Industry-specific impact assessment program: table grape

Impact assessment report for project *Co-management of the Greater Sunraysia Pest Free Area for market access* (MT12052)

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Project code:

MT18009

Date:

30 September 2019

Funding statement:

This project has been funded by Hort Innovation, using research and development levies and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Publishing details:

Published and distributed by: Hort Innovation

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Contents

Tables

Figures

Executive Summary

What the report is about

This report presents the results of an impact assessment of a Horticulture Innovation Australia Limited (Hort Innovation) investment in *MT12052: Co-management of the Greater Sunraysia Pest Free Area for market access.* The project was funded by Hort Innovation over the period June 2013 to May 2016.

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 has enabled fruit industries to co-manage Queensland fruit fly (Qfly) control and eradication activities in the Greater Sunraysia Pest Free Area and make a contribution to regaining and retaining the area's Qfly-free status. Consequently MT12052 is likely to have contributed to future pre-harvest treatment cost savings and post-harvest market access cost savings. Other potential impacts include improved fruit quality, more effective Integrated Pest Management systems, additional industry biosecurity capacity and increased income in the Sunraysia region.

Investment Criteria

Total funding from all sources for the project was $2.45 million (present value terms) with Hort Innovation investment in the project totalling $1.78 million. The investment produced estimated total expected benefits of $5.75 million (present value terms). This gave a net present value of $3.30 million, an estimated benefit-cost ratio of 2.3 to 1, an internal rate of return of 11% and a MIRR of 8%.

Conclusions

Four impacts were not valued. When inability to value all impacts is combined with conservative assumptions for the principal economic impacts valued, it is reasonable to conclude that the valuation may be an underestimate of the actual performance of the investment.

Keywords

Impact assessment, cost-benefit analysis, MT12052, table grape, