

4. Further information was assembled where appropriate from industry personnel and others associated with the industry, and the quantitative analysis undertaken.

5. Drafts were passed by industry personnel for comment.

The potential benefits from each investment were identified and described in a triple bottom line context. Some of these benefits were then valued.

The factors that drive the investment criteria for R&D include:

C The cost of the R&D.

K The magnitude of the net benefit per unit of production affected; this net benefit per unit also takes into account the costs of implementation.

Q The quantity of production affected by the R&D, in turn a function of the size of the target audience or area, and the level of initial and maximum adoption ultimately expected, and level of adoption in the intervening years.

D The discount rate.

$T_1$ The time elapsed between the R&D investment and commencement of the accrual of benefits.

$T_2$ The time taken from first adoption to maximum adoption.

A An attribution factor can apply when the specific project or investment being considered is only one of several pieces of research or activity that have contributed to the outcome being valued.

P Probability of an R&D output, commercialisation etc. occurring. Can be applied when the research is not complete or when some further investment is required before the outputs of the research are translated into adoptable outcomes and extended to the industry.

Defining the 'without R&D' scenario to assist with defining and quantifying benefits is often one of the more difficult assumptions to make in investment analyses. The 'without' scenario (referred to here as counterfactual) usually lies somewhere between the status quo or business as usual case and the more extreme positions that the research would have happened anyway but at a later time; or the benefit would have been delivered anyway through another mechanism. The important issue is that the definition of the counterfactual scenario is made as consistently as possible between analyses.

The Present Value of Benefits (PVB) and Present Value of Costs (PVC)were used to estimate investment criteria of Net Present Value and Benefit-Cost Ratio at a discount rate of 5%. The Internal Rate of Return was also estimated from the annual net cash flows. The PVB and PVC are the sums of the discounted streams of benefits and costs. The discounting is used to allow for the time value of money. All dollar costs and benefits were expressed in 2010/11 dollar terms and discounted to the first year of the investment being analysed. A 40 year time frame was used in all analyses, with the first year being the initial year of investment in the R&D project. Costs for the R&D project included the cash contributions of the Program (RIRDC and industry investment), as well as any other resources contributed by third parties (e.g. researchers).

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions. Sensitivity analyses were undertaken in most cases for those variables where there was greatest uncertainty or for those that were thought to be key drivers of the investment criteria.

Some identified benefits were not quantified mainly due to:

- A suspected, weak or uncertain relationship between the research investment and the identified R&D outcomes and associated benefits.
- The magnitude of the value of the benefit was thought to be only minor.

# 3. Results

The results for each of the three project evaluations are reported in Appendices 1 to 3. The following provides a summary of results of the three evaluations.

## 3.1 Qualitative Results

Table 3.1 identifies the benefits from each of the three case studies. Each benefit is categorised as economic, environmental or social. Not all of the case studies demonstrated benefits from each category. In fact there were no environmental benefits identified.

**Table 3.1: Summary of Benefits for Three Investments**

| Project Cluster | Benefits |
|---|---|
| Sustainable Farm Families – Future Directions | Economic<br>• Saved health costs for future additional participants and their families who will participate in SFF due to evidence provided by the Future Directions project<br>• Saved long-term public health costs due to preventative health, wellbeing and safety measures taken by additional future participants who will participate in SFF due to evidence provided by Future Directions project<br>• Saved health costs for participants in the Future Directions project due to reinforcement of messages from earlier SFF participation<br><br>Environmental<br>• Nil<br><br>Social<br>• Improved health, safety and wellbeing of future additional participants and their families who will participate in SFF due to evidence provided by Future Directions project<br>• Improved health, safety and wellbeing of all future participants due to changes to the program influenced by the Future Directions project<br>• Improved health, safety and wellbeing for participants in the Future Directions project due to reinforcement of messages from earlier SFF participation |
| Testing Media and Communication Strategies | Economic<br>• Potentially more efficient use of industry media and communication resources regarding child farm safety<br>• Potentially increased productivity on farms due to reduced worry and concern<br>• Potentially reduced public health costs associated with child injury and death on farms<br>• Potentially more efficient use of public media and communication resources regarding child farm safety<br><br>Environmental<br>• Nil |

| | |
|---|---|
| | Social<br>• Potentially reduced risk of child injury and death on farms |
| Farm Safety Studies | Economic<br>• Reduced healthcare costs due to reduced likelihood of death and injury on farms<br>• Efficiencies in use of resources to develop and promote farm safety practices<br>• Reduced loss of income and productivity to employees and employers from lost time due to injury and/or death<br><br>Environmental<br>• Nil<br><br>Social<br>• Reduced death and injury for those on farms |

## 3.2 Quantitative Results

The investment criteria calculated for each project cluster were the Net Present Value (NPV), the Benefit-Cost Ratio (B/C Ratio) and the Internal Rate of Return (IRR). The NPV is the difference between the Present Value of Benefits (PVB) and the Present Value of Costs (PVC). Present values are the sum of discounted streams of benefits and/or costs. The B/C Ratio is the ratio of the PVB to the PVC. The IRR is the discount rate that would equate the PVB and the PVC, thus making the NPV zero and the B/C Ratio 1:1. Investment criteria were estimated for both the total investment and for the Program (RIRDC and industry)investment. For one of the projects total investment was the same as the Program investment.

Table 3.2 presents the investment criteria for the total investment in each of the three projectsanalysed at a 5% discount rate.

**Table 3.2: Investment Criteria for Total Investment for Projects**

(discount rate 5%)

| Investment (Project) | PVB ($m) | PVC ($m) | NPV ($m) | B/C Ratio | IRR (%) |
|---|---|---|---|---|---|
| Sustainable Farm Families – Future Directions | 1.39 | 0.25 | 1.14 | 5.59 | 21.5 |
| Testing Media and Communication Strategies | 0.24 | 0.11 | 0.13 | 2.21 | 12.0 |
| Farm Safety Studies | 2.29 | 0.56 | 1.73 | 4.07 | 23.9 |

Table 3.3 presents the investment criteria for the Program investment only in each of the three projectsat a 5% discount rate.

**Table 3.3: Investment Criteria for ProgramInvestment Only for Projects**

(discount rate 5%)

| Investment (Project) | PVB ($m) | PVC ($m) | NPV ($m) | B/C Ratio | IRR (%) |
|---|---|---|---|---|---|
| Sustainable Farm Families – Future Directions | 1.12 | 0.20 | 0.92 | 5.57 | 21.3 |
| Testing Media and Communication Strategies (a) | 0.24 | 0.11 | 0.13 | 2.21 | 12.0 |
| Farm Safety Studies | 1.08 | 0.26 | 0.82 | 4.09 | 24.1 |

(a) The Program Investment and Total Investment criteria are the same as there was no 'other' investment in this project cluster

Total funding for the three investments analysed was $0.92million (present value terms) and produced aggregate total expected benefits of $3.92 million (present value terms). The Programshare of the total investment was 62%. The analyses found all three investments provided positive returns with individual benefit-cost ratios ranging from 2.2to 5.6.

The results produced are highly dependent on the assumptions made in each analysis, many of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes.

A confidence rating based on these two factors has been given to the results of each investment analysis (Table 3.4). The rating categories used are High, Medium and Low, where:

High: denotes a good coverage of benefits or reasonable confidence in the assumptions made

Medium: denotes only a reasonable coverage of benefits or some significant uncertainties in assumptions made

Low: denotes a poor coverage of benefits or many uncertainties in assumptions made

**Table 3.4: Confidence in Analysis for Three Project Clusters**

| Project Cluster | Coverage of Benefits | Confidence in Assumptions |
|---|---|---|
| Sustainable Farm Families – Future Directions | Medium | Medium |
| Testing Media and Communication Strategies | Medium | Low |
| Farm Safety Studies | Medium | Low |

## 3.3 Previous Economic Evaluations of Investments in Farm & Fishing Health & Safety Programs

An evaluation of the former Farm Health and Safety Joint Venture Research Programwas undertaken by Agtrans Research in 2008 (Chudleigh and Simpson, 2008). The study included benefit-cost analyses that quantified the return on investment of 3 of the projects. The projects were selected for evaluation on the basis of being anticipated to be high impact, as well as the relative availability of information on their likely impact. The results of the evaluations (discounted to 2005/06 at a 5% discount rate, over 30 years from the first year of investment, and expressed in 2005/06 dollar terms) are shown in Table 3.5.

**Table 3.5: Investment Criteria for Three Selected Investments in the Farm Health and Safety Joint Venture Research Program**

| Project cluster | Present Value of Benefits ($m) | Present Value of Costs ($m) | Net Present Value | Benefit to Cost Ratio | Internal Rate of Return (%) |
|---|---|---|---|---|---|
| US-87A and GAP1A National Farm Machinery Safety Program and Regulatory Review | 4.38 | 0.32 | 4.06 | 13.8 | 34.5 |
| US-126A: Effective Safe Play Area Fencing Options for Rural Properties | 1.62 | 0.03 | 1.59 | 55.5 | 178 |
| US-86A and US121A: National Farm Injury Data Collection | 1.65 | 0.55 | 0.98 | 2.5 | 14.8 |

The B/C Ratios range from 2.5:1 to 55.5:1. It is difficult to compare this result to those in the current analysis, as the projects analysed in Chudleigh and Simpson 2008 were selected as high performing, rather than being randomly selected.

A benefit cost analysis was carried out by Agtrans Research (2010) for the Fisheries R&D Corporation (FRDC) on a group of projects targeted at occupational health and safety in the fishing industry. There were three projects included in the analysis. The projects focused on infections in western rock lobster fisherman, the safety of pearl divers, and an OHS DVD for use in the post-harvest sector. Table 3.6 presents the results of the analysis. The analysis is in 2008/09 dollar terms and the present values were calculated using a discount rate of 5% (discounted to 2008/09). The analysis ran for 30 years from the last year of investment.

**Table 3.5: Investment Criteria for a Workplace Safety Cluster Analysed for FRDC**

| Project cluster | Present Value of Benefits ($m) | Present Value of Costs ($m) | Net Present Value | Benefit to Cost Ratio | Internal Rate of Return (%) |
|---|---|---|---|---|---|
| FRDC Workplace safety cluster (3 projects) | 5.12 | 0.75 | 4.37 | 6.8 | 27.8 |

# 4. Findings and Conclusions

## 4.1 Summary of Findings

**A summary of findings for each of the three investments is provided below. The detailed impact assessments are included in appendices 1 to 3.**

### Sustainable Farm Families – Future Directions

The investment in this project has contributed to demonstrating the impact of the Sustainable Farm Families (SFF) approach to improving health and safety on farms. This will in turn contribute to continued funding of the program, and continued interest in the program by farming families. The benefits from the project have been estimated by valuing the improvements in health for those participants who would not have been a part of the future SFF program if the Future Directions project had not been undertaken. A small increase in health and wellbeing outcomes for all participants is also valued.

Given the assumptions made and a discount rate of 5%, the total investment of $0.25 million (present value of costs) was estimated to produce expected total benefits of $1.39 million (present value of benefits) giving a net present value of $1.14 million and a benefit-cost ratio of 5.6 to 1. The internal rate of return was 21.5%.

### Testing Media and Communication Strategies

The project was successful in providing an evaluation of the performance of a range of communication and media tools used to promote messages regarding child safety on farms. There is the potential for the findings and recommendations from the evaluation to be used by those developing child safety media and communication materials to enhance the effectiveness of those materials, and therefore increase the adoption of child safety practices on farms. Such adoption could lead to a subsequent reduction in the probability of a child being fatally injured on a farm.

However, to date, there has been little usage of the projects outputs, largely due to a reduction in funding for child farm safety campaigns. In addition, time lags in data regarding deaths on farms and difficulties in determining any causal links between safety campaigns and subsequent reductions in death and injury rates led to difficulties in estimating the benefits from the research. Despite this, a probabilistic approach to valuing the potential benefits from the projects outputs was used in this analysis. Given the assumptions made, the results were that using a discount rate of 5%, the total investment of $0.11 million (present value of costs) would produce expected total benefits of $0.24 million (present value of benefits) giving a net present value of $0.13 million and a benefit-cost ratio of 2.2 to 1. The internal rate of return was 12%. This benefit-cost ratio is influenced by the low value of the investment and the high value of life of a child.

### Farm Safety Studies

In order to improve understanding of the factors contributing to safe farm practices, more knowledge was needed on the perceptions of, and attitudes to, safety on farms by those who live and work on farm. In addition, knowledge was needed on how information about farm OHS is received and used on farms, what impediments and costs are associated with uptake and the practical benefits that accrue from increased attention to safety.Alongitudinal study was funded to engage with farmers and their families and workers to gather information about the nature and scale of the OHS problem on farms. The baseline for such a longitudinal study was funded through this project.

The project also funded activity to continue to collate and report a wide range of data on OHS practices and incidents on farms, as the National Farm Injury Data Centre has been doing for a number of years. The funding provided by the project analysed here allowed for such work to continue.

The investment in this project has resulted in a number of outputs including a baseline industry farm safety survey in NSW, and a series of 'chartbook' publications on high priority issues regarding health and safety in agriculture. These outputs have been, and will continue to be, used to influence a wide range of policy, research and communication applications, and there is some evidence of that use to date. As with a lot of research related to health and safety, it is difficult to determine with confidence a causal relationship between the outputs of this research, and any subsequent reduction in the likelihood of death or injury on farm. However, an attempt has been made here to place a value of on the potential impact of the research outputs.

The benefits of the research were valued assuming a contribution to a decreased probability of death on farms in the future. The analysis found that given the assumptions made, for the investment of $0.56 million (present value terms) there was a return of $2.3 million when considering benefits over 40 years (present value using a 5% discount rate). This resulted in a benefit-cost ratio of 4.1 to 1.

