Industry-specific impact assessment program: apple and pear

Impact assessment report for project *Understanding apple and pear production systems in a changing climate* (AP12029)

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What the report is about

This report presents the results of an impact assessment of a Horticulture Innovation Australia Limited (Hort Innovation) investment in *Understanding apple and pear production systems in a changing climate (AP12029).* The project was funded by Hort Innovation form October 2012 to March 2017.

Methodology

The investment was first analysed qualitatively within a logical framework that included activities and outputs, outcomes and impacts. Actual and/or potential impacts then were categorised into a triple bottom line framework. Principal impacts identified were then considered for valuation in monetary terms (quantitative assessment). Past and future cash flows were expressed in 2017/18 dollar terms and were discounted to the year 2018/19 using a discount rate of 5% to estimate the investment criteria and a 5% reinvestment rate to estimate the modified internal rate of return (MIRR).

Results/key findings

The investment in this apple and pear project delivered useful information for growers to better manage the changing climate and its effects on the production system, particularly on flowering and fruit quality. Analyses demonstrated differences in climate change impacts between different apple and pear growing regions. Analyses suggested that milder winter growing regions are likely to experience increasing frequency of inadequate chilling in future years; also, extreme heat days will increase. The project identified the need for detailed information and guidelines for matching apple and pear cultivars with the future climates as well as guidelines for managing extreme heat such as canopy structures and netting.

Investment Criteria

Total funding from all sources for the project was $1.61 million (present value terms). The investment produced estimated total expected benefits of $4.65 million (present value terms). This gave a net present value of $3.04 million, an estimated benefit-cost ratio of 2.89 to 1, an internal rate of return of 9.5% and a MIRR of return of 9.1%.

Conclusions

The investment in AP12029 is likely to contribute significantly to the preparedness of pome fruit growers to climate change. The project will lead to growers adopting new varieties and other preparation methods in the face of climate change because of the project.

As several economic and social impacts identified were not valued, the investment criteria estimated by the evaluation may be underestimates of the actual performance of the investment.

Keywords

Impact assessment, cost-benefit analysis, apple and pear industry, climate change, adaptation strategies

Introduction

All research and development (R&D) and marketing levy investments undertaken by Horticulture Innovation Australia Limited (Hort Innovation) are guided and aligned to specific investment outcomes, defined through a Strategic Investment Plan (SIP). The SIP guides investment of the levy to achieve each industry's vision. The current industry SIPs apply for the financial years 2016/17 – 2020/21.

In accordance with the Organisational Evaluation Framework, Hort innovation has the obligation to evaluate the performance of its investment undertaken on behalf of industry.

This impact assessment program addresses this requirement through conducting a series of industry-specific ex-post independent impact assessments of the apple & pear (AP), avocado (AV), mushroom (MU) and table grape (TG) RD&E investment funds.

- Twenty-seven RD&E investments (projects) were selected through a stratified, random sampling process. The industry samples were as follows:
- Nine AP projects were chosen worth $15.46 million (nominal Hort Innovation investment) from an overall population of 19 projects worth an estimated $33.31 million,
- Seven AV projects worth $1.91 million (nominal Hort Innovation investment) from an overall population of 27 projects worth approximately $9.97 million,
- Five MU projects worth $1.75 million (nominal Hort Innovation investment) from a total population of 20 projects worth $7.94 million, and
- Six TG projects worth $2.84 million (nominal Hort Innovation investment) from an overall population of 11 projects worth $5.0 million.

The project population for each industry included projects where a final deliverable had been submitted in the five-year period from 1 July 2013 to 30 June 2018.

The projects for each industry sample were chosen such that the investments represented (1) at least 10% of the total Hort Innovation RD&E investment expenditure for each industry, and (2) the SIP outcomes (proportionally) for each industry.

Project AP12029*: Understanding apple and pear production systems in a changing climate* was randomly selected as one of the 22 unique MT18009 investments and was analysed in this report.

