Industry-specific impact assessment program: apple and pear

Impact assessment report for projects Apple and pear industry leadership initiative (AP12034 and AP15015)

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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 the *Apple and pear industry leadership initiative (AP12034 and AP15015).* The projects were funded by Hort Innovation between May 2013 and November 2018.

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 has delivered 63 short course graduates and two scholarship recipients trained to become apple and pear industry leaders with each graduate able to provide high level managerial input into their own business, their industry and their regional community.

Investment Criteria

Total funding for the project was $0.73 million (present value terms). The investment produced estimated total expected benefits of $2.02 million (present value terms). This gave a net present value of $1.29 million, an estimated benefit-cost ratio of 2.75 to 1, an internal rate of return of 35% and a MIRR of 9%.

Conclusions

The Hort Innovation investment in projects AP12034 and AP15015 has added to the leadership capability of the apple and pear industry. Several economic and social impacts identified in the assessment were not valued in the economic analysis as the impacts were considered difficult to value due to lack of data upon which credible assumptions could be based. Hence, investment criteria provided by the valuation may be an underestimate of the actual performance of the investment.

Keywords

Impact assessment, cost-benefit analysis, apple and pear industry, leadership, training, budding leaders, scholarship, Marcus Oldham College, productivity, RD&E investment

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.

Projects AP12034 and AP15015: *Apple and Pear Leadership Initiative* were 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 (Apple and Pear Australia Limited (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 S.A.R.

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.

Rational

The Apple and Pear Industry Strategic Plan, New Horizons 2015 highlighted the urgency with which change was needed in the industry. A rapid response was required to respond to domestic and export market challenges and to improve industry communication and capability. To achieve this, the plan identified the need for the industry to improve motivation, communication and knowledge transfer to individual growers and the consequent development of leadership and skills competency.

The plan noted that the involvement of tertiary training institutions was important in encouraging people to engage with the apple and pear industry. Projects AP12035 and AP15015 have adopted that sentiment to fill a gap in the industry's leadership portfolio created by the windup of the Australian Fresh Fruit Company (AFFCO). The Young Leaders Retreat and previous courses run by AFFCO were highly regarded by participants and a number of graduates have gone on to undertake greater leadership roles in their businesses or the industry.

Project AP15015 was a continuation of AP12034 following a review of project management arrangements.

Project Details

Summary

Project Codes: AP12034 and AP15015

Title: *Apple and pear industry leadership initiative*

Research Organisations: APAL (2013-2016) and Marcus Oldham College (2017-2018)

Project Leaders: Annie Farrow (2013-2016), Tony McMeel (2016-2018)

Period of Funding: May 2013 to March 2016 and March 2016 to November 2018

Objectives

The objectives of project AP12034 and AP15015 were to:

- Invest in leadership and people development
- Lift the level of leadership and skills present in the industry across the supply chain
- Create graduates capable of leading their business, industry and community
- Create graduates able to represent their colleagues in decision-making forums
- Create graduates able to address issues facing rural industries and communities.

Logical Framework

Table 1 provides a detailed description of both projects in a logical framework.

Table 1: Logical Framework for Project AP12034 and AP15015

Activities and Outputs	• The apple and pear industry leadership initiative consisted of two independent parts: (1) a short term (five day) intensive course (2) an APAL New Horizons Scholarship. • The short course was aimed at equipping budding industry leaders with practical skills in leadership and management matched with confidence building exercises. A commitment from participants to undertake a specific change project applicable to their business or industry was also required. The course was made available to growers and supply chain participants in the apple, pear, nashi, summerfruit and cherry industries. Funding was not sought from non-apple / pear industries in recognition of some apple/pear orchardists also growing these crops. • The APAL New Horizons Scholarship provided a $10,000 scholarship towards the cost of a Diploma of Agribusiness or year 1 of an Associate or Bachelor degree in Agribusiness. • APAL and Marcus Oldham College jointly developed the content for the short course and the requirements of the scholarship program. All training was delivered by Marcus Oldham College. • Participants funded their attendance at the course but were subsidised part of the cost by the project. Scholarships covered part of a single year's tuition and accommodation costs. • Attendees and scholars were identified through direct approaches to prospective candidates, via high schools in growing areas, industry websites, industry networks (including APAL events) and publications including Australian Fruit Grower Magazine and 'The Juice' magazine. • Successful applicants needed to demonstrate a passion for the apple and pear industry and must intend to work within the industry upon completing their short course or diploma/degree. • The first set of 21 industry leaders was trained in July 2013. Graduates included 8 females and 13 males and consisted of 12 apple/pear growers, one agronomist, four chemical company representatives, two industry organisation and two RD&E staff. • 21 potential leaders were trained in July 2014 in the second intake – 9 apple/pear growers, 9 apple/pear supply chain participants, 2 cherry growers, a blueberry grower and a cider producer • A further 21 potential industry leaders completed the course in July 2015 intake – 18 apple/pear growers and one from each of the supply chain, industry association and government. • Training included informal interactive sessions, conventional teaching sessions, group