### Public versus private benefits

All three project clusters have captured both public and private benefits. There will be private benefits to those living and working on farms in terms of avoided death and injury, and avoidance of associated health care costs and 'friction' costs that come with lost income and productivity as a result of the individual and workplace recovering from the injury or death. In addition, there may be benefits to industry generally through more efficient use of resources invested in improving farm health and safety. The public benefits will also be in the form of reduced health care costs and efficiencies in resources spent on farm health and safety improvements.

### Distribution of benefits along the supply chain

For all three projects analysed, the benefits will largely accrue to the public and to individuals on farms. There are no supply chain costs or benefits. With respect to the Sustainable Farm Families project however there may be implications for the medical community in terms of increased visits in the short-term, but reduced needs for visits and medication in the longer-term.

### Benefits to other primary industries

The benefits from all three research projects will potentially accrue to a wide range of agricultural industries, as all three projects have targeted a range of industries, and not been limited to one specific enterprise type. For example, The SFF program (including the Future Directions component) has had participants from a wide ranging number of agricultural industries including grazing, cropping and horticulture enterprises. None of the randomly selected projects focused on the fishing and forestry industries, and there is limited scope for these particular projects to have influence to members of those industries.

### Match with national priorities

The Australian Government's National and Rural R&D Priorities are reproduced in Table 4.1.

**Table 4.1: National and Rural R&D Research Priorities 2007-08**

| Australian Government | |
|---|---|
| **National Research Priorities** | **Rural Research Priorities** |
| 1. An environmentally sustainable Australia<br>2. Promoting and maintaining good health<br>3. Frontier technologies for building and transforming Australian industries<br>4. Safeguarding Australia | 1. Productivity and adding value<br>2. Supply chain and markets<br>3. Natural resource management<br>4. Climate variability and climate change<br>5. Biosecurity<br>*Supporting the priorities:*<br>1. Innovation skills<br>2. Technology |

All three projects will contribute to National Research Priority 2. None of the projects contribute directly to any of the Rural Research Priorities, as none of the Rural Research Priorities address health and safety on farms. However, for all three projects here may be some minor contribution to Rural Research Priority 1 through the avoidance of lost productivity on the farm that can occur as a result of the trauma of a death within the farm family.

### Additionality

If the government's contribution to RIRDC was reduced by half, then it is likely that the three projects would have still been funded, as RIRDC is only one contributor to the FFHS program. It is likely that RIRDC would still take on the role of managing this program, as it is seen as a high priority cross-industry issue where efficiencies can be made by funding multi-industry projects through one program. The individual projects would still have been relatively high priority, but some of themmay have had reduced budgets if less funds were available.

If government funding of RIRDC did not exist at all, then the delivery of public benefits may have been restricted for all three investments. It is unclear whether public agencies other than RIRDC would have funded these types of investments (e.g. health research funders) or whether industry funds alone would have been directed to the investments.

## 4.2 Conclusions

The current analyses of three projects from the Farming and Fishing Health and Safety R&D Programhave shown benefit-cost ratios in the range of 2.2 to 5.6. The three projects analysed represent 22% of the population of projects in value terms.

The benefits identified were both economic and social benefitsresulting from improvements in the health and safety practices of Australian farmers, therefore reducing the likelihood of death or injury occurring on-farm. Subsequent benefits include reduced healthcare costs and reduced loss of productivity.

There are difficulties in estimating the benefits from health and safety research in a quantitative sense due to difficulties placing values on the loss of life, as well as difficulties making a causal link between policies and promotion strategies, changed practices on farm, and subsequent improvements to health and safety.

Despite these difficulties, the positive results in terms of the benefits identified and those valued demonstrate that the Program is delivering impacts and is providing a return on investment. The overall result should be heartening to RIRDC management, the industries funding the program, and policy personnel responsible for the allocation of public funds.

# References

Agtrans Research 2010 An Economic Analysis of FRDC Investment in Workplace Health and Safety (Cluster 22) http://www.frdc.com.au/research/benefits/BCA13-Workplace-safety

Chudleigh, P. and Simpson, S. (2008) Farm Health and Safety Joint Research Venture Impact Evaluation. RIRDC Publication No. 08/141.

# Appendix 1: Impact Assessment of Investment in Sustainable Farm Families – Future Directions

## Background

The Sustainable Farm Families (SFF) program originally ran from 2003 to 2007 and was funded by the Joint Research Venture for Farm Health and Safety. It was developed by the Western District Health Service in Victoria and involved collaboration with health services, university, agricultural agencies training bodies and farming communities. It involved the participation of 128 farm men and women from three states over three years, as well as a separate cotton and sugar program which ran for two years in NSW and Qld involving 65 participants. The purpose of the program was to influence farmers' behaviour with respect to their health, safety and wellbeing. Participants were self-selecting, aged between 18 and 75 years, and had farmed for more than five years. Participants engaged with the project through annual workshops, newsletters and their industry association over the three years.

Over the life of this original program there were statistically significant reductions among participants of the clinical indicators that correlate to major diseases such as cardiovascular disease and type 2 diabetes (e.g. blood pressure, fasting blood cholesterol, body mass index, and waist measurement).

Due to its success the program had its funding extended through a variety of industries, philanthropic organisations and government, so that there by 2009 there had been over 1,700 participants engaged with SFF programs, and 135 rural professionals had undertaken SFF training. Some of the areas into which it was extended include dairy farmers in 11 locations across Victoria; remote farming populations in nine locations in WA, Qld, NT and NSW; Victorian farmers in 50 exceptional circumstances locations; and North Western Tasmanian farmers in one location.

A project was funded by the Fishing and Farming Health and Safety Program to revisit the original 193 participants to understand the longer term impacts of SFF five to six years after the commencement of the original SFF program. This project is called SFF – Future Directions and is the project evaluated here.

## The Project

There is one project included in this analysis.Table 1 provides the Project Number, Project Title, Research Organisation, Principal Investigator and Period of Research for the project.

**Table 1: Summary of Project Details**

| Project Number | Project Title | Other Details |
|---|---|---|
| PRJ003083 | Sustainable Farm Families – Future Directions | Research Organisation: Deakin University<br>Period: 30 May 2009 to 30 March 2011<br>Principal Investigator: Susan Brumby |

## Project Objectives

The objectives for project PRJ003083 are:

- To consider the long-term benefits (health gain, equity and empowerment) from the Sustainable Farm Families program on the individual, the farm and the family.
- To measure and evaluate if their clinical improvements have been maintained and to gather evidence about their morbidity and mortality.
- To evaluate the acquired skills, knowledge and change in behaviour associated with completing the first program.
- To communicate project findings to both participants and industry.

## Project Costs

Details of the annual total investment in the project are provided in Table 2.

**Table 2: Estimate of Investment in PRJ003083 (nominal $; including Program and other contributions)**

| Year ending June | 2009 | 2010 | 2011 | Total |
|---|---|---|---|---|
| Program | 115,000 | 30,680 | 54,070 | 199,750 |
| Other contributions[a] | 0 | 42,600 | 5,000 | 47,600 |
| **Total** | **115,000** | **73,280** | **59,070** | **247,350** |

[a] The other contributions include in-kind contributions from Deakin University, Western District Health Service, La Trobe University, Cotton R&D Corporation and farmer participants

## Project Description

The agricultural industries and locations involved in the longitudinal study were:

- Mixed grazing, wool production, cropping and beef production locations at Benalla, Hamilton, Swan Hill and Horsham in Victoria, and Clare in South Australia
- Cotton production at Wee Waa in New South Wales and Dalby in southern Queensland
- Sugar production at Ayr and Ingham in central Queensland

Data from each of the original 191 (out of a total of 192; one was now deceased) participants was obtained, and each of these original participants was then contacted personally by phone to invite them to participate in the extension of the SFF program. The participants were asked to fill out a number of questionnaires. The questionnaires used were the same as those that had been used when the participants were first involved in the program. The questionnaires related to:

- Health conditions
- Health behaviours
- Farm safety
- Health and wellbeing – Kessler K10 (a measure of non-specific psychological distress)
- Agri-chemicals usage

Workshops were held at the same ten locations as they had been in the original SFF program, and they were also held at the same time of year where possible. The workshops were held between 5 and 6 years after the initial workshops had been held. On the day of the workshop a number of medical tests were conducted using the same types of equipment and testing protocols that had been used to conduct the same tests during the original SFF program. The tests included:

- Cholesterol

- Blood glucose
- Systolic and diastolic blood pressures (measured by two methods)
- Height, weight, waist and hip circumferences
- Body mass index
- Body fat percentage

As well as the physical health assessments, the SFF Future Directions workshops involved:

- Focus group discussions moderated by social scientists, providing the opportunity for farm men and women to talk in groups about the various issues affecting the links between family health and farm productivity
- Pre and post knowledge assessments
- Action planning and reflection to address behaviour, lifestyle and business decisions
- Feedback to all participants of the results of the original SFF program
- Presentation of updated pertinent rural and agricultural health and safety topics

The areas of focus group discussion related mostly to changes since first participating in the program including:

- attitudes to health, wellbeing and safety
- health behaviours
- any significant family, career and farming business decisions as a result of participation in the program
- had a changing climate impacted on their health, wellbeing or farm business decisions
- had they used or referred to the SFF participant manual since the original program
- any other changes since participation in the program

The focus group discussions were scribed and later analysed. Following the focus groups, individuals gave short presentations on how the SFF program had influenced their farming family lives over the past five years. This included sharing the action plans they had developed during the original SFF program, and telling their story of how they had followed it. They were also asked to self rate their achievement against their plan.

There was also some additional information presented to workshop participants to update relevant health and safety information since the last workshop had been delivered, for example, there was a focus on respiratory health that had not been captured in previous workshops.

Following the completion of all of the workshops and data collection, an independent qualitative evaluation of the program was undertaken by a consulting firm (Roberts Evaluation). It involved semi-structured interviews conducted over the telephone with a randomly selected sample of 54 participants (stratified by gender, age, geographic location, and industry). Seven of those interviews were in-depth. In addition, six industry partners were interviewed. The industry partners included farmers groups such as the Victorian Farmers Federation (VFF) and Australian Women in Agriculture, as well as the Cotton R&D Corporation, the Sugar RD Corporation and the Grains R&D Corporation. This external evaluation focused on determining if the SFF program:

- Altered the way participants think about their physical and mental health and safety
- Influenced participants' health and safety decisions in their daily lives
- Impacted on participants' resilience and the way they deal with change
- Influenced the way that participants see their health in relation to their farm practices and productivity

## Outputs

The major outputs from the project include:

- A report detailing the results and key findings of the project with respect to how the SFF Program has influenced the health, wellbeing and safety of participants. The report also includes recommendations with respect to improving the ongoing and future SFF programs that are operating throughout Australia.

- A number of communication activities were carried out including presentations at six Australian and international conferences; publication of six media articles; publication of newsletters for industry partners, two posters to assist in promoting the program, and a fridge magnet provided to all the participants who were invited to the workshops.

Examples of the key findings with respect to the influence of the program on the original 191 participants are listed below. It should be noted that the potential reasons for these changes, and other factors that may have contributed to these changes apart from SFF are not always indicated:

- There was a retention rate of 77% of participants from the 191 who participated in the first SFF workshops, to 148 who participated in the workshops as part of this project.

- The proportion of farm families reporting that their health was either excellent or very good had increased, but so had the number indicating their health was fair/poor. The number indicating their health was 'good' had declined.

- The number of alcohol consumers decreased from the first SFF workshop to the SFF Future Directions workshops. Overall alcohol consumption use diminished over the course of the research phase, however those consuming alcohol at the highest levels (measured as drinks per week) did increase over the research phase.

- As part of the original SFF program, participants had often been given referrals to appropriate agencies and services for further medical investigation of a number of issues (e.g. skin lesions, cardiovascular assessment). Ninety-four percent of participants in the SFF Future Directions workshops indicated they had acted upon the last referrals they had been given from the previous SFF program they attended.

- Over the whole group, total cholesterol levels decreased significantly, while blood glucose levels and body mass index both increased. For the participants who had been identified as at risk in the first program, there were significant improvements in the key areas of fasting cholesterol, and systolic and diastolic blood pressure.

- SFF participants have reduced their psychological distress levels, with many participants moving from the high-very high categories during the first workshop into the low-moderate categories in the SFF – Future Directions workshop. This reduction is likely to have been influenced by the program, but in some cases could also be partly explained by the higher level of climatic stress and hardship at the times of the original tests compared to the Future Direction Workshops.

- There was a significant increase in the total utilisation of personal protective equipment, including that required when using chemicals, when using outdoor tools, workshop tools and machinery (e.g. eye and ear protection) and equipment required for sun protection.

- Late in the previous SFF program, participants were asked if they wore a helmet while riding a motorbike, and if not, why they didn't. Based on the feedback from that program, the design of motorbike helmets has been changed to incorporate a more practical and comfortable design

for farmers. This new helmet was introduced to farmers as part of the SFF – Future Directions workshops.

- Participants were surveyed as to their knowledge with respect to health and wellbeing. The survey results showed that there had been an overall retention in learnings for both female and male participants from the original program to SFF Future Directions. Of the 19 questions analysed for females, 12 had significant increases in learnings retained, and 9 out of 16 questions asked of males had significant increases in learnings. There was only one question where knowledge had reduced, with all others having increased, although not significantly.

- During the first SFF program, participants were asked to develop action plans for particular health or safety target areas, and review and revise them every twelve months. At the end of the first program (24 months after their first workshop), 83% of participants rated their achievement of action plans with moderate to high results. In the SFF Future Directions workshop participants (60 to 72 months after their first workshops were held) were again asked to rate their achievement and this number had increased to 86% with a moderate to high rating.

- During the focus groups, 19% of participants stated they now have an increased awareness of the impact their choices have on their daily lives as a result of the program, and that 21.7% have opted for a healthier diet (reading labels and growing vegetables), while 20.3% have more regular check-ups.

- During the focus groups, 42.6% of participants indicated they had made a significant family, career or farming business decision as a result of participating in the SFF program.