General Method

The impact assessment follows general evaluation guidelines that are now well entrenched within the Australian primary industry research sector including Research and Development Corporations, Cooperative Research Centres, State Departments of Agriculture, and some universities. The approach includes both qualitative and quantitative descriptions that are in accord with the impact assessment guidelines of the CRRDC (CRRDC, 2018).

The evaluation process involved identifying and briefly describing project objectives, activities and outputs, outcomes, and impacts. The principal economic, environmental and social impacts were then summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were then valued in monetary terms. Where impact valuation was exercised, the impact assessment uses cost-benefit analysis as its principal tool. The decision not to value certain impacts was due either to a shortage of necessary evidence/data, a high degree of uncertainty surrounding the potential impact, or the likely low relative significance of the impact compared to those that were valued. The impacts valued are therefore deemed to represent the principal benefits delivered by the project. However, as not all impacts were valued, the investment criteria reported for individual investments potentially represent an underestimate of the performance of that investment.

Background & Rationale

Background

Apples and pears are two of the main horticulture crops produced in Australia. Combined, the apple and pear industries produce more fresh fruit than any other fruit industry in Australia (APAL, 2019). The main production of apples and pears occurs in Victoria (at 45% and 88% of national production respectively), with major apple producers also located in all other states. Most Australian apples and pears are for fresh supply, but both also have significant production sent for processing (for juices and other value-added products).

In 2017/18, Australian apples had a farm gate value (FGV) of $418.3 million and production of 269,355 tonnes, while pears (including Nashi) had an FGV of $80.2 million and production of 103,748 tonnes (ABS, 2019). Domestic apple consumption has remained relatively stable over time, but per capita consumption has been falling (Hort Innovation, 2016). Fresh pear (excluding Nashi) per capita consumption has remained stable since 2002/03 (Hort Innovation, 2016).

Exports, while relatively small compared to domestic consumption, represent an important growth area for apples and pears. A total of 2,134 tonnes (or 1% of fresh production) of apples was exported in 2014/15 (Hort Innovation, 2016) with major markets being Papua New Guinea, United Kingdom, Sri Lanka, and Hong Kong.

For pears, a total of 7,647 tonnes (7% of fresh production) was exported the same year (Hort Innovation, 2016), with major export markets being New Zealand, Indonesia, Canada, Singapore, and more recently India. Australia does allow imports of both apples and pears, but quantities are relatively small compared to domestic production.

There are both opportunities and challenges for the Australian apple and pear industry to improve in areas such as biosecurity, inconsistency of eating quality, export competition and market access, and an oversupply leading to lower prices (Hort Innovation, 2016).

The collective goal of the two industries is to increase the growth in domestic consumption of apples and pears, and to see growth in exports. The apple and pear industries have funded a number of projects, through Hort Innovation and industry RD&E investments, around improving access to the Asian export market, improved marketing of apples and pears, and improving industry productivity and quality (APAL, 2013). Statutory levies are in place for both industries for Emergency Plant Pest Response, National Residue Testing, Plant Health Australia, Marketing and R&D. Marketing and R&D levies are managed by Hort Innovation. APAL is the apple and pear industry's representative body and non-profit membership organisation.

Rationale

Future climate scenarios are predicted to have a significant impact on the apple and pear industry. Less chill days may reduce productivity of existing varieties in their current locations. It was considered important that greater understanding of the effects of factors associated with climate change on apple and pear production and how growers could be better prepared to manage and ameliorate such effects.

Project Details

Summary

Project Code: AP12029

Title: *Understanding apple and pear production systems in a changing climate*

Research Organisation: Department of Agriculture and Fisheries, Queensland

Project Leader: Heidi Parkes

Period of Funding: Years ending 30th June 2012 to 2016

Objectives

1. Develop climate change scenarios for pome fruit growing regions of Australia in 2030 and 2050, including the likely impact of climate change on winter chill and extreme heat.
2. Understand how changes in autumn, winter and spring temperatures might impact the timing and quality of flowering in cultivars of apple and pear.
3. Identify adaptations to manage any negative effects of climate change on flowering.
4. Understand how changes in the frequency of extreme heat days might impact on the incidence of sunburn in pome fruit and the effectiveness of netting as an adaptation strategy.
5. Understand how different colours of netting impact on the orchard environment, fruit yield and quality.
6. Understand how the changing climate might impact the yield potential of apples.