	activities and challenges, guest speakers, tour of production areas and other adult learning opportunities. • All graduates viewed the training as extremely valuable with positive implications for their apple / pear businesses, the apple/pear industry and their communities. • The greatest insights participants gained from the course were in relation to negotiation, communication, public speaking, self-awareness, an understanding of personal strengths and conflict management. • A Future Horizons Scholarships was not awarded in 2014 due to the absence of a suitable candidate. The first scholarship was awarded in 2015 to an apple grower from Tasmania who completed a two-year Bachelor of Agribusiness. In 2017, a second apple grower from Tasmania received a scholarship to complete a Bachelor of Agribusiness. In 2018, Marcus Oldham College was unable to identify a final scholarship recipient and funding was used to support the second Bachelor of Agribusiness student for a further year. • All graduates were supported with follow up contract from Marcus Oldham College and membership of the Deciduous Tree Fruits Graduate Leadership network (renamed the 'Fresh Fruit Network'). The network is managed by APAL. • Scholarship recipients provided articles for Australian Fruit Grower Magazine, presented at the industry's conference and attended at least one Future Orchard Walk.
Outcomes	• A total of 63 short course graduates and 2 scholarship recipients trained to become apple and pear industry leaders with each graduate able to provide high level managerial input into their own business, their industry and their regional community.
Impacts	• Businesses that are more profitable (lower cost of production) with graduate managerial input. • Industry making better decisions – improved allocation of R&D and marketing resources. • Industry spillovers – individuals with leadership training taking up positions in other industries. • Community spillover – individuals with leadership training that are more able and willing to contribute to community initiatives in regional Australia. • Environmental spillover – leadership training included environmental management and sustainability and is likely to result in improved environmental outcomes.

Project Investment

Nominal Investment

Table 2 shows the annual investment made in Project AP12034 and AP15015 by Hort Innovation. No other organisations contributed funding to the projects.

Table 2: Annual Investment in Project AP12034 and AP15015 (nominal $)

Year ended 30 June	HORT INNOVATION ($)	TOTAL ($)
2013	130,000	130,000
2014	28,682	28,682
2015	163,443	163,443
2016	148,346	148,346
2017	0	0
2018	10,000	10,000
2019	10,000	10,000
Total	**490,471**	**490,471**

Program Management Costs

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). This information was 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.

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, 2019). No additional costs of extension were included as the project itself was extension oriented and involved the training of future industry leaders.

Impacts

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

Table 3: Triple Bottom Line Categories of Principal Impacts from Project AP12034 and AP15015

Economic	• Businesses that are more profitable (lower production cost) with graduate managerial input. • Industry making better decisions – improved allocation of R&D and marketing resources.
Environmental	• Environmental spillover – leadership training included environmental management and sustainability and is likely to result in improved environmental outcomes.
Social	• Industry spillovers – graduates taking up positions in other industries. • Community spillover – individuals with leadership training that are more able and willing to contribute to community initiatives in regional Australia.

Public versus Private Impacts

The impacts identified from the investment are both private and public in nature. Graduates of the apple and pear industry leadership initiative will have new skills in management that are directly applicable to their business whether they are growers or involved in the industry's supply chain. However, graduates will also have developed skills relevant to industry and community decision making that will create positive impacts for the Australian community. These positive public impacts are especially likely in regional communities where organisations and institutions may otherwise rely on a limited pool of leaders.

Distribution of Private Impacts

The impacts on the apple and pear industries from investment in leadership will be shared along the supply chain with growers and supply chain partners directly benefiting via superior enterprise management. To the extent that superior farm business management results in additional profit, this profit will also be shared along the supply chain depending on both short and long term supply and demand elasticities in both the domestic and export apple and pear markets.

Impacts on Other Australian Industries

Impacts will be realised in other tree crop industries that contributed students to the apple and pear leadership initiative. These include the nashi, summerfruit, cherry and blueberry industries.

Impacts Overseas

Some impacts overseas are possible. Graduates may find themselves working in overseas apple and pear industries or part of an Australian apple and pear export program as a result of their training.

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 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 AP12034 and AP15015 addressed Outcome 3, Strategy 3.7.

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.

Two impacts were valued:

Impact 1: More profitable (lower production cost) apple/pear growing businesses with graduate managerial input
Impact 2: Increased efficiency of R&D and marketing investment with graduates contributing to industry decision making

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

Impacts Not Valued

Not all of the impacts identified in Table 3 could be valued in the assessment. Three impacts were hard to value due to a lack of data, difficulty in quantifying the causal relationship and pathway between AP12034 / AP15015 and the impact and the complexity of assigning monetary values to the impact.

The impacts identified but not valued were:

- Environmental spillover – leadership training included environmental management and sustainability and is likely to result in improved environmental outcomes.
- Industry spillovers – graduates take up positions in other industries.
- Community spillover – individuals with leadership training that are more able and willing to contribute to community initiatives in regional Australia.

Valuation of impact 1: More profitable (lower production cost) apple/pear growing businesses with graduate managerial input

The outcomes and impacts from the two leadership projects were not highly targeted at specific technology or practice changes and it is therefore difficult to place quantitative values on these impacts. However, with this said, it is likely that leadership training graduates returning to the orchard will be in a position to make better business decisions than those who do not receive training. The approach taken in this analysis of using a generic cost reduction seeks to take account of the diverse range of potential on farm impacts. Often when an impact relates to a yield increase, it is converted to a cost reduction for the purposes of cost-benefit analysis. That is, if a higher yield is achieved, then the unit cost per tonne of production may well have decreased. Likewise with improvements to risk management, capital costs may well increase but in the long-run average annual production costs may decrease.

Valuation of impact 2: Increased efficiency of R&D and marketing investment with graduates contributing to industry decision making

Leadership training will benefit the Australian apple and pear industry in a number of ways including capacity to shape favourable policy outcomes, more integrated, efficient and profitable supply chains and better allocation of R&D and marketing resources. In this analysis, industry benefit is quantified as an efficiency dividend in the management of the Hort Innovation apple and pear R&D and marketing program through more capable industry contributions including industry leadership initiative graduates contributing superior research proposals and a number of graduates contributing to research/marketing levy management through the Strategic Investment Advisory Panel.

Attribution

All students were required to contribute funding to either their short course or their degree qualification. Students also incurred out of pocket expenses and forfeited income during their training period. Estimates of the relative share of funding provided by the projects compared to total training cost are shown in Table 5.

Table 5: Project and Student Contribution to Leadership Training

Course Type	No. Students	Fees paid by Projects ($/student)	Fees paid by Student ($/student)	Student Costs ($/student)#	Project Contribution ($)	Student Fee Contribution	Total Training Cost ($)
Short course	63	$3,650	$1,500	$1,500	$229,950	$189,000	$418,950
B. Agribusiness 1	1	$10,000	$78,200	$80,000	$10,000	$158,200	$168,200
B. Agribusiness 2	1	$20,000	$68,200	$80,000	$20,000	$148,200	$168,200
Total	65				$259,950		$755,350

Income foregone plus out of pocket expenses

The projects were estimated to contribute around 34% ($259,950 / $755,350) of the total benefits to business cost savings and increased industry efficiencies quantified in this analysis.

Counterfactual

If these projects had not been funded the gap in apple and pear industry leadership training would have persisted and there would be a continued shortage of capacity in business and industry.

Summary of Assumptions

A summary of the key assumptions made for valuation of the two impacts of Project AP12034 and AP15015 is provided in Table 6.

Table 6: Summary of Assumptions for Impact Valuation

Variable	Assumption	Source/Comment
Impact 1: More profitable (lower production cost) apple/pear growing businesses with graduate managerial input		
Total apple and pear tonnage.	398,934 tonnes	Three year average of 297,128 tonnes for apples and 101,806 tonnes for pears (ABS).
Share of industry production benefiting from leadership training.	11.5%	65 leadership initiative graduates each assumed to have equal responsibility in apple and pear production (noting that trained agronomists will have more influence while some graduates will not work on farm). There are 563 apple and pear growing enterprises in the Australian industry (Hort Innovation 2016).
Production cost per tonne for apples and pears.	$1,326 per tonne	AgFirst 2017.
Cost reduction attributable to leadership training.	2%	Analyst estimate after review of AgFirst (2017) and noting the contribution to cost structure / enterprise profitability made by superior farm management.
Year of first benefit	2015	Two years after the first students graduate and changes made to the apple/pear enterprise are realised as cost savings.
Years to reach maximum benefits	5 years	Time is required for changes made to 'pay dividends'.
Period of maximum benefits	5 years	Leaders move to alternative roles.
Year of final benefit	5 years after last year of maximum benefit.	Leaders move to alternative roles.
Probability of impact	50%	It is not guaranteed that improved leadership will reduce production cost.
Attribution of benefits to these projects.	34%	See above.
Counterfactual	100%	See above.
Impact 2: Increased efficiency of R&D and marketing investment with graduates contributing to industry decision making		
Apple and pear industry spend on R&D and marketing.	$5,915,341 per year.	Hort Innovation (2019a)

R&D and marketing spend efficiency dividend from contribution made by leadership graduates.	5%	Analyst assumption.
Year of first benefit, maximum benefit and final benefit.	As per Impact 1.	See above.
Probability of impact	50%	It is not guaranteed that improved leadership will result in increased efficiency of R&D and marketing investment.
Attribution of benefits to these projects.	34%	See above.
Counterfactual	100%	See above.

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 (2018/19) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

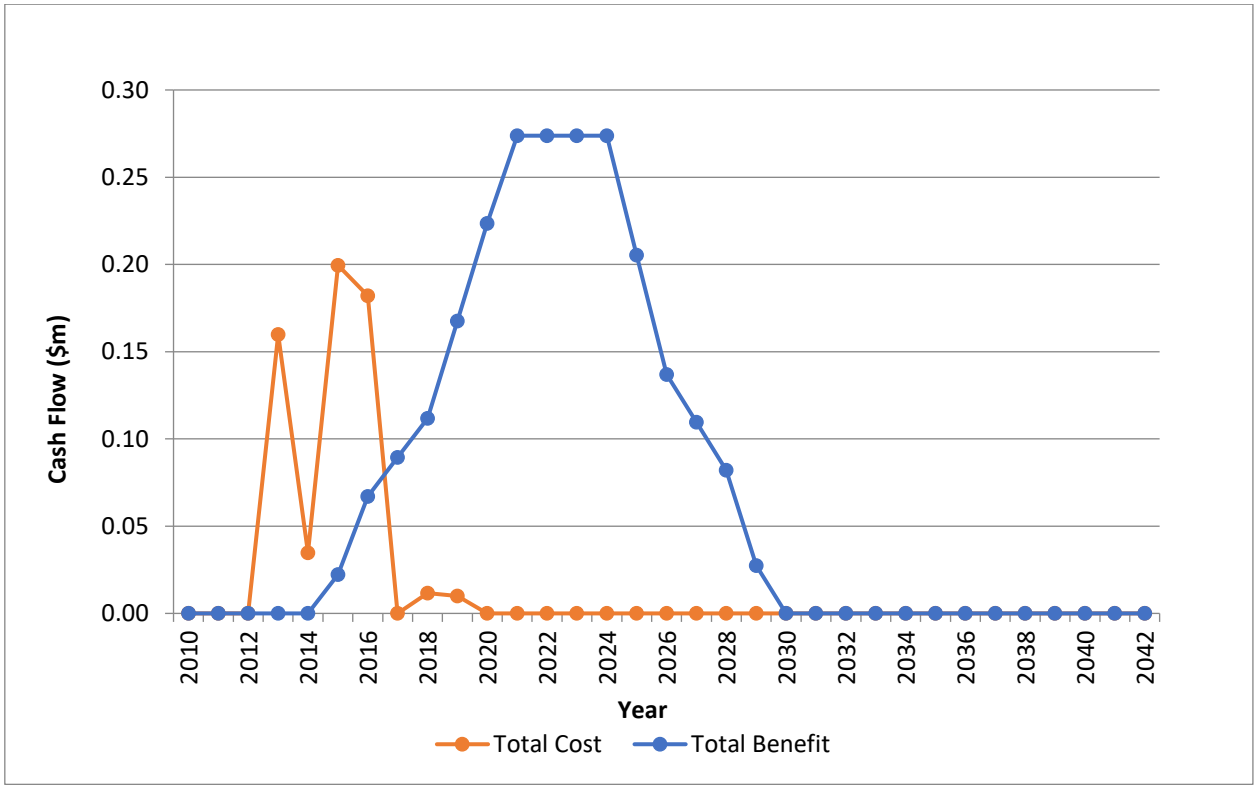
Table 7 shows the investment criteria estimated for different periods of benefits for the total investment. The investment criteria for Hort Innovation investment are the same as for total investment as Hort Innovation was the only investor.