- 20.9% of participants indicated they had changed their lifestyle (e.g. more recreation time and doing activities as a family); while 17.9% had made changes to make the farm a safer work place, and 16.5% had made positive changes with respect to exercise.

- Focus group participants were asked whether a changing climate has impacted their health and wellbeing, or the farm business decisions. Participants reported that the changing climate has increased stress levels for 19.3%, and that it had affected the decision making of 28.9%. This finding conflicts somewhat with the findings from the SFF Future Directions workshops that stress had decreased significantly

The independent evaluation of the program undertaken by Roberts Evaluation Pty Ltd, and reported in the final report for PRJ003083 made the following conclusions:

- Approximately 68% of respondents had altered their previous ‘she’ll be right’ attitude to one of preventative action, and are now going for regular checkups.

- The program has increased 97% of participant farmers’ knowledge of relevant health issues.

- Of respondents, 55% had improved their diet, 45% had increased exercise, 45% were taking time away from the farm and doing activities to de-stress, and 19% were seeking treatment for health issues, compared to when they commenced the program.

- The SFF program had increased participants’ resilience and the way they deal with change.

- It was recommended that the SFF model be continued and implemented to new groups of farmers, whilst maintaining further follow-up with current farmers to continue to monitor progress and reinforce messages.

## Outcomes

The outputs of the research can be used to demonstrate to potential funders and participants that participation in the program is worthwhile, and that the benefits are ongoing and not short-lived. For example, there has recently been funding approved from the Victorian governmentto run the SFF program in 12 flood affected communities in Victoria. This funding decision would have been partly influenced by the Future Directions project, as the findings were being widely promoted in the media at that time. In addition, a decision to fund four pilot SFF programs in Queensland (Greenvale, Bollon, Wondai, Georgetown) while the Future Directions project was still being undertaken was also likely influenced by the activities of the Future Directions project in Queensland at that time. It is anticipated that in the future, the findings of the Future Directions project will continue to be used to demonstrate the long-term impact of the SFF program. It has also contributed to building the evidence base for clinical and health promotion practice and engaging with farmers.

In addition, the outputs of this research will be used to make improvements to the SFF program where required, to ensure that it continues to provide the maximum health, safety and wellbeing benefits to participants. For example, in future there will be an increased amount of one-on-one interaction that will be incorporated into the program, and the testing and delivery of information relating to diabetes will be moved to the first workshop rather than the last workshop. In addition, a decision was made to obtain a blood testing machine for use in the workshops that can undertake lipid analysis and therefore identify good versus bad cholesterol, rather than just total cholesterol (Susan Brumby, pers comm., 2011).

It is possible that the SFF Future Directions workshops held as part of this project might also have outcomes for the individual participants, with respect to reinforcing the messages from the program, and ensuring continued focus on the lessons learnt.

An evaluation survey was given to participants at the completion of the SFF Future Directions Workshop. Participants responded very positively to the quality of the presentations and their appreciation of the opportunity to learn more about health issues. The physical assessments and specific data on their own health were important factors in encouraging the farmers to continue their participation with the program, as well as to change their attitudes and actions.

The sense of empowerment to make improved health and lifestyle decisions provided by the SFF program was another positive attribute highlighted. This included the preventative aspect, and putting responsibility and influence over health back to the individual. The vast majority of respondents indicated that they ‘strongly agreed’ or ‘agreed’ that they could apply the content in the workshops to their life and work.

One hundred percent of respondents indicated that they would recommend the SFF program to other farm families, and a large number of them had already done so. The reasons they would recommend it included that it was practical and relevant, and the delivery method provided an environment where the participants felt safe and welcomed, and free to openly discuss issues.

Some research priorities were identified from lessons learnt as part of the Future Directions project, for example, information around hearing and working with a hearing deficit were requested from participants and the Western District Health Service is partnering with ANU and the National Acoustic Laboratory in a grant to address this.

## Benefits

A specific benefit of the SFF Future Directions project relates to the influence the findings and recommendations will have on securing new and continuing investment in extending the program to new areas and new participants. It is likely that even without the Future Directions project that the SFF program would have continued to be funded in the future, however it is noted that the funding from year to year is insecure, and the continuation of the program relies on one-off grants.The evidence

provided in this project will likely lead to an increased security of funding and therefore an increase in the number of farm families participating each year. It will also lead to some improvements to the program that might lead to increased benefits from future programs (e.g. new information on respiratory health, improved blood testing equipment, change of timing of delivery of diabetes information).

The major potential benefits from the investment in the entire SFF investment (including the SFF Future Directions component) relate to improvements in the health and wellbeing of farm families. The ways in which the program improves the health and wellbeing of participants and their families includes:

- More attention to and improvements in farm safety.
- Participants are more likely than before to seek medical advice by going to a doctor.
- Participants are more likely to take preventative measures to improve their health and wellbeing (e.g. diet and exercise).
- Participants are more likely to better manage stress and work/life balance and therefore improve mental health.

Over time, this program has engaged over 1,700 participants and their families across all states and the Northern Territory, and across a wide range of agricultural industries.

An economic evaluation was carried out on the original program in 2006 (Boymal et al, 2006). The analysis focused on the improvements in quality of life, and the estimated downstream cost savings, through changes in morbidity and mortality relating to cardiovascular disease and type 2 diabetes, given changes in behaviour and clinical indicators. It did not include potential changes to morbidity and mortality as a result of improvements in farm safety, cancer risks, and anxiety and depression.

The 2006 study (Boymal et al, 2006) used the concept of quality adjusted life years (QALYs) to estimate the health benefits from the program. One QALY is said to be equal to one year of perfect health. The study found that for all participants, the mean change in estimated life years over 10 years was -0.22% in relation to cardiovascular indicators. The average change in probability of a cardiovascular disease event was -2.12%. This is likely to result in the avoidance of 2.06 cardiovascular events among 97 participants over 10 years (the data is based on 97 participants only as there were three years of data available for this number of participants at the time of the study). The reductions were higher when considering only those participants with baseline problems. When converted to QALYs, the QALY gained with respect to cardiovascular disease over 10 years per participant was 0.74 (undiscounted).

For Type 2 Diabetes, there was no change in the probability ofdeveloping the disease when considering all participants, however, when considering participants with a body mass index of greater than or equal to 25 (68% of participants), then the mean change in probability of Type 2 diabetes from the program was 12%, leading to avoidance of 8 cases of Type 2 diabetes. When converted to QALYs, the QALY gained with respect to Type 2 Diabetes was 4.72 (undiscounted) over 10 years.

Together, the QALY gained as a result of the reduction in cardiovascular disease and Type 2 diabetes, is 5.61 over 10 years (undiscounted) across the 97 participants for whom three years of data was available at the time of the study (which equates to approximately 0.058 QALYs per participant).

In considering these potential benefits, it should be noted however that there may be some ‘self-selection’ bias in that those who choose to participate in the program, are those that already have some concern over their health. In addition, there are limited means by which the health and safety improvements of the participants can be compared to any general health improvements for those who

are not part of the program. Nevertheless, the improvements to health and safety identified are likely to have been significant.

In summary, there are demonstrated benefits for improved health and wellbeing from participation in the SFF program, and the Future Directions project will contribute to increasing the participation in the program, and improving even further the health and wellbeing outcomes from those who participate.

### Summary of Benefits

A summary of the principal types of benefits associated with the outcomes of the investment in the project is shown in Table 3.

**Table 3: Categories of Benefits from the Investment**

| **Levy Paying Industries** | **Spillovers** | | |
|---|---|---|---|
| | **Other Industries** | **Public** | **Foreign** |
| Economic benefits | | | |
| Saved health costs for future additional participants and their families who will participate in SFF due to evidence provided by the Future Directions project<br><br>Saved health costs for participants in the Future Directions project due to reinforcement of messages from earlier SFF participation | | Saved long-term public health costs due to preventative health, wellbeing and safety measures taken by additional future participants who will participate in SFF due to evidence provided by Future Directions project | |
| Environmental benefits | | | |
| | | | |
| Social benefits | | | |
| Improved health, safety and wellbeing of future additional participants and their families who will participate in SFF due to evidence provided by Future Directions project<br><br>Improved health, safety and wellbeing of all future participants due to changes to program influenced by Future Directions project<br><br>Improved health, safety and wellbeing for participants in | | | |

| | | | |
|---|---|---|---|
| the Future Directions project due to reinforcement of messages from earlier SFF participation | | | |

### Public versus Private Benefits

The benefits from this research will be both private and public in nature. The private benefits will be in the form of improved health and safety, and improved quality of life, to the individual participants and their families. This will in turn lead to public benefits in terms of public health savings as a result of the preventative action taken by participants.

### Distribution of Benefits

The benefits will accrue to the public and to individuals on farms. There are no supply chain costs or benefits. There may however be implications for the rural medical community in terms of increased visits in the short-term, but reduced needs for visits and medication in the longer-term.

### Benefits to Other Primary Industries

The SFF program (including the Future Directions component) has had participants from a wide ranging number of agricultural industries including grazing, cropping and horticulture enterprises. It has not yet been extended to the fishing and forestry industries, however there is the possibility that any future program in these industries could draw on the experiences of the SFF program.

### Match with National Priorities

The Australian Government's National and Rural R&D Priorities are reproduced in Table 4.

**Table 4: National and Rural R&D Research Priorities 2007-08**

| Australian Government | |
|---|---|
| **National Research Priorities** | **Rural Research Priorities** |
| 1. An environmentally sustainable Australia<br>2. Promoting and maintaining good health<br>3. Frontier technologies for building and transforming Australian industries<br>4. Safeguarding Australia | 1. Productivity and adding value<br>2. Supply chain and markets<br>3. Natural resource management<br>4. Climate variability and climate change<br>5. Biosecurity<br>*Supporting the priorities:*<br>1. Innovation skills<br>2. Technology |

The project investment will contribute to National Research Priority 2. It does not directly contribute to any of the Rural Research Priorities (except perhaps for some indirect impact on Rural Research Priority 1), as none of them are directly targeted at health and safety on farms.

## Quantification of Benefits

### Benefits Valued

The benefit of the SFF – Future Directions project is quantified through two approaches:

- Firstly, assuming that due to this project there will be more support for the SFF program over the coming years, and therefore the number of individuals and families influenced by the program will increase over what would have occurred if the Future Directions component of the program had not been funded.

- Secondly, assuming that due to changes to the SFF Program prompted by the Future Directions project, participants will have an increased QALY outcome, compared to before the Future Directions project.

#### Increased Participation

Given that approximately 1,700 individuals have participated in the program over approximately seven years, it is assumed that the participation rate is approximately 240 people per year. It is assumed that without the Future Directions project, this level of participation would have continued over the next 10 years (years ending 30 June 2012 to 2021). However, due to the Future Directions project, this level of participation is assumed to increase by 10%, resulting in an additional 24 participants per annum for 10 years.

The economic analysis of the SFF program undertaken in 2006 concluded that with respect to cardiovascular disease and Type 2 Diabetes, there was a gain of 5.61 quality adjusted life years (QALYs) for 96 participants over ten years (equating to 0.058 QALYs per participant). At the time the study from which this data was sourced was completed, there had been 128 participants, with 104 completing the full process and data available for 97 of those 104. Therefore, the proportion of

original participants who are expected to achieve this gain is 76%. This figure is consistent with the findings of the Future Directions study, where the retention rate of the original 192 participants to those who participated in the Future directions study was 77%. It is therefore assumed that the QALY gain of 0.058 per participant will apply only to 76% of the 24 participants per annum who participate in SFF due to the Future Directions project.

Placing a dollar value on the quality of life (including mortality and morbidity) is a difficult concept. However, Abelson (2003) undertook a study to measure the Australian willingness to pay for avoiding an immediate death of a healthy individual in middle age ($2.5 million). The Abelson figure of $2.5 million has been accepted in the past as an appropriate figure to use for Australian public policy decisions, and was used by Agtrans Research in a previous economic evaluation of farm health and safety R&D projects (Chudleigh and Simpson, 2008).

The $2.5 million is considered to be the value of a statistical life (VOSL), and it can be converted to a constant value of a life year. Allowing a life expectancy of 40 years (from middle age) and a consumer discount rate of 5%, the constant VOSL would be approximately $150,000. This is referred to as the value of a life year (VOLY). A Quality Adjusted Life Year (QALY) is one year of perfect health. Quality of Life (QoL) indices can be used to capture the multiple dimensions of health in a single index number and measure health status on a scale of 1 to 0 where 1 represents a healthy life year and 0 represents death.

The QALY gain per participant of 0.058 is assumed to be achieved over 10 years from the year after the first involvement in the program.

The 2006 economic study (Boymal et al, 2006) estimated the cost of delivering the program per person was $1,087, and that in addition to the costs of running the program, participants themselves had costs of $369 per person as a result of their involvement in the program. This included increased costs for cooking equipment, exercise equipment and health service utilisation. It is assumed that these costs (total of $1,456) occur in the first year of participation in the program.

**Improved Health and Safety Outcomes**

The Future Directions project has contributed to potentially increasing the effectiveness of the health and safety outcomes from the program. It is assumed that because of the changes made to the program, the QALY gain per participant will increase by 5%. This increase will apply to all future participants, not just those 24 new participants influenced to participate due to Future Directions.

## The Counterfactual Situation (Without the Investment)

As stated earlier, without the investment in SFF – Future Directions, it is assumed that the program would have continued at the same size for the next ten years, and that the participants would have continued to achieve health and wellbeing improvements. However, the extent of support for the program, and therefore the number of participants, would not have been as great as is expected with the evidence of success provided by the Future Directions study. The level of health and wellbeing improvement would have continued at 0.058 QALYs per participant, and not increased by 5%.

### Summary of Assumptions

A summary of the key assumptions made is shown in Table 5.