There was also three specific development and extension objectives of the project. These objectives were:

1. Facilitate greater understanding of how the climate is likely to change by 2030 and 2050 in apple and pear growing regions of Australia, how this might impact on apple and pear production, and potential adaptation strategies to reduce the associated risks.
2. Increase knowledge and skills to enable informed decision-making around climate change adaptation, and orchard investment and planning, based on scientific evidence.
3. Build a connected and collaborative approach between research partners, funding bodies, industry and growers around managing and adapting to climate change.

A project variation was executed in April 2016. The aim of the extension was to develop a user-oriented, research-based website to assist growers, and industry more broadly, to access and interpret winter chill data.

The following table (Table 1) provides a detailed description of the project in a logical framework.

Table 1: Logical Framework for Project AP12029

Activities and Outputs	• Modelling was undertaken to project when flowering of apples and pears would take place in the future due to climate change. • A “Cripps Pink (also known as Pink Lady)” chill overlap model was used to predict future climate modelling growth prospects. • Winter chill was calculated using the best practice Dynamic Model. • In apple growing regions of Applethorpe, Shepparton, Manjimup, Huonville, Orange, and Mount Barker, historical trends of average temperatures, winter chill and heat days were analysed. • Climate projects for these locations were analysed for 2020 and 2050 under different climate scenarios (including RCP4.5 (minimum case scenario) and RCP8.5 (worst case scenario)). The overall results showed that all regions will have an increased number of heat days in future during the growing season. • Baseline data for temperature, bud burst and flowering from Applethorpe, Manjimup and Shepparton from 2012 to 2015 were assembled. • The data were used to assess the variation in bud burst and flowering time across locations, seasons and cultivars. • Average chill days showed a good year in 2050 will be equivalent of a bad year at present. The greatest declines will be in Applethorpe and Manjimup (with greater than 20% decline in chill days), with Huonville and Orange having the smallest declines (with less than 15% of a reduction in chill days).

	• The chill-overlap model for Cripps Pink was used to predict changes in flowering times. 2030 flowering times are in line with current flowering times, but there are differences for 2050 flowering times. At all locations apart from Orange, the model predicted later full bloom flowering times. • The project suggested options for adaptation in managing climate change. The project recommended that more detailed monitoring and recording of green tips be undertaken to identify cultivars that are performing well in the local climate. The records could be used to track the timing of flowering. • The project recognised that a change in thinning practices may need to take place due to irregular and protracted flowering in the future. • There were project site trials in three growing regions in Western Australia, Victoria, and Queensland. • Also, the project conducted netting trials in Western Australia. • The project carried out feedback on the research and extension activities with APAL staff and apple growers. In 2015 at a workshop in Bilpin, 100% of 12 growers said that the workshop was useful and will attend similar workshops in the future. • In 2014 and 2015 grower workshops were conducted covering o Climate change impacts o Climate change adoption o Risk mitigation strategies • The project produced several industry and grower publications and reports. • The project identified that there were confusions around the terms winter chill and chilling in relation to climate change impacts on winter chill and flowering. As a result, a "winter chill and growing degree day" website was developed to help inform growers of better management strategies for low winter chill years.; the existence of the website was communicated to growers. • The website received 987 hits from 2014 to 2016.
Outcomes	The outcomes driven by the project included: • The tool developed by the project will reduce confusion around chilling, and winter chill requirements, therefore improving grower information for improved management in the future. • There may be a change in certain apple crops being grown to adjust for future conditions, with predicted lower chill days in non-cold years. • Lower risk that apple growers will be affected by climate change than without the project. • Improved and more detailed climate forecasting is planned to take place because of the project.
Impacts	The most important impacts provided by the project investment were: • Some contribution to improved preparedness and adaptation of pome fruit management in future with associated avoidance of some fruit quality and quantity reduction. • A small contribution to useful management information yet to be generated from the priorities and recommendations emanating from the AP12029 investment. • Improved profitability due to increased preparedness for climate mitigation action

Project Investment

Nominal Investment

Table 2 shows the annual investment made in Project AP12029 by Hort Innovation and the three State Government Departments involved in the project. As only the total investment over all years was available for the State Departments, the proportion of funding for each year for the Hort Innovation investment was used to apportion the total State Department funding for individual years.

Table 2: Annual Investment in Project AP12029 (nominal $)

Year ended 30 June	HORT INNOVATION ($)	HORT INNOVATION (%)	OTHER DAF (QLD), DEDJTR (VIC), DAFWA (WA) ($)	TOTAL ($)
2013	163,400	27.87	155,631	319,031
2014	140,502	23.96	133,797	274,299
2015	144,632	24.67	137,762	282,394
2016	21,318	3.64	20,326	41,644
2017	116,463	19.86	110,902	227,365
Total	**586,315**	**558,418**	**558,418**	**1,144,733**

Source: Project Schedule

Program Management Costs

For the Hort Innovation investment the cost of managing the Hort Innovation funding was added to the Hort Innovation contribution for the project via a management cost multiplier (1.162). This multiplier was estimated based on the share of 'payments to suppliers and employees' in total Hort Innovation expenditure (3-year average) reported in the Hort Innovation's Statement of Cash Flows (Hort Innovation Annual Report, various years). This multiplier was then applied to the nominal investment by Hort Innovation shown in Table 2.

Management and other investment costs by the three Government Departments were assumed to be already included in Table 2.

Real Investment and Extension Costs

For purposes of the investment analysis, the investment costs of all parties were expressed in 2017/18 dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2018). No additional costs of extension were included as the project itself included State Departments and was extension oriented. Also, the project involved and maintained communication channels with a number of other apple and pear R&D projects as well as apple and pear growers.

Impacts

Table 3 provides a summary of the principal types of impacts delivered by the project, based on the logical framework. Impacts have been categorised into economic, environmental and social impacts.

Table 3: Triple Bottom Line Categories of Principal Impacts from Project AP12029

Economic	• Some contribution to improved preparedness and adaptation of pome fruit management in future with associated avoidance of some fruit quality and quantity reduction. • A small contribution to useful management information yet to be generated from the priorities and recommendations emanating from the AP12029 investment.
Environmental	• Nil
Social	• Improved profitability of growers of apples and pears in the climate change future will increase or protect current spillovers to regional areas where apples and pears are produced and distributed.

Public versus Private Impacts

The impacts identified from the investment are predominantly private impacts accruing to apple and pear growers. However, some public benefits also could be produced in the form of spillovers to regional communities from enhanced incomes of growers and others along the supply chain.

Distribution of Private Impacts

The private impacts will have been distributed between apple and pear growers and the businesses along product supply chains,

Impacts on Other Australian Industries

It is likely that most impacts will be confined to the Australian apple and pear industry.

Impacts Overseas

It is unlikely that there will be any significant spillover impacts to overseas interests

Match with National Priorities

The Australian Government's Science and Research Priorities and Rural RD&E priorities are reproduced in Table 4. The project outcomes and related impacts will contribute primarily to Rural RD&E Priority 1 and 4, and to Science and Research Priority 1.

Table 4: Australian Government Research Priorities

Australian Government	
Rural RD&E Priorities (est. 2015)	**Science and Research Priorities (est. 2015)**
1. Advanced technology 2. Biosecurity 3. Soil, water and managing natural resources 4. Adoption of R&D	1. Food 2. Soil and Water 3. Transport 4. Cybersecurity 5. Energy and Resources 6. Manufacturing 7. Environmental Change 8. Health

Sources: (DAWR, 2015) and (OCS, 2015)

Alignment with the Apple and Pear Strategic Investment Plan 2017-2021

The strategic outcomes and strategies of the apple and pear industry are outlined the Apple and Pear Strategic Investment Plan 2017-2021[1] (Hort Innovation, 2017). Project AP12029 addressed Outcome 3, Strategy 3.1 and 3.4.