Table 7: Investment Criteria for Total Investment in Project AP12034 and AP15015

Investment Criteria	**Years after Last Year of Investment**						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present Value of Benefits ($m)	0.49	1.63	2.02	2.02	2.02	2.02	2.02
Present Value of Costs ($m)	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Net Present Value ($m)	-0.25	0.89	1.29	1.29	1.29	1.29	1.29
Benefit-Cost Ratio	0.67	2.21	2.75	2.75	2.75	2.75	2.75
Internal Rate of Return (%)	negative	negative	34.5	34.5	34.5	34.5	34.5
MIRR (%)	negative	negative	15.5	12.3	10.6	9.6	8.8

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the AP12034 and AP15015 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



Contribution to Total Benefits

Table 8 shows the contribution of each impact to the total Present Value of Benefits (PVB). Table 9 shows that, if only the more profitable business impact was delivered, the value of that impact alone would have covered the Present Value of Investment Costs (PVC) of $0.73m.

Table 8: Contribution of Benefits by Source

Impact	**PVB ($m)**	**% of Total PBV**
Impact 1: More profitable (lower production cost) apple/pear growing businesses	1.78	88%
Impact 2: Increased efficiency of R&D and marketing investment	0.24	12%
Total	2.02	100.0%

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 9 present the results. The results show a moderate sensitivity to the discount rate.

Table 9: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	**Discount rate**		
	0%	**5% (base)**	**10%**
Present Value of Benefits ($m)	2.34	2.02	1.80
Present Value of Costs ($m)	0.60	0.73	0.90
Net Present Value ($m)	1.74	1.29	0.90
Benefit-cost ratio	3.91	2.75	2.00

A sensitivity analysis was undertaken for the production cost saving attributable to apple/pear grower leadership training. Even if assumed cost saving is as low as 1%, the project produces a positive return on investment – Table 10.

Table 10: Sensitivity to Assumed Grower Cost Saving
(Total investment, 30 years)

Investment Criteria	Decrease in Production Cost		
	1%	2% (base)	4%
Present Value of Benefits ($m)	1.13	2.02	3.80
Present Value of Costs ($m)	0.73	0.73	0.73
Net Present Value ($m)	0.40	1.29	3.07
Benefit-cost ratio	1.54	2.75	5.17

A final sensitivity test examined the efficiency dividend for the industry's R&D and Marketing program. An efficiency dividend as low as 2.5% has little impact on overall investment returns – Table 11.

Table 11: Sensitivity to Assumed R&D and Marketing Efficiency Dividend
(Total investment, 30 years)

Investment Criteria	Increase in Investment Efficiency		
	2.5%	5% (base)	10%
Present Value of Benefits ($m)	1.90	2.02	2.26
Present Value of Costs ($m)	0.73	0.73	0.73
Net Present Value ($m)	1.17	1.29	1.53
Benefit-cost ratio	2.59	2.75	3.08

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 12). 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 12: Confidence in Analysis of Project

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

Coverage of benefits valued was assessed as Medium-High due to the prominence of impacts valued. Confidence in assumptions was rated as medium-low, as the key driving assumption of the benefits valued were not well-supported by specific evidence.

Conclusion

The investment in AP12034 and AP15015 is likely to contribute positively to managerial decision making on the graduates own orchards and efficiencies in the management of industry R&D and marketing funds.

Total funding for the project was $0.73 million (present value terms). The investment produced estimated total expected benefits of $2.02 million (present value terms). This gave a net present value of $1.29 million, an estimated benefit-cost ratio of 2.75 to 1, an internal rate of return of 34.5% and a modified internal rate of return of 8.8%.

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

ABS	Australian Bureau of Statistics
APAL	Apple and Pears Australia Limited
CRRDC	Council of Research and Development Corporations
DAWR	Department of Agriculture and Water Resources (Australian Government)
GDP	Gross Domestic Product
GVP	Gross Value of Production
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
OCS	Office of Chief Scientist Queensland
PVB	Present Value of Benefits
RD&E	Research, Development and Extension
SIP	Strategic Investment Plan
SIAP	Strategic Investment Advisory Panel