**Table 5: Summary of Assumptions**

| Variable | Assumption | Source |
|---|---|---|
| Number of participants in future SFF programs per annum without project | 240 per annum | Estimated from participation rate to date (1,700 participants over 7 years) |
| Increase in number of future participants in SFF programs due to project | 10% | Agtrans assumption |
| First year of increased participation rate | 2011/12 | Final report will be released early in the 2011/12 financial year |
| Final year of influence on increased participation rate | 2020/21 | Assumed other studies will have been required by this time to drive continued increases in participation |
| Improvement in quality of life (QALYs) per new participant influenced to participate due to Future Directions | 0.058 per participant over 10 years | Derived from Boymal et al 2006 (QALY increase of 5.61 after 10 years per 97 participants) |
| Increase in QALYs achieved for all future participants due to improvements to program due to Future Directions project | 5% of 0.058 per participant | Agtrans assumption |
| Proportion of participants achieving improvement | 76% | Derived from Boymal et al, 2006 and Brumby et al, 2011 |
| Value of a QALY | $188,747 (2010/11 $ terms) | Derived from Abelson, 2003 ($150,000 in 2003$ terms) |
| Additional program delivery and health and wellbeing management costs per participant | $1,678 (2010/11 $ terms) (calculated from $1,456 one-off cost per participant in 2005/06 $ terms) | Derived from Boymal et al 2006 |

## Results

### *Overall Return on Investment*

All past costs and benefits were expressed in 2010/11 dollar terms using the CPI. All benefits after 2010/11 were expressed in 2010/11 dollar terms. All costs and benefits were discounted to the first year of investment using a discount rate of 5%. The base run used the best estimates of each variable, notwithstanding a high level of uncertainty for many of the estimates. All analyses ran for 40 years including the first year of investment. Investment criteria were estimated for both total investment and for the Program investment alone. The investment criteria are reported in Table 6. The results show that the benefit cost ratio is 5.6 to 1. It is noted that this is possibly an underestimate of the benefits from the program, as the analysis only values the health benefits with respect to cardiovascular disease and Type 2 diabetes. There may also be benefits from the program with respect to other health and wellbeing issues (e.g. cancer, mental health), as well as improved farm safety.

**Table 6: Investment Criteria for Total Investment and Program Investment**

(Discount rate 5%, 40 years)

| Criterion | Program Investment only | Total Investment |
|---|---|---|
| Present value of benefits ($m) | 1.12 | 1.39 |
| Present value of costs ($m) | 0.20 | 0.25 |
| Net present value ($m) | 0.92 | 1.14 |
| Benefit cost ratio | 5.57 | 5.59 |
| Internal rate of return (%) | 21.3 | 21.5 |

### *Sensitivity Analyses*

Sensitivity analyses were carried out on a range of variables and results are reported in Tables 7 and 8. All sensitivity analyses were performed on the total investment only using a 5% discount rate (with the exception of Table 7) with benefits taken over the 40 year period. All other parameters were held at their base values.

Table 7 shows that the investment criteria are somewhat sensitive to the discount rate.

**Table 7: Sensitivity to Discount Rate**

(Total Investment, 40 years)

| Criterion | Discount Rate | | |
|---|---|---|---|
| | 0% | 5% (Base) | 10% |
| Present value of benefits ($m) | 2.68 | 1.39 | 0.76 |
| Present value of costs ($m) | 0.26 | 0.25 | 0.24 |
| Net present value ($m) | 2.43 | 1.14 | 0.52 |
| Benefit cost ratio | 10.43 | 5.59 | 3.16 |

Table 8 shows the sensitivity of the investment criteria to the assumption of the potential QALY improvement. The base assumption is a 0.058 QALY improvement per participant. The analysis shows that the investment criteria are somewhat sensitive to the QALY improvement. This is because the implementation costs per participant do not change, but the level of benefit they receive does change. The break-even QALY improvement (at a 5% discount rate) is 32% of the assumed base QALY of 0.058.

**Table 8: Sensitivity to the Assumed QALY Improvement**

(Total Investment, 5% discount rate; 40 years)

| Criterion | QALY improvement per participant | | |
|---|---|---|---|
| | Half of base | 0.058 (base) | Double base |
| Present value of benefits ($m) | 0.55 | 1.39 | 3.06 |
| Present value of costs ($m) | 0.25 | 0.25 | 0.25 |
| Net present value ($m) | 0.30 | 1.14 | 2.81 |
| Benefit cost ratio | 2.23 | 5.59 | 12.32 |
| Internal rate of return (%) | 11.1 | 21.5 | 33.4 |

## Confidence Rating

The results produced are highly dependent on the assumptions made, many of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 9). The rating categories used are High, Medium and Low, where:

High: denotes a good coverage of benefits or reasonable confidence in the assumptions made

Medium: denotes only a reasonable coverage of benefits or some significant uncertainties in assumptions made

Low: denotes a poor coverage of benefits or many uncertainties in assumptions made

**Table 9: Confidence in Analysis**

| Coverage of Benefits | Confidence in Assumptions |
|---|---|
| Medium | Medium |

## Conclusions

The investment in this project has contributed to demonstrating the impact of the Sustainable Farm Families approach to improving health and safety on farms. This will in turn contribute to continued funding of the program, and continued interest in the program by farming families. The benefits from the project have been estimated by valuing the improvements in health for those participants who would not have been a part of the futureSFF program if the Future Directions project had not been undertaken. A small increase in the health and wellbeing outcomes for all participants is also valued.

Given the assumptions made and a discount rate of 5%, the total investment of $0.25 million (present value of costs) was estimated to produce expected total benefits of $1.39 million (present value of benefits) giving a net present value of $1.14 million and a benefit-cost ratio of 5.6 to 1. The internal rate of return was 21.5%.

## Acknowledgments

Susan Brumby, Western District Health Service

## References

Boymal, J., Rogers, P. Brumby, S. & Wilder S. (2006) Economic Evaluation of the Sustainable Farm Families Project. Submitted to RIRDC October 2006.

Chudleigh, P. and Simpson, S. (2008) Farm Health and Safety Joint Research Venture Impact Evaluation. RIRDC Publication No. 08/141.

# Annex 1: Results for CRRDC Process

As for the results presented earlier, all past costs and benefits were expressed in 2010/11 dollar terms using the CPI. All benefits after 2010/11 were expressed in 2010/11 dollar terms. All costs and benefits were discounted to the year of analysis (2010/11) using a discount rate of 5%. These results are shown in Table A.1 and A.2 and reported for different periods of benefits with year 0 being the last year of investment. Benefits ran for a maximum period of 30 years from year 0. Investment criteria were estimated for both total investment and for the Program investment alone.

**Table A.1: Investment Criteria for Total Investment and Total Benefits**

(discount rate 5%)

| | **0 years** | **5 years** | **10 years** | **15 years** | **20 years** | **25 years** | **30 years** |
|---|---|---|---|---|---|---|---|
| Present value of benefits ($m) | 0.00 | 0.08. | 0.67 | 1.33 | 1.53 | 1.53 | 1.53 |
| Present value of costs ($m) | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| Net present value ($m) | -0.27 | -0.19 | 0.39 | 1.06 | 1.26 | 1.26 | 1.26 |
| Benefit cost ratio | - | -0.29 | 2.43 | 4.86 | 5.59 | 5.59 | 5.59 |
| Internal rate of return (%) | - | neg | 15.5 | 20.9 | 21.4 | 21.4 | 21.4 |

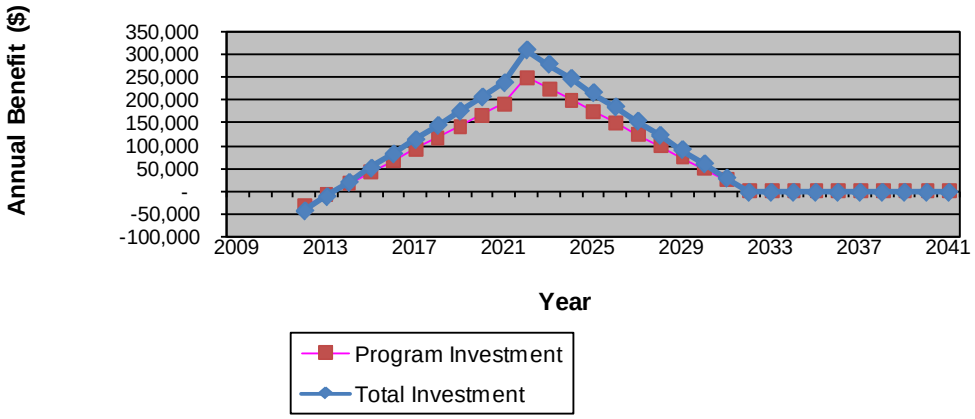
**Table A.2: Investment Criteria for Program Investment and Program Benefits**

(includes both RIRDC and industry contributions; discount rate 5%)

| | **0 years** | **5 years** | **10 years** | **15 years** | **20 years** | **25 years** | **30 years** |
|---|---|---|---|---|---|---|---|
| Present value of benefits ($m) | 0.00 | 0.06 | 0.54 | 1.08 | 1.24 | 1.24 | 1.24 |
| Present value of costs ($m) | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| Net present value ($m) | -0.22 | -0.16 | 0.32 | 0.85 | 1.02 | 1.02 | 1.02 |
| Benefit cost ratio | - | 0.29 | 2.42 | 4.84 | 5.57 | 5.57 | 5.57 |
| Internal rate of return (%) | - | neg | 15.4 | 20.7 | 21.3 | 21.3 | 21.3 |

The flow of annual benefits is shown in Figure A.1 for both the total investment and for the Program investment.

**Figure A.1: Annual Benefits**



# Appendix 2: Impact Assessment of Investment in Testing and Delivering Media Communication Strategies for Child Farm Safety

## Background

The farm environment can hold many safety hazards, especially for children. Examples include machinery, water bodies and vehicles. Farmsafe Australia reports that approximately 20 children under 15 years are fatally injured on Australian farms each year. In addition, many more children are treated medically for injuries as a result of farm accidents.

Farmsafe Australia is an association of national agencies that share a common interest in Australian farm safety. It was incorporated in 1993 as an Association, and leadership of the association comes from the agriculture industry. Farmsafe Australia has implemented a range of programs and projects aimed at enhancing the well-being and productivity of Australian agriculture through improved farm health and safety awareness and practices. One of these programs is the Child Safety on Farms (CSF) program. Farmsafe Australia consulted with peak farmer groups and researched data from the Australian Centre for Agricultural Health and Safety (ACAHS) (based at the Moree and part of the University of Sydney) in order to develop priorities for child safety on farms. The ACAHS developed a number of publications for farm families relating to key child injury risks on farm and best practice safety recommendations. Farmsafe Australia was also involved in the development of these resources, and used communication and media tools to promote child farm safety messages widely.

It was thought timely to assess the success of the various media communication strategies utilised by the program. A project was funded by the Farm Occupational Health and Safety Program (now the Farming and Fishing Health and Safety Program, managed by RIRDC) in order to make this assessment and identify areas for improvement in media communication strategies. The investment in the assessment project is the subject of the following economic evaluation.

## The Project

There is one project included in this analysis. Table 1 details the Project Number, Project Title, Research Organisation, Principal Investigator and Period of Research for the project.

**Table 1: Summary of Project Details**

| Project Number | Project Title | Other Details |
|---|---|---|
| PRJ-000652 (USA-14A) | Testing and delivering media communication strategies for child farm safety | Research Organisation: University of South Australia<br>Period: October 2004 to October 2008<br>Principal Investigator: Lia Bryant |

## Project Objectives

The objectives for the project were:

- To identify and evaluate the effectiveness of all aspects of the Farmsafe Australia Communications Strategy for the Child Safety on Farms Program (e.g. webpages, booklets, communication programs, articles in newspapers, newsletters, television, radio)

- To use case studies of a random sample of farm families from a selection of industries within SA, WA, Qld and NSW to test responses of adults and children who are over seven years of age to media communication strategies currently used, being developed and new strategies written by the steering committee

- To assess effectiveness of media strategies prior to implementation

## Project Costs

Estimates of the annual total investment in the project are provided in Table 2. All investment was by the Program with no other researcher or industry contributions.

**Table 2: Estimate of Investment in the Project (nominal $; including Program and other contributions)**

| Year ending June | 2005 | 2006 | 2007 | Total |
|---|---|---|---|---|
| Program | 49,100 | 33,977 | 11,326 | 94,403 |
| Others | 0 | 0 | 0 | 0 |
| Total | 49,100 | 33,977 | 11,326 | 94,403 |

## Project Description

A range of data was collected to determine the effectiveness of the Farmsafe Australia Child Safety on Farms Strategy. These included:

- Telephone interviews with 18 representatives and workers involved in child farm safety including CSF workers, committee members from Farmsafe Australia and organisational representatives with an interest in child safety on farms. The representatives were from all states and territories except ACT.
- Fourteen focus groups with rural community representatives in South Australia, Victoria, New South Wales, Queensland and Western Australia. The average group had eight participants and included farm parents and grandparents, representatives from rural based businesses, healthcare professionals, educators and members of local government.
- Thirty-two focus groups held in five states with school aged children in four age cohorts (7-9 years; 10-12 years; 13-15 years; and 16+ years).

The telephone interviews included both short, closed questions utilising ranking scales, as well as open qualitative questions to illicit evaluative feedback on the specific strategies and overall messages used in the CSF communication strategies (both current and prospective strategies).

The focus groups were run by a facilitator and included direct questioning and discussion on each of the communication strategies used by the CSF program. The media and communication strategies used by the CSF program and evaluated by the focus groups include:

- Child Safety Checklist
- Safe Play Area brochure and guide
- Child Safety on Farms Guidance Notes

- Get Going booklet
- Poster
- Fridge magnet
- Safety on the Land kit
- Radio public service announcements
- TV advertisement

A seminar was held in Canberra during the project. The seminar provided an opportunity for researchers, consultants and child farm safety organisations to discuss the findings of the telephone interviews and focus groups, and develop recommendations relating to the development of media and communication tools in the future.

## Outputs

A large report detailing the results of the surveys and focus groups was prepared and submitted to RIRDC but was not published; a short summary report was instead published. The report was also provided to Farmsafe Australia.