Valuation of Impacts

Impacts Valued

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions, particularly when some uncertainty was involved. Sensitivity analyses were undertaken for those variables where there was greatest uncertainty or for those that were identified as key drivers of the investment criteria.

The impact that was valued was the Project AP12029 contribution to improved adaptation of pome fruit management in future. The improved adaptation was assumed to be delivered in the form of growers avoiding some losses of fruit from using information from Project AP12029, but more importantly, from a small contribution to useful management information yet to be generated from the priorities and recommendations emanating from this investment.

Impacts Not Valued

Not all of the impacts identified in Table 3 could be valued in the assessment. Those not valued included:

- Increased regional community spillovers.

This impact was not valued largely due to lack of data to support credible assumptions.

Summary of Assumptions

A summary of the key assumptions made for valuation of impacts of investment in project AP12029 is provided in Table 5.

Table 5: Summary of Assumptions for Impact Valuation for AP12029

Variable	Assumption	Source/Comment
General assumptions		
Farm gate value (FGV) of Australian apples	$418.3 million in 2017/18	ABS (2019)
Farm FGV of Australian pears	$80.2 million in 2017/18	
FGV of Australian apples and pears	$498.5 million in 2017/18	418.3+ 80.2
Estimate of farm profit of apple and pear growers (includes impact of Technical Manager)	15% of FGV	Conservative analyst assumption. Based on average net orchard profits (before tax) of $0.20 per gross kg of production. 0.20/1.05 = ~19.0% reduced for tax (AgFirst, 2017)
Estimate of current profits of Australian apples and pear growers	$74.8 million	15% x $498.5 million
Impact: Future loss of profits with climate change		
First year of loss in FGV due to climate change with no adaptation by growers	2031	Agtrans Research
Year when maximum loss experienced	2040	
Proportion of industry affected in some way	100%	
Average maximum loss in FGV without	30% per annum	

[1] For further information, see: https://www.horticulture.com.au/hort-innovation/funding-consultation-and-investing/investment-documents/strategic-investment-plans/

adaptation (both yield and quality losses)		
Maximum loss in FGV without adaptation	$149.6 million per annum	30% of $498.5 m
Proportion of climate change impact avoided due to adaptation management	40%	Agtrans Research
Maximum loss of profits avoided	$4.49 m per annum	149.6 x 40% x 7.5%
Cost to growers of climate change adaptation	10% of gain made (cost of impact avoided)	Agtrans Research
Maximum net loss of profits avoided due to adaptation management	$4.03 m per annum	$4.49 x 0.90
Attribution of gains to Project AP12029	20%	Agtrans Research assumption; other future projects are expected to contribute significantly more to adaptation than AP12029
Risk factors		
Probability of outcome (further information for growers developed and made available)	75%	Agtrans Research
Probability of impact (assuming successful management outcome)	75%	Agtrans Research
Counterfactual		
If Project AP12029 had not been funded it is assumed that, while some improvement in adaptation management would have eventuated, it would have occurred later and may have been less comprehensive in its coverage of issues. The attribution factor included in the assumptions above broadly allows for this counterfactual situation.		

Results

All costs and benefits were discounted to 2018/19 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the Modified Internal Rate of Return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the project investment period plus 30 years from the last year of investment (2017/18) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

Tables 6 and 7 show the investment criteria estimated for different periods of benefits for the total investment and the Hort Innovation investment alone.