The key findings from the telephone interviews with CSF workers and representatives included:

- The group had a high awareness of the CSF program key themes (including seatbelts, riding in back of utes, 4-wheel motorbikes, helmet use on bikes/horses).

- The CSF media and communication tools were highly rated by the group, with the Child Safety Checklist and Safe Play Area brochure and guide the most commonly known and used resources.

- There is a need to brand the media and communication strategies as there is no linkage identifying that they come from the same reputable source.

- There should be a focus on up and coming farmers (e.g. agricultural schools, traineeships) as those individuals are going to be the future parents on farms.

- Field days, agricultural meetings and regional radio could be better utilised by the program for communication purposes.

- Full-time coordinators in states (not just based on volunteers) and a tightening up of networks (i.e. communication between various Farmsafe groups) would be valuable improvements.

The key findings from the adult focus groups included:

- Most of the participants had not been aware of the material prior to the focus groups, and did not have access to the resources within their communities.

- The adult groups considered that the Safety on the Land Kit, the Safe Play Area brochure and guide, the Child Safety Checklist and the television advertisements would be the most effective communication tools. The poster, radio announcements and magnet were considered the least effective.

- There was a need to distribute targeted resources for particular issues related to particular industries.

- Clear, simple, succinct and visually appealing resources were the best method of communicating messages to the general rural public, children and farmers. There was criticism

of those resources (particularly the magnet and poster) where a clear correlation between written text and visual images was absent.

- It was suggested that the use of local community members in the television and radio advertisements could increase their legitimacy and authenticity. In addition it was thought that more graphic and confrontational images of hazards and accidents would increase the likelihood of future compliance to farm safety regulations.

- It was suggested that "the use of rural citizens and local workers for resource distribution and further training and development of rural community members in farm safe practices would be the most effective method in achieving community trust and compliance".

Key findings from the school-aged focus groups included:

- Children in the 7-9 and 10-12 years of age cohorts demonstrated an understanding of the safety message of all media materials, but interpreted the poster's message in a variety of ways.

- The Safety on the Land Kit provided the strongest safety message to children within the 7-9 year age cohort.

- Students aged 13-15 years found the poster confusing and those aged 16+ thought that younger children would be confused by it.

- Students aged 13-15 rated the fridge magnet highly and those aged 16+ thought that television and the use of cartoons were effective in attracting the attention of teenagers.

- The primary school students were asked to draw their own CSF poster and high school students were asked to construct their own media tools. The resulting posters and products showed some innovative initiatives.

Following the analysis of the interviews and focus groups, as well as the seminar held in Canberra to discuss the results, a number of key recommendations were made with respect to further research, and improved service delivery. The key recommendations relating to further research were:

- That action research be undertaken with children in age cohorts to develop age appropriate media strategies.

- That research funding be available for the development of media tools for children aged 10-12 and teenagers aged 13-15 years and 16+ years.

- That action research be undertaken in classrooms to identify age-appropriate ways to include CSFmessages in kindergartens and in primary school curriculum.

- That qualitative research be undertaken to identify meanings of potential confrontational media messages and impact of those messages.

The key recommendations for service delivery were that Farmsafe Australia:

- Develop different mechanisms for distribution of written materials.

- Redevelop the poster and consider ways in which written material in the community domain should be child/teenager friendly.

- Promote increased radio interviews and announcements especially targeted at farm parents and grandparents as they are less likely to read mailed media tools.

- Consider branding of all written material, so it is obvious it has all come from the same reliable source, and is easily recognised.

- Work together with farming industries to obtain funding and develop industry specific media tools.

## Outcomes

To date, there has been limited adoption of the recommendations from this report in terms of further development of child safety media and communication materials. The recommendations with respect to funding research specifically aimed at identifying the best strategies to target individual age cohorts has also not been undertaken.

A number of the recommendations related to the need for media and communication tools to be more directly targeted at children. At the time the project was being undertaken, the CSF Program was in the process of developing a farm safety resource specifically aimed at implementation in the classroom. This resource was not able to be included in the group of materials reviewed by the focus groups as it was not yet complete. Many of the recommendations made with respect to targeting children more specifically were already being incorporated into this new resource. Therefore, while this new resource does in some part address a number of the recommendations, the direct influence of the project on the resource was relatively insignificant.

The validity of a number of the other recommendations is recognised, and there is the potential to incorporate such recommendations into the design of media and communication materials and strategies in the future. However, the release of the projects findings coincided with significant reductions in the funding for the child safety on farm program, and there has been little scope to produce new materials or develop new campaigns that can incorporate the recommendations.

Despite no real scope for adopting the recommendations in a direct way to date, those involved with the ongoing child farm safety activities are aware of the report and its recommendations, and it may have had some indirect impact on the ongoing activities. It is anticipated however, that if resources allow it in the future, many of the recommendations will be taken on board in a more direct way than currently.

## Benefits

Due to the limited adoption of the findings from the report to date, there are few benefits to date, and any potential benefits from the project are therefore likely to occur in the future. The major potential benefits from the investment relate to the potential for the findings to improve the effectiveness of Farmsafe Australia's CSF communication messages. It could do this through ensuring that the messages conveyed by the various communication and media tools, are conveyed more widely, strongly and succinctly than they may be without the knowledge provided by the project. There is also the potential for the communication and media messages to be more targeted at specific age cohorts.

This means that Farmsafe Australia and others involved in the promotion of the child farm safety message will be able to have a greater impact on adoption of safety best practice. Through increasing the awareness and adoption of these best practices, there is likely to be a reduction in the rate of child death and injury on farms.

The impact of the Farmsafe Australia child safety on farms strategy prior to this project is thought to have been significant, however there is no data to support a causal link between the strategy and reductions in child fatalities on farms. Data from the National Farm Injury Data Centre did indicate that there had been a significant reduction in child fatalities on farms from the 1989-92 period to the 2001-2004 period, however more recent data is not available. The ACAHS reported in January 2011 that agricultural field day surveys between 2003 and 2008 (3000 farmers surveyed) showed that there had been an increase in child safety awareness and practices over this period. It was also reported that

the range of guidelines and publications produced relating to child safety on farms had been picked up and promoted by State government departments (e.g. Department of Community Services in NSW and Department of Child Safety in Queensland), and that the guidelines had also been adopted by the NSW Child Deaths Review Team in the investigation of child deaths in that state.

The impact of a child being severely injured of dying in a farming accident is great. As well as the loss of the child itself, the emotional toll associated with the loss and grief can have far-reaching impacts in terms of the health and wellbeing of the family members. The productivity of the farm family and farm workers is likely to be impacted due to these impacts on health and wellbeing. In addition, there is a range of costs to families and to the public in terms of hospital and other injury treatment expenses.

### Summary of Benefits

A summary of the principal types of benefits associated with the outcomes of the investment is shown in Table 3.

**Table 3: Categories of Benefits from the Investment**

| **Levy Paying Industry** | **Spillovers** | | |
|---|---|---|---|
| | **Other Industries** | **Public** | **Foreign** |
| Economic benefits | | | |
| Potentially more efficient use of industry media and communication resources regarding child farm safety.<br><br>Potentially increased productivity on farms due to reduced worry and concern. | | Potentially reduced public health costs associated with child injury and death on farms.<br><br>Potentially more efficient use of public media and communication resources regarding child farm safety. | |
| Environmental benefits | | | |
| | | | |
| Social benefits | | | |
| Potentially reduced risk of child injury and death on farms. | | Potentially reduced risk of child injury and death on farms. | |

### Public versus Private Benefits

The potential benefits from this research will be both public and private in nature. The public benefits will be in the form of efficiencies in public spending on media and communication strategies for child farm safety, and reduced risk of injury and death on farms with associated health care costs. Private (industry) benefits will also be in the form of reduced risks of child injury and death on farms, and efficiencies in industry spending on communication strategies.

### Distribution of Benefits

The benefits will accrue to the public and to individuals on farms. There are no direct supply chain costs or benefits.

### Benefits to Other Primary Industries

The benefits from this research will potentially accrue to all primary industries.

### Match with National Priorities

The Australian Government's National and Rural R&D Priorities are reproduced in Table 4.

**Table 4: National and Rural R&D Research Priorities 2007-08**

| **Australian Government** | |
|---|---|
| **National Research Priorities** | **Rural Research Priorities** |
| 1. An environmentally sustainable Australia<br>2. Promoting and maintaining good health<br>3. Frontier technologies for building and transforming Australian industries<br>4. Safeguarding Australia | 1. Productivity and adding value<br>2. Supply chain and markets<br>3. Natural resource management<br>4. Climate variability and climate change<br>5. Biosecurity<br>*Supporting the priorities:*<br>1. Innovation skills<br>2. Technology |

The project investment will contribute to National Research Priority 2. It does not contribute to any of the Rural Research Priorities, as none of them focus on health and safety. There may be some minor contribution to Rural Research Priority 1 through the avoidance of lost productivity on the farm that can occur as a result of the trauma of a death of a child within the farm family.

## Quantification of Benefits

### Benefits Valued

The benefits from this project are estimated through assuming that the lessons learnt from this project, and potential adoption of subsequent recommendations, will potentially lead to improved delivery of child farm safety messages, and therefore adoption of child farm safety best practice. Subsequently, it can be assumed that there may be an improvement in child farm safety (and reduced probabilities of death and injury) that can be attributed to this project.

While it is recognised that it is a difficult subject, valuing the benefits from lowering the accidental death of small children on farms is best achieved by valuing the life of a child and estimating the value of a reduction in the probability of the death rate. There are many approaches to valuing a year of life of a human being. The approach taken in this analysis is based on a willingness to pay (WTP) study by Abelson (2003) who undertook a study to measure the Australian WTP for avoiding an immediate death of a healthy individual in middle age. This value was calculated as $2.5 million, which can be converted to an annual value of a statistical life (VOSL) or a value of a life year (VOLY) of $150,000 (using a life expectancy of 40 years and a consumer discount rate of 5%). This value is inclusive of medical and emotional costs. More detail on the method for developing this value is provided in

Chudleigh and Simpson (2008). If a Value of Life Year (VOLY) is valued at $150,000 per year, and the life expectancy of a 0-15 years (average 7.5 years) child is 70 additional years, the value of a statistical life (VOSL) for a child 0-15 years is valued at $2.9 m, using a discount rate of 5%.

The number of children 0-15 years of age living on farms is estimated at 135,000 (adapted from ABS, 2003). At 20 deaths per year, the probability of a farm death for a child 0-15 years based on the best available data is 20/135,000 = approximately 0.000148 per annum. If the application of child safety programs reduced (for example) the death rate from 20 to 19 each year, the probability of death would be reduced to 0.000141, or a reduction of 0.000007 in the probability of any one of the 135,000 children dying from farm accidents each year. While this analysis assumes a drop in the death rate of 1 death per year, there is no data or evidence on which to base this assumption. It is therefore used only to be indicative of the scale of benefits likely, if the research has contributed to the avoidance of one death (e.g. in reality, the death rate may have increased due to a range of other factors, but the media and communication strategies may still have contributed to avoiding one extra death).

In addition to the project analysed here (PRJ000652) there is a wide range of other research and extension programs that would contribute to this change in behaviour and reduction in the probability of a child death or injury on-farms (for example, development of safety devices and other awareness programs). It is therefore assumed that this project to improve the media and communication activities relating to child farm safety would have been only one small part of the total contribution to this reduction. A 5% attribution factor to this individual project is assumed to the saving of 1 child death per annum. In addition, as highlighted earlier, the actual use of the project's outputs to date has not been significant, and any potential benefit depends on the opportunity to use the potential benefits in the future. Therefore a probability of this actual use occurring of 25% is assumed. The first year of the use of the recommendations is assumed to be 2012/13, with the benefits assumed to commence in 2013/14 and end after ten years in 2022/23. The benefits are curtailed as the influence of the projects findings on media and communication tools, and the use of those communication tools, is likely to be less efficacious over time as farm practices and innovations change.

### The Counterfactual Situation (Without the Investment)

It is assumed that without the investment in PRJ000652 the media and communication strategies associated with child farm safety would have continued to be delivered using the same methods and tools as in the past. Therefore, the efforts in this area would have continued to achieve the same impact on preventing child death and injury on farms, as before the study was done.

### Summary of Assumptions

A summary of the key assumptions made is shown in Table 5.

**Table 5: Summary of Assumptions**

| Variable | Assumption | Source |
|---|---|---|
| VOLY for a child | $3.65 million | Calculated from Abelson, based on a life expectancy of 70 years from mid-childhood; and after converting $ terms from 2003 to 2011 |
| Number of children under 15 years on farms | 135,000 | Adapted from ABS, 2003 |
| Number of child deaths annually without intervention to promote best practice for child safety on farms | 20 | From Child Safety on Farms website, based on 2004 data |

| | | |
|---|---|---|
| Probability of child death without intervention | 0.000148 | Calculated from above |
| Number of child deaths annually with intervention to promote best practice for child safety on farms | 19 | Agtrans estimate |
| Probability of child death with intervention | 0.000141 | Calculated from above |
| Reduction in annual probability of death per child | 0.000007 | Calculated from above |
| Attribution of benefit to PRJ000652 | 5% | Agtrans assumption |
| Probability of future use of research outputs to achieve assumed benefit | 25% | Agtrans assumption |
| First year of benefits | 2013/14 | Agtrans assumption |
| Final year of benefits | 2022/23 | Agtrans assumption |

## Results

### *Overall Return on Investment*

All past costs and benefits were expressed in 2010/11 dollar terms using the CPI. All benefits after 2010/11 were expressed in 2010/11 dollar terms. All costs and benefits were discounted to the first year of investment using a discount rate of 5%. The base run used the best estimates of each variable, notwithstanding a high level of uncertainty for many of the estimates. All analyses ran for 40 years including the first year of investment. Investment criteria are estimated for both total investment and for the Program investment alone (note however that for this project, there was no additional investment from the researchers or industry). The investment criteria are reported in Table 6. It should be noted that this may be an underestimate, as reduced mortality only and not morbidity (injury) has been included in the analysis. It is assumed that parents and family suffering is implicitly included in the value of the willingness to pay estimate.

**Table 6: Investment Criteria for Total Investment and Program Investment**

(discount rate 5%)

| Criterion | Program Investment | Total Investment |
|---|---|---|
| Present value of benefits ($m) | 0.24 | 0.24 |
| Present value of costs ($m) | 0.11 | 0.11 |
| Net present value ($m) | 0.13 | 0.13 |
| Benefit cost ratio | 2.21 | 2.21 |
| Internal rate of return (%) | 12.0 | 12.0 |

The results of the analysis are partly influenced by the low investment in the project (represented by the PVC). It is also influenced by the nature of the high values associated with reductions in the probability of death or severe injury. Due to the high value of the life of a child, even small contributions to improved safety can lead to significant benefits when measured in this way.

### *Sensitivity Analyses*

Sensitivity analyses were carried out on a range of variables and results are reported in Tables 7 to 9. All sensitivity analyses were performed using a 5% discount rate (with the exception of Table 7) with benefits taken over the 40 year period. All other parameters were held at their base values.

Table 7 shows that the investment criteria are somewhat sensitive to the discount rate.

**Table 7: Sensitivity to Discount Rate**

(Total Investment, 40 years)

| Criterion | Discount Rate | | |
|---|---|---|---|
| | 0% | 5% (Base) | 10% |
| Present value of benefits ($m) | 0.46 | 0.24 | 0.13 |
| Present value of costs ($m) | 0.11 | 0.11 | 0.10 |
| Net present value ($m) | 0.35 | 0.13 | 0.03 |
| Benefit cost ratio | 4.12 | 2.21 | 1.25 |

Table 8 shows the sensitivity of the investment criteria to the assumptions of the number of child deaths prevented by the child safety effort. The base scenario assumes 1 child death is avoided per annum. The number of child deaths required to be avoided for the investment to break-even at a 5% discount rate was estimated at 0.5 deaths per annum (assuming all other assumptions remain equal).

**Table 8: Sensitivity to Assumption Relating to Number of Child Deaths Avoided**

(Total Investment, 5% discount rate; 40 years)

| Criterion | Number of child deaths avoided per annum | | |
|---|---|---|---|
| | 0.5 | 1 | 2 |
| Present value of benefits ($m) | 0.12 | 0.24 | 0.48 |
| Present value of costs ($m) | 0.11 | 0.11 | 0.11 |
| Net present value ($m) | -0.01 | 0.13 | 0.37 |
| Benefit cost ratio | 1.11 | 2.21 | 4.43 |
| Internal rate of return (%) | 5.9 | 12.0 | 18.8 |

Table 9 shows the sensitivity of the investment criteria to the assumption of the probability of the outputs being used in the future. The base assumption used in the analysis was 25%. The probability of use of research outputs required for the investment to break-even at a 5% discount rate is 11% (assuming all other assumptions remain unchanged).

**Table 9: Sensitivity to Probability of Use of Research Outputs**

(Total Investment, 5% discount rate; 40 years)

| Criterion | Probability of Use of Research Outputs | | |
|---|---|---|---|
| | 10% | 25% (base) | 50% |
| Present value of benefits ($m) | 0.10 | 0.24 | 0.48 |
| Present value of costs ($m) | 0.11 | 0.11 | 0.11 |
| Net present value ($m) | -0.01 | 0.13 | 0.37 |
| Benefit cost ratio | 0.89 | 2.21 | 4.43 |
| Internal rate of return (%) | 4.0 | 12.0 | 18.8 |

## Confidence Rating

The results produced are highly dependent on the assumptions made, many of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 10). The rating categories used are High, Medium and Low, where:

High: denotes a good coverage of benefits or reasonable confidence in the assumptions made

Medium: denotes only a reasonable coverage of benefits or some significant uncertainties in assumptions made

Low: denotes a poor coverage of benefits or many uncertainties in assumptions made

**Table 10: Confidence in Analysis**

| Coverage of Benefits | Confidence in Assumptions |
|---|---|
| Medium | Low |

## Conclusions

The project was successful in providing an evaluation of the performance of a range of communication and media tools used to promote messages regarding child safety on farms. There is the potential for the findings and recommendations from the evaluation to be used by those developing child safety media and communication materials to enhance the effectiveness of those materials, and therefore increase the adoption of child safety practices on farms. Such adoption could lead to a subsequent reduction in the probability of a child being fatally injured on a farm.

However, to date, there has been little usage of the projects outputs, largely due to a reduction in funding for child farm safety campaigns. In addition, time lags in data regarding deaths on farms and difficulties in determining any causal links between safety campaigns and subsequent reductions in death and injury rates led to difficulties in estimating the benefits from the research. Despite this, a probabilistic approach to valuing the potential benefits from the project's outputs was used in this analysis, and the expected return to the research is 2.2 to 1. This benefit-cost ratio is influenced by the low value of the investment (present value of costs of $0.11m) and the high value of life of a child.

## Acknowledgments

Julie Depczynski, Farmsafe Australia

## References

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# Annex 1: Results for CRRDC Process

As for the results presented earlier, all past costs and benefits were expressed in 2010/11 dollar terms using the CPI. All benefits after 2010/11 were expressed in 2010/11 dollar terms. All costs and benefits were discounted to the year of analysis (2010/11) using a discount rate of 5%. These results are shown in Table A.1 and A.2 and reported for different periods of benefits with year 0 being the last year of investment. Benefits ran for a maximum period of 30 years from year 0. Investment criteria were estimated for the Program investment (there were no other contributions from the researcher or industry).

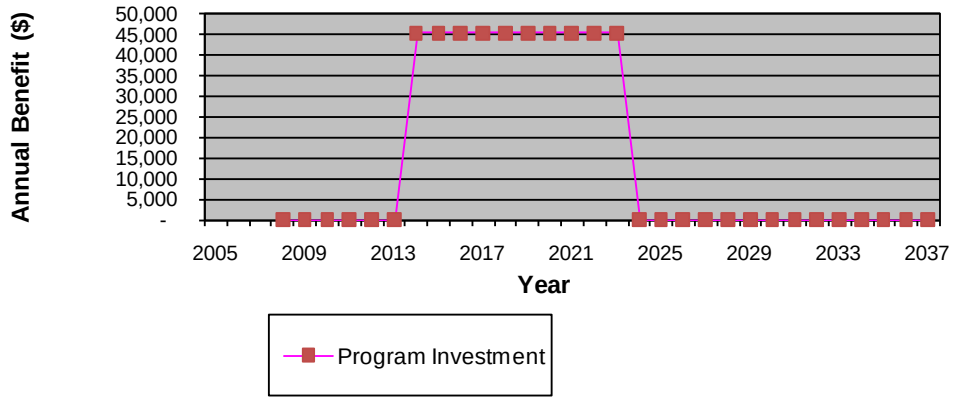
**Table A.1: Investment Criteria for Program Investment and Program Benefits**

(discount rate 5%)

| | 0 years | 5 years | 10 years | 15 years | 20 years | 25 years | 30 years |
|---|---|---|---|---|---|---|---|
| Present value of benefits ($m) | 0.00 | 0.00 | 0.10 | 0.19 | 0.21 | 0.21 | 0.21 |
| Present value of costs ($m) | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| Net present value ($m) | -0.12 | -0.12 | -0.02 | 0.07 | 0.09 | 0.09 | 0.09 |
| Benefit cost ratio | - | - | 0.81 | 1.62 | 1.76 | 1.76 | 1.76 |
| Internal rate of return (%) | neg | neg | 2.8 | 9.3 | 9.9 | 9.9 | 9.9 |

The flow of annual benefits is shown in Figure A.1 for the Program investment.

**Figure A.1: Annual Benefits**



# Appendix 3: Impact Assessment of Investment in Farm Safety Studies

## Background

The health and safety of those living and working on farms has been of concern to those involved with agricultural industries for many years. The National Farm Injury Data Centre reports that the rate of work-related deaths and workers' compensation claims in agriculture ranks among the highest 2-3 industries Australia-wide. There has been ongoing work by the National Farm Injury Data Centre and a number of Commodity Specific Reference Groups in order to identify key risk factors and address key issues (e.g. tractor safety, farm workshop safety, child safety) in this on-farm area. There has also been significant investment in training and exploring possible incentives for uptake of Occupational Health and Safety(OHS) risk management programs on farms. However, improvingadoption of safe farm practices has been complicated by the family business nature and scattered structure of farm–based industry.

In order to improve understanding of the factors contributing to safe farm practices, more knowledge was needed on the perceptions of, and attitudes to, safety on farms by those who live and work on farm. In addition, knowledge was needed on how information about farm OHS is received and used on farms, what impediments and costs are associated with uptake and the practical benefits that accrue from increased attention to safety.

Prior to the funding of the project being analysed here, most information on OHS risk and health outcomes on farms has been from surveys at one point in time or from data collected for other purposes (e.g. coroners reports, insurance data). There was also not much information collected on the uptake and impact of farm safety programs. It was felt that a longitudinal study was needed to engage with farmers and their families and workers to gather information about the nature and scale of the OHS problem on farms.

There was also a need to continue to collate and report a wide range of data on OHS practices and incidents on farms, as the National Farm Injury Data Centre has been doing for a number of years (based at the Australian Centre for Agricultural Health and Safety (ACAHS) at Moree). The funding provided by the project analysed here allowed for such work to continue.

## The Projects

There is one project included in this analysis. Table 1 details the Project Number, Project Title, Research Organisation, Principal Investigator and Period of Research for the project.

**Table 1: Summary of Project Details**

| Project Number | Project Title | Other Details |
|---|---|---|
| PRJ-000541 (US-141A) | Farm safety studies | Research Organisation: University of Sydney (ACAHS)<br>Period: October 2005 to July 2007<br>Principal Investigator: Lyn Fragar |

## Project Objectives

The objective of the project is to improve the ability of Australian agriculture to manage risk of injury through:

- The provision of accurate, timely, concise and relevant data about injury occurring on farms or due to agricultural work; and

- The establishment of a population of people who have agreed to participate in a five-year study of enterprise OHS risk factors and personal health related to work and life in agricultural production.

## Project Costs

Estimates of the annual total investment in the project are provided in Table 2.

**Table 2: Estimate of Investment in PRJ-000541 (nominal $; including Program and other contributions)**

| Year ending June | 2006 | 2007 | 2008 | Total |
|---|---|---|---|---|
| Program | 107,323 | 106,690 | 26,673 | 240,686 |
| Other[a] | 131,577 | 136,555 | 0 | 268,132 |
| Total | 238,900 | 243,245 | 26,673 | 508,818 |

[a] Includes contributions from research organisation and industry

## Project Description

The project contained a number of components, including updating and publication of data, updating and publication of industry guides and the establishment of a baseline for a longitudinal survey of industry with respect to farm safety.

With respect to the longitudinal survey, the project included the establishment of a project steering group with representation of the collaborating research partners that included NSW Famers and the cotton industry. The survey was distributed widely within a number of Statistical Local Areas (SLAs), and across a number of enterprise types across NSW. A cohort group of 335 farm enterprises were recruited into the study, from six SLAs in NSW, and from a range of enterprise types including cattle, sheep, grains, horticulture, cotton, dairy and sugarcane. A large number of the enterprises were mixed enterprises. The 335 responses came from a mail out of 8,880 information packages seeking participation in the study. The addresses for the mail out were rural addresses sought from the Australian Electoral Commission, and may have included farms that did not derive an income from agriculture. It was acknowledged when reporting the results of the survey that is likely to be some self-selection and non-respondent bias in the survey, however no adjustments were made to the results to allow for this.

There were six sections to the questionnaire including:

1. Demographics
2. Safety climate (relates to the perceptions of farm health and safety)
3. Safety management systems (relates to the management of health and safety on the farm)
4. Control of major safety hazards (relates to the management of priority hazards identified by Farmsafe Australia)
5. Free text questions relating to recent safety changes made on farm, prompts to make these changes, and current safety risks or issues
6. Injury reporting, including questions relating to injuries that occurred on the farm

Sections 2 to 4 of the questionnaire included a total of 70 questions that were to be answered using 'Yes', 'No', 'To some extent' or 'Not sure'. The results for these sections were recorded as percentage scores, and a general linear model was applied to the data collected to determine whether variables such as age, gender and enterprise influenced the scores.

While the survey was described as 'longitudinal' it is only the establishment of the survey cohort and an initial baseline survey that were carried out as part of this project. Any future survey of the cohort group will be carried out under separate funding.

The project also involved maintaining the National Farm Injury Data Centre death registers (Farm Injury Optimal Data Set), using a combination of data from National Coroners Information System (NCIS), Health Outcomes Information Statistical Toolkit (HOIST), National Occupational Health and Safety Commission (NOHSC) and Australian Bureau of Statistics (ABS) data, as well as through monitoring of the press.

The other major component of the project related to the creation and publication of a wide range of publications, commonly referred to as 'chartbooks'. These 'chartbooks' are largely based on the data collected and collated by the National Farm Injury Data Centre, as well as data from other surveys.

## Outputs

The results of the survey carried out were submitted to RIRDC in a final report, but that report has not yet been published. The survey results were also published as part of a PhD thesis (Pollock, 2010). The key findings were:

- There were 335 farm owner/manager participants in the survey. Almost 80% of the respondents were male, and their ages ranged from <25 years to >65 years. The most common age grouping was 45-54 years. Owners and/or managers made up 70% of the respondents. Mixed enterprises made up 65% of the respondent farms. Grains and livestock were the most frequently reported industry mix, followed by those who farmed only cattle, and mixed cattle and sheep farmers.

- The most common prompt for farmers to make safety changes in the past 12 months was related to meeting regulatory requirements (28%). The next most important prompts were: belief in importance of safety; old equipment unsafe; response to media or promotion campaign; replace system to improve productivity; good business management; OHS or other training; accident or near miss; safety of employees.