Table 6: Investment Criteria for Total Investment in Project AP12029

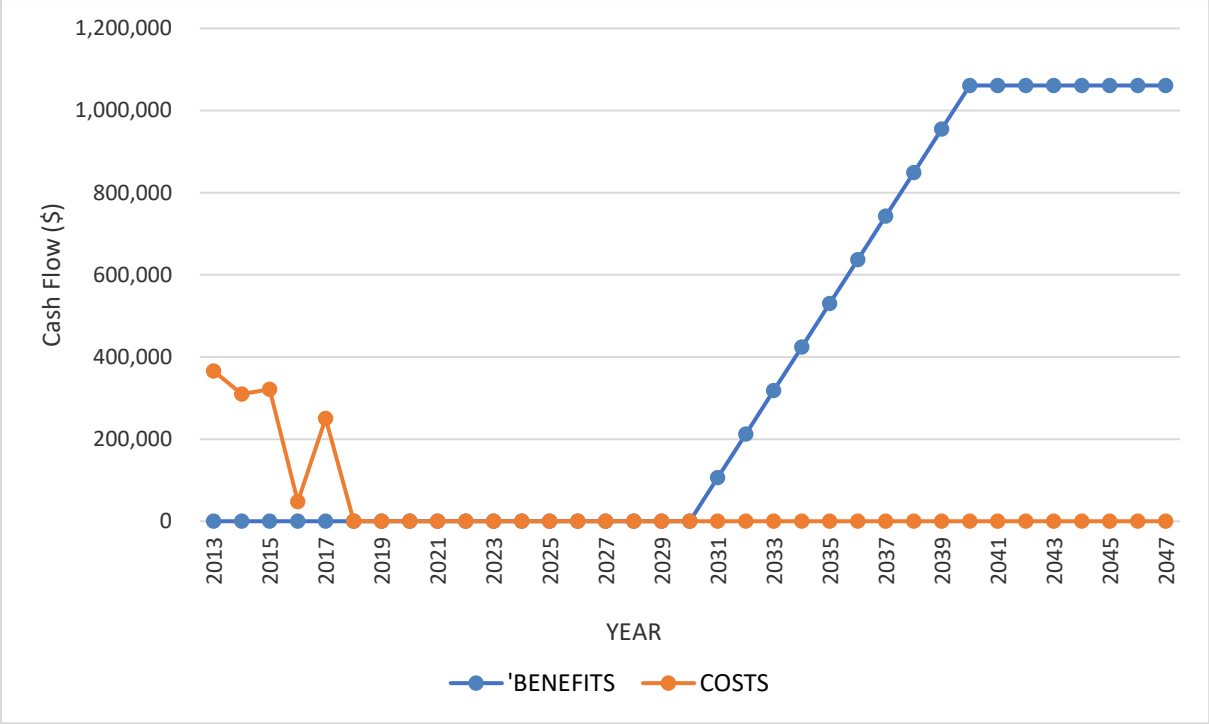
Investment Criteria	**Years after Last Year of Investment**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present Value of Benefits ($m)	0.00	0.00	0.00	0.17	1.37	3.15	4.65
Present Value of Costs ($m)	1.61	1.61	1.61	1.61	1.61	1.61	1.61
Net Present Value ($m)	-1.61	-1.61	-1.61	-1.44	-0.24	1.54	3.04
Benefit-Cost Ratio	0.00	0.00	0.00	0.11	0.85	1.96	2.89
Internal Rate of Return (%)	negative	negative	negative	negative	4.2	8.1	9.5
MIRR (%)	negative	negative	negative	negative	4.1	8.1	9.1

Table 7: Investment Criteria for Hort Innovation Investment in Project AP12029

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits ($m)	0.00	0.00	0.00	0.09	0.75	1.73	2.55
Present Value of Costs ($m)	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Net Present Value ($m)	-0.88	-0.88	-0.88	-0.79	-0.13	0.85	1.67
Benefit-Cost Ratio	0.00	0.00	0.00	0.11	0.85	1.96	2.89
Internal Rate of Return (%)	negative	negative	negative	negative	4.2	8.1	9.5
MIRR (%)	negative	negative	negative	negative	4.1	8.1	9.1

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the AP12029 investment plus 30 years from the last year of investment are shown in Figure 1.