- Barriers or concerns relating to implementation of farm safety measures were reported as: safety planning; drought impact on safety; resource constraint; age of people at risk; human limitations/problems; nature of farm work; difficulties in safety program; frustrations with OHS demands; lack of control over visitors and contractors.

- On average, younger respondents had more negative attitudes towards farm safety than older respondents. With respect to grain farmers however, the responses revealed that this positive commitment from older farmers did not translate to the actual implementation of safety on farms. Interestingly, the reverse applied to younger farmers where there were more negative attitudes but more effective systems in place.

- Females tended to have more positive attitudes towards farm safety than males.

- Sheep farmers had the least positive attitudes to farm safety when considering results by enterprise type. Cotton and horticulture enterprises performed strongly with respect to having safety management systems in place. Cattle enterprises scored relatively low with respect to the control of major safety hazards when compared to other enterprises (e.g. tractors,

machinery guarding, workshop safety, chemical safety, vehicle and road safety, helmets, working from heights and child safety).

- For a number of industries, links were made between the experience of that industry as a whole with quality assurance programs, and their likelihood of industry members adopting OHS practices.

- There had been an average of 2.4 safety changes per farm in the 12 months prior to the survey.

- There is a disconnect between what farmers perceive as the risks on their farm and what hazards and risks actually cause the highest rates of fatalities. For example, the highest ranked risk reported by farmers was livestock handling, followed by silos and chemical handling. However, while these agents are relatively common causes of minor injuries, they do not feature highly in the causation of deaths on Australian farms. In contrast, farmers saw ATVs as safer than 2-wheeled motorcycles or horses, when they are in fact responsible for more traumatic deaths.

As well as the survey, a range of other data collection and collation activities were undertaken. These included the maintenance of the Farm Injury Optimal Data Set as well as the use of that data, together with information collected and collated elsewhere, to produce a series of publications often referred to as 'chartbooks'. These publications included:

- A publication titled "The mental health of people on Australian farms: The Facts – 2008"

- A publication titled "Health and safety in older farmers in Australia: The Facts – 2007"

- A publication titled "Traumatic deaths in Australian Agriculture: The Facts – 2007"

- A publication titled "Vehicle injury associated with Australian Agriculture: The Facts -2008"

- A publication titled "The safety of young people in Australian Agriculture: The Facts – 2008"

- An on-farm OHS risk management package for the Sugarcane industry titled "Managing Sugar Cane Production Safety" was developed and published by RIRDC in 2007. It was largely based on information collected through an earlier project carried out by ACAHS and RIRDC.

These publications present a range of facts and figures associated with injury, death and wellbeing in different sectors of the farming community (including specific industries, demographic groups, or risks (e.g. ATVs). For example, the vehicle injury publication provides information on the situations and demographic groups for which injury is most likely to occur, and the mental health publication includes information on key pressures on rural farmers that contribute to mental health issues.

## Outcomes

The findings of the survey provide new information on the perceptions and behaviours of farmers with respect to farm health and safety. This information if used by work safety authorities, industry, Farmsafe Australia and health practitioners should help them to evaluate their existing approaches (such as legislation, communication strategies, priorities, further research) and make changes to improve such approaches. In the past, the development of many of the approaches has been based on hypotheses, rather than the type of data that will now be available due to this survey. Some key examples of recommendations made as part of the survey analysis that may be used to improve farm health and safety include:

- Differences in attitudes between younger and older farmers towards farm safety may require different approaches to targeting these two groups, especially given how these attitudes do not necessarily translate to adoption of safety practices.

- Women have a more positive attitude towards farm safety than men, which might make them appropriate targets for delivering practical approaches, systems and management, as they are already committed to farm safety.
- The strong Quality Assurance systems requirements within the horticulture and cotton industries have possibly contributed to the strong performance of these enterprises with respect to safety management systems. The cotton industry's Best Management Practice (BMP) manual approach is something that could be considered by other industries.
- The findings relating to cattle enterprise indicate a more targeted approach that demonstrates that improvements to safety systems are not complicated, expensive or time consuming and may result in significant improvements.
- Further research is required into barriers to adoption and drivers for change for specific groups and for specific risks or hazards. The survey demonstrated that there can be a disconnect between attitudes and beliefs, and actual practice change. Examining the disconnect and how to overcome it would be a valuable research area.
- Being able to demonstrate that changes to safety systems can be made in a cost and time efficient manner is important to ensuring adoption. It was recommended that promoting changes made by actual farmers may be more successful than focusing on recommendations from research or work safety authorities.
- The study found that in the past the use of government incentives in the form of subsidies or rebates had been successful in ensuring adoption of changes requiring machinery upgrades etc, and that a review of major hazards that may be successfully eliminated through such incentives be undertaken.
- Regulation and legislation are also successful drivers of improvement, and therefore a review of such legislations should be a priority task.
- An understanding and detailed analysis of the potential efficiency, production and financial gains that can be achieved through farm safety changes should be undertaken as such information can be used in future promotion campaigns.

As the survey report has not been published, the results have not been widely distributed or used by those outside of the ACAHS and Farmsafe Australia. However, these two groups have made extensive use of the survey results in setting their research and program priorities. The survey results are also used in all of their relevant research projects. For example, a study of small-scale famers has just been carried out, and the data from the original survey informed the development of this project. In addition, the survey results have been used for benchmarking with respect to a wide number of other safety audits and training programs.

To date, there has been no additional phase or expansion of the survey carried out. However, a recent study carried out by the ACAHS for RIRDC and ABARES used the same set of questions as part of the basis for a survey of 700 properties Australia wide in order to establish a health and safety baseline for Australian farms

The series of 'chartbook' publications from this project were targeted at a range of individuals and agencies who:

- work to reduce risk associated with elderly farmers
- work to reduce risk associated with young workers on farms
- work to reduce high rates of serious injury and death
- deliver programs that aim to influence the mental health and wellbeing of the farming population

The publications were targeted particularly at educators and developers of public and industry policy interested in improving farm safety.

In January 2011 ACAHS produced a report on the impact of the Centre's work impact titled "From Research to Safe Practice on Farms". This publication provides information on where the outputs and

products produced by ACAHS have been used to inform policy and practices. The following information extracted from that report provides examples of uses of some of the particular publications produced as part of the funding provided by PRJ000541:

- The data in the report on traumatic deaths was used in the development of the Farmsafe Australia Communication Framework and Strategy 2008-2010 and also to develop strategic approaches to farm vehicle safety.
- 'The Facts' series of books have been downloaded from the Farmsafe Australia website at a rate of 200 to 300 per month. Those downloading the reports include educators, contractors, policy makers and public health units.
- Data from 'The Facts' series of books has guided the development of Farmsafe Australia sponsored national strategies to address safety associated with each topic.
- The 'Managing Sugarcane Production Safety' guidelines were endorsed by the Sugarcane industry and made accessible to industry members through the Farmsafe Australia website.
- 'The Facts' report on vehicle injuries was part of a proposal to develop a national farm vehicle safety strategy. Funding was received from the NRMA for the ACAHS to develop a guideline/fact sheet on the need to use vehicle restraints while driving/riding in vehicles on farms.
- 'The Facts' report on the safety of young people in Australian agriculture contributed to the development of an entry level rural worker induction employee guide and discussion guide. It is expected that the adoption of the worker induction material will be Australia wide and partnerships are being formed with Youth Safe Australia, the College of Road Safety and NRMA to promote and deliver the material.
- 'The Facts' reports on young people and traumatic deaths were used by the ACAHS to assist the Commonwealth Department of Immigration and Citizenship in its review of the Temporary Business (long stay), sub class 457 visa. The role of the ACAHS was specifically to provide advice on qualifications, skill and experience necessary to satisfy visa requirements. The ACAHS was said to be "instrumental in the development of changes to the Subclass 457 policy for OHS standards".
- Information in 'The Facts' report on older farmers was used in the development of a publication titled "The great ideas bank – making farm work easier as we get older". This publication is being rolled out through community agencies such as Rotary, and through industry groups including the Macadamia Industry at their 2008 annual conference.

## Benefits

The major potential benefit from the investment (in both the survey and the chartbooks) relates to improving the policies, products and information aimed at encouraging adoption of best practice farm safety. The outputs from the project have, or potentially will, contribute to improving these policies and products, and improving adoption rates of safe practices, by collecting and collating more detailed information on the existing barriers to adoption, as well as the existing risk factors associated with particular activities and demographic groups. This in turn should lead to increased adoption of safe farm practices, and subsequent reductions in rates of injury and death on farms. Even if the survey is not extended to become a longitudinal survey over time, the baseline data established through the first phase of the survey in this project will still provide valuable information to achieve such a benefit.

The ACAHS reported in January 2011 that the National Farm Injury Data Centre indicates a significant reduction in the number of farm deaths during the life of the ACAHS. In the 1989-92 period there was an average of 146 deaths per years, while in the period 2003-06 there were only 82 deaths per year (a reduction of 44%). More recent national data is not available. When measured in terms of deaths per 10,000 farms or per 100,000 employees, the reduction has been 35% and 54% in the respective death rates over this period. It is recognised that these statistics refer to the period prior to the funding of the project being analysed here.

It is difficult to make a specific causal link between any use of the chartbooks and survey data, and any reduction in the farm deaths and injuries. This is because there are such a wide range of factors that

influence safety practices on farms. There are a large number of organisations and individuals involved in developing farm safety policies, determining best practices, developing communication and extension materials, and delivering that information to farmers and farm workers. In addition, as the results of the survey have shown, there are many factors that influence a farmer's decision making with respect to farm safety, and these factors vary greatly between individuals.

Another complication in establishing any benefit from such research investments is the time delays evident in the reporting of analysed summary statistics that provide evidence of reductions in farm death and injury rates for particular industries, particular at-risk groups, or particular high risk behaviours.

Regardless of these factors, it is reasonable to assume, given the evidence, that the development and promotion of best practices for farm safety on farms has been improved by the contribution of the knowledge and publications produced by this project. There are likely to have been, or be in the future, some reduction in the likelihood of injury and death on farms as a result of this contribution.

The project also may have lead to some efficiencies in resource use associated with the development and promotion of farm safety practices by a range of organisations. The data analysis and identification of high risk areas will contribute to efficiencies for policy makers in identifying high risk activities and demographic groups for targeting with policies and promotional efforts. In addition, the results of the survey regarding key barriers and motivators for change will also assist in more efficiently targeting appropriate policy and promotion efforts.

It is recognised that there may be some additional costs and time involved for farmers adopting changed safety practices as recommended. However, it is assumed that any such costs will be less than the benefits of a reduced probability of death and/or injury. In some cases, it has been found that the adoption of safe practices can actually lead to improved productivity on the farm. The benefits from the reduced probability of death and/or injury include not only the health and wellbeing benefits to individuals, but also more direct financial benefits in terms of reduced down time and days off work due to injuries, and subsequent financial benefits to employers.

### Summary of Benefits

A summary of the principal types of benefits associated with the outcomes of the investment in the project is shown in Table 3.

**Table 3: Categories of Benefits from the Investment**

| Levy Paying Industry | Spillovers | | |
|---|---|---|---|
| | **Other Industries** | **Public** | **Foreign** |
| Economic benefits | | | |
| Reduced healthcare costs due to reduced likelihood of death and injury on farms.<br><br>Efficiencies in use of resources to develop and promote farm safety practices.<br><br>Reduced loss of income and productivity to employees and employers from lost time due to injury and/or death. | | Reduced healthcare costs due to reduced likelihood of death and injury on farms.<br><br>Efficiencies in use of resources to develop and promote farm safety practices. | |
| Environmental benefits | | | |
| | | | |
| Social benefits | | | |
| Reduced death and injury for those on farms. | | Reduced death and injury for those on farms. | |

### Public versus Private Benefits

The benefits from this research will be both public and private in nature, in that they will accrue to both members of the public, and those who are part of the agricultural industries, who avoid being injured on farms with subsequent reduced business and downtime costs. In addition, there will be reduced healthcare costs that will accrue to both the public and the family of the individual who avoids injury.

### Distribution of Benefits

The benefits will accrue to the public and to individuals on farms. There are no direct supply chain costs or benefits.

### Benefits to Other Primary Industries

The research will result in benefits to a wide ranging number of agricultural industries including grazing, cropping and horticulture enterprises.

### Match with National Priorities

The Australian Government's National and Rural R&D Priorities are reproduced in Table 4.

**Table 4: National and Rural R&D Research Priorities 2007-08**

| Australian Government | |
|---|---|
| **National Research Priorities** | **Rural Research Priorities** |
| 1. An environmentally sustainable Australia<br>2. Promoting and maintaining good health<br>3. Frontier technologies for building and transforming Australian industries<br>4. Safeguarding Australia | 1. Productivity and adding value<br>2. Supply chain and markets<br>3. Natural resource management<br>4. Climate variability and climate change<br>5. Biosecurity<br>*Supporting the priorities:*<br>1. Innovation skills<br>2. Technology |

The project investment will contribute toNational Research Priority 2. It does not contribute directly to any of the rural research priorities, as health and safety is not included in the priorities. There is however an indirect link to Rural Research Priority 1.

## Quantification of Benefits

### Benefits Valued

The benefits from this project are valued through estimating the value of a potential reduction in the likelihood of death or injury on farm, as a result of improved policy, practices and promotion derived from the contribution of the information and publications produced. As noted above, it is difficult to make any causal link between the project's outputs and any reduction in likelihood of death or injury. In addition, given data limitations, it is difficult to draw any conclusions regarding whether there has been any reductions in likelihood of death or injury on farms. Therefore, the approach taken here is indicative only of the potential scale of benefits, given certain assumptions regarding the impact that it could reasonably be assumed this project has had.