Figure 1: Annual Cash Flow of Undiscounted Total Benefits and Total Investment Costs



Sensitivity Analyses

A sensitivity analysis was carried out on the discount rate. The analysis was performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values. Table 8 present the results. The results in Table 9 show a high sensitivity to the discount rate due to the long period of years before significant benefits accrue to growers.

Table 8: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	Discount rate		
	0%	5% (base)	10%
Present Value of Benefits ($m)	13.26	4.65	1.78
Present Value of Costs ($m)	1.30	1.61	1.98
Net Present Value ($m)	11.97	3.04	-0.21
Benefit-cost ratio	10.24	2.89	0.90

A sensitivity analysis was then undertaken for the proportion of losses saved that could be ascribed to Project AP12029 (the attribution factor). Results are provided in Table 9. The breakeven attribution factor, given all other assumptions remaining unchanged, was 14% to Project AP12029.

Table 9: Sensitivity to Assumed Attribution of Losses Avoided due to Project AP12029
(Total investment, 30 years)

Investment Criteria	**Proportion of Losses Avoided through AP12029**		
	20%	**40% (base)**	**60%**
Present Value of Benefits ($m)	2.32	4.65	6.97
Present Value of Costs ($m)	1.61	1.61	1.61
Net Present Value ($m)	0.72	3.04	5.36
Benefit-cost ratio	1.45	2.89	4.34

Confidence Rating

The results produced are highly dependent on the assumptions made, some 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 uncertainties in assumptions made

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

Table 10: Confidence in Analysis of Project

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

Coverage of benefits valued was assessed as only medium due to only one impact being valued and the impact only affecting apple and pear growers in terms of adaption to climate change. Confidence in assumptions was rated as medium-low, as the key driving assumption are based on different future climate scenarios and growers decisions to respond to climate change.

Conclusion

The investment in AP12029 is likely to contribute significantly to the preparedness of pome fruit growers to climate change. The project will lead to growers adopting new varieties and other preparation methods in the face of climate change because of the project.

Total funding from all sources for the project was $1.61 million (present value terms). The investment produced estimated total expected benefits of $4.65 million (present value terms). This gave a net present value of $3.04 million, an estimated benefit-cost ratio of 2.89 to 1, an internal rate of return of 9.5% and a modified internal rate of return of 9.1%.

As several economic and social impacts identified were not valued, the investment criteria estimated by the evaluation may be underestimates of the actual performance of the investment.

Glossary of Economic Terms

Cost-benefit analysis:	A conceptual framework for the economic evaluation of projects and programs in the public sector. It differs from a financial appraisal or evaluation in that it considers all gains (benefits) and losses (costs), regardless of to whom they accrue.
Benefit-cost ratio:	The ratio of the present value of investment benefits to the present value of investment costs.
Discounting:	The process of relating the costs and benefits of an investment to a base year using a stated discount rate.
Internal rate of return:	The discount rate at which an investment has a net present value of zero, i.e. where present value of benefits = present value of costs.
Investment criteria:	Measures of the economic worth of an investment such as Net Present Value, Benefit-Cost Ratio, and Internal Rate of Return.
Modified internal rate of return:	The internal rate of return of an investment that is modified so that the cash inflows from an investment are re-invested at the rate of the cost of capital (the re-investment rate).
Net present value:	The discounted value of the benefits of an investment less the discounted value of the costs, i.e. present value of benefits - present value of costs.
Present value of benefits:	The discounted value of benefits.
Present value of costs:	The discounted value of investment costs.

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Abbreviations

AP	Apple and Pear
APAL	Apple and Pears Australia Limited
AV	Avocado
CRRDC	Council of Research and Development Corporations
DAWR	Department of Agriculture and Water Resources (Australian Government)
FGV	Farm Gate Value
MIRR	Modified Internal Rate of Return
MU	Mushroom
OCS	Office of Chief Scientist
PVB	Present Value of Benefits
R&D	Research and Development
RD&E	Research, Development and Extension
SIP	Strategic Investment Plan
TG	Table Grape