A PhD thesis by Pollock (2010) estimated the economic impact of farm-related fatalities on Australian farms. The thesis took a human capital approach to estimating the direct and indirect costs of fatalities. The study concluded that the total economic cost of farm-related fatalities over the period 2001-2004 was estimated to be $650.6 million (in 2008 dollars). This equated to an average cost of $1.6 million per individual fatality (there were 404 farm-related fatalities over the period). The average economic cost per annum over the four years was $162.6 million (650.6/4). The five most common agents causing death accounted for half of the total fatalities and 46.7% of the economic cost ($303.5 million). The five most common agents causing death (in order) were tractors, ATVs, drowning, utilities and 2-wheel motorcycles. The economic impact calculated by Pollock includes:

- the expected future earning capacity (including wages, benefits and household contribution values) of the individual fatality victims (based on average life expectancy and lifetime earnings data for individuals of their age, gender etc);

- the direct costs relating to ambulance, police, hospital, premature funeral, coronial and work safe authority investigation and death compensation costs; and
- an allowance for 'friction costs' which is the loss in output from remaining workers, and training and recruitment costs for the employer over a period of time.

It is assumed that due to use of the outputs from this research project, there will be some increase in the effectiveness of farm safety policies, publications and promotional efforts. This will in turn lead to increased uptake of safe practices, and a subsequent reduction in the likelihood of injury and/or death on farms. During the period from 2001 to 2004, there were 404 fatalities on farms (average of 101 per annum). Over the period 2003 to 2006, the average number of fatalities on farms was 82 deaths per year. More recent statistics are not available, however for the purposes of this analysis it is assumed that the average number of deaths per annum on farms at the time this project was completed (2008) was 90 deaths per annum. If it is assumed there are approximately 330,000 persons employed in agriculture, this equates to a very small probability of death of 0.00027 per annum. It is noted however that a proportion of those having fatal accidents are not workers, but are children or visitors to the farm.

It is assumed that the outputs of this project will influence the development of policy and therefore the safety practices of farmers over the period 2009 to 2019. A number of the publications (chartbooks) were released in 2007 and 2008, and the survey data was made available over the period 2008 to 2010. It is assumed that due to these efforts, the number of fatalities on farms might reduce from 90 deaths per annum to 85 deaths per annum over the 10 years (a reduction of one death every two years). This equates to a reduction in the probability of death from 0.00027 to 0.00026 per annum over the ten years. It is recognised that in reality, the number of deaths on farms, and the probability of death on farms will fluctuate from year to year due to a range of factors. The assumed decrease in probability over the 10 years due to the influence of this project is indicative of the scale of benefits likely to be captured. The assumptions should not be interpreted as a prediction of the actual likelihood of death over this period. The relatively long time scale until maximum benefits are reached is due to the long time-frames that are likely to be evident in policy makers and others utilising the outputs of this project, and then subsequent impact in terms of adoption of changed practices on farms. It is further assumed that after the maximum benefit is reached, the influence of the projects outputs declines over the following five years, before declining to zero impact in 2021/22

The reduction in the probability of death is assumed to flow from both the survey and the creation of the chartbooks. It is assumed that 25% of the assumed benefit is attributable to the use of the survey results, and that 75% is attributable to the use of the chartbooks. For the survey, the assumed benefits relate only to this baseline survey, and are not dependent on future surveys being carried out on the same population as planned. Benefits from such subsequent surveys will be in addition to the benefits assumed here.

It is recognised that for the project to achieve the benefits from the baseline survey, additional resources will be invested by those utilising the survey results (e.g. policy makers, extension officers). Therefore only 10% of the benefit from the use of the survey is assumed attributable to this project.

With respect to the chartbooks, allowance needs to be made to the investment that has gone into collecting the information presented in the chartbooks, much of which was funded outside of this project. In addition, as with the survey, there will be additional resources that will go into developing the policies and practices that will utilise the information from the survey and the chartbooks. For these two reasons, only 5% of the benefit from the use of chartbooks is assumed attributable to this project.

### The Counterfactual Situation (Without the Investment)

Without this investment, it is likely that the ACAHS and other responsible bodies would have continued to develop policies, products and promotional activities aimed at encouraging improved safety on farms, and there would have been some decrease in the probability of death or injury based on these activities and policies. However, that decrease in probability may not have been as significant, due to the decisions being based on a less strategic or targeted approach to understanding the risks and barriers to adoption within different industries and demographic groups.

### Summary of Assumptions

A summary of the key assumptions made is shown in Table 5.

**Table 5: Summary of Assumptions**

| Variable | Assumption | Source |
|---|---|---|
| Probability of death due to a farm accident without project | 0.00027 | Calculated based on 90 deaths per annum, out of a total workforce of 330,000 people |
| Probability of death due to a farm accident with project | 0.00026 | Calculated based on 85 deaths per annum, out of a total workforce of 330,000 people |
| First year of decline in probability due to project | 2009 | Year of the majority of outputs from project |
| Number of years until maximum reduction in assumed probability is reached | 10 years, and the benefits decline to zero after five years | Agtrans assumption |
| Average value of one life | $1.6 million | From Pollock, 2010 (2008 dollar terms; is a present value calculated using a discount rate of 3%) |
| Attribution of total benefit to survey component | 25% | Agtrans assumption |
| Attribution of total benefit to chartbook component | 75% | Agtrans assumption |
| Attribution of benefits from survey to PRJ000541 | 10% | Agtrans assumption |
| Attribution of benefits from chartbook to PRJ000541 | 5% | Agtrans assumption |

## Results

### *Overall Return on Investment*

All past costs and benefits were expressed in 2010/11 dollar terms using the CPI. All benefits after 2010/11 were expressed in 2010/11 dollar terms. All costs and benefits were discounted to the first year of investment using a discount rate of 5%. The base run used the best estimates of each variable, notwithstanding a high level of uncertainty for many of the estimates. All analyses ran for 40 years including the first year of investment. Investment criteria were estimated for both total investment and for the Program investment alone. The investment criteria are reported in Table 6. It should be noted that the investment criteria may be an underestimate of total benefits, as fatalities only have been accounted for with non-fatal injuries excluded.

**Table 6: Investment Criteria for Total Investment and Program Investment**

(discount rate 5%)

| Criterion | Program Investment only | Total Investment |
|---|---|---|
| Present value of benefits ($m) | 1.08 | 2.29 |
| Present value of costs ($m) | 0.26 | 0.56 |
| Net present value ($m) | 0.82 | 1.73 |
| Benefit cost ratio | 4.09 | 4.07 |
| Internal rate of return (%) | 24.1 | 23.9 |

*Sensitivity Analyses*

Sensitivity analyses were carried out on several variables and results are reported in Tables 7and 8. The sensitivity analyses were performed on the total investment only using a 5% discount rate (with the exception of Table 7) with benefits taken over the 40 year period. All other parameters were held at their base values.

Table 7 shows that the investment criteria are not very sensitive to the discount rate. This is partly due to the short time period of benefits assumed (benefits curtailed after fifteen years).

**Table 7: Sensitivity to Discount Rate**

(Total Investment, 40 years)

| Criterion | Discount Rate | | |
|---|---|---|---|
| | 0% | 5% (Base) | 10% |
| Present value of benefits ($m) | 3.75 | 2.29 | 1.46 |
| Present value of costs ($m) | 0.58 | 0.56 | 0.55 |
| Net present value ($m) | 3.17 | 1.73 | 0.92 |
| Benefit cost ratio | 6.48 | 4.07 | 2.67 |

Table 8 shows the sensitivity of the investment criteria to the assumption of the number of deaths that is likely to be avoided due to the project. The base assumption was 5 deaths avoided over 10 years. The number of deaths that would have to avoided over 10 years for the investment to break-even at a 5% discount rate is 1.2 deaths

**Table 8: Sensitivity to AssumptionsRegarding Number of Deaths Avoided**

(Total Investment, 5% discount rate; 40 years)

| Criterion | Number of Deaths Avoided Over 10 Years | | |
|---|---|---|---|
| | 2 | 5 | 10 |
| Present value of benefits ($m) | 0.92 | 2.29 | 4.58 |
| Present value of costs ($m) | 0.56 | 0.56 | 0.56 |
| Net present value ($m) | 0.35 | 1.73 | 4.02 |
| Benefit cost ratio | 1.63 | 4.07 | 8.14 |
| Internal rate of return (%) | 10.8 | 23.9 | 36.3 |

### Confidence Rating

The results produced are highly dependent on the assumptions made in each analysis, many of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 9). The rating categories used are High, Medium and Low, where:

High: denotes a good coverage of benefits or reasonable confidence in the assumptions made

Medium: denotes only a reasonable coverage of benefits or some significant uncertainties in assumptions made

Low: denotes a poor coverage of benefits or many uncertainties in assumptions made

**Table 9: Confidence in Analysis**

| Coverage of Benefits | Confidence in Assumptions |
|---|---|
| Medium | Low |

## Conclusions

The investment in this project has resulted in a number of outputs including a baseline industry farm safety survey in NSW, and a series of 'chartbook' publications on high priority issues regarding health and safety in agriculture. These outputs have been, and will continue to be, used to influence a wide range of policy, research and communication applications, and there is some evidence of that use to date. As with a lot of research related to health and safety, it is difficult to determine with confidence a causal relationship between the outputs of this research, and any subsequent reduction in the likelihood of death or injury on farm. However, an attempt has been made here to place a value of on the potential impact of the research outputs.

The benefits of the research were valued assuming a contribution to a decreased probability of death on farms in the future. The analysis found that for the investment of $0.56 million (present value terms) there was a return of $2.3 million when considering benefits over 40 years (present value using a 5% discount rate). This resulted in a benefit-cost ratio of 4.1 to 1.

## Acknowledgments

Tony Lower, Australian Centre for Agricultural Health and Safety
John Temperley, Australian Centre for Agricultural Health and Safety

## References

Pollock, K.S. (2010) "The economic cost of farm-related fatalities and the perceptions and management of health and safety on Australian farms" Thesis submitted for the degree of Doctor of Philosophy to Sydney Medical School, University of Sydney, March 2010.

# Annex 1: Results for CRRDC Process

As for the results presented earlier, all past costs and benefits were expressed in 2010/11 dollar terms using the CPI. All benefits after 2010/11 were expressed in 2010/11 dollar terms. All costs and benefits were discounted to the year of analysis (2010/11) using a discount rate of 5%. These results are shown in Table A.1 and A.2 and reported for different periods of benefits with year 0 being the last year of investment. Benefits ran for a maximum period of 30 years from year 0. Investment criteria were estimated for both total investment and for the Program investment alone.

**Table A.1: Investment Criteria for Total Investment and Total Benefits**
(discount rate 5%)

| | 0 years | 5 years | 10 years | 15 years | 20 years | 25 years | 30 years |
|---|---|---|---|---|---|---|---|
| Present value of benefits ($m) | 0.00 | 0.60 | 1.87 | 2.41 | 2.41 | 2.41 | 2.41 |
| Present value of costs ($m) | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 |
| Net present value ($m) | -0.59 | 0.01 | 1.28 | 1.81 | 1.81 | 1.81 | 1.81 |
| Benefit cost ratio | - | 1.01 | 3.17 | 4.07 | 4.07 | 4.07 | 4.07 |
| Internal rate of return (%) | neg | 5.3 | 22.1 | 23.7 | 23.7 | 23.7 | 23.7 |

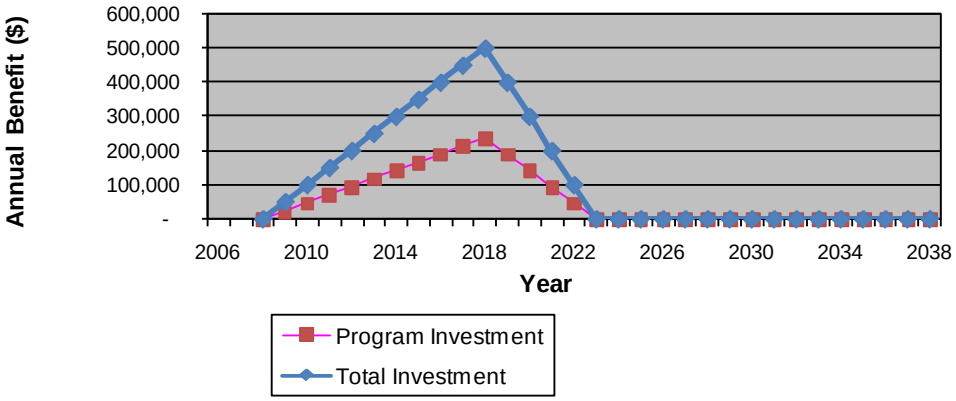
**Table A.2: Investment Criteria for Program Investment and Program Benefits**

(includes both RIRDC and industry contributions; discount rate 5%)

| | 0 years | 5 years | 10 years | 15 years | 20 years | 25 years | 30 years |
|---|---|---|---|---|---|---|---|
| Present value of benefits ($m) | 0.00 | 0.28 | 0.88 | 1.13 | 1.13 | 1.13 | 1.13 |
| Present value of costs ($m) | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 |
| Net present value ($m) | -0.28 | 0.004 | 0.61 | 0.86 | 0.86 | 0.86 | 0.86 |
| Benefit cost ratio | - | 1.02 | 3.18 | 4.09 | 4.09 | 4.09 | 4.09 |
| Internal rate of return (%) | neg | 5.3 | 22.3 | 24.1 | 24.1 | 24.1 | 24.1 |

The flow of annual benefits is shown in Figure A.1 for both the total investment and for the Program investment.

**Figure A.1: Annual Benefits**



# Economic Evaluation of Investment in the Farming & Fishing Health & Safety R&D Program

by Peter Chudleigh, Sarah Simpson and Jessica Lai

Publication No. 11/170

This report presents the results of economic analyses of three investments within the Farming & Fishing Health & Safety Program.

The information contained in the report is targeted at Program and RIRDC management, those within the industries that support the Program, and the wider community. Another target audience is the Australian Government and Council of Rural Research and Development Corporations (CRRDC).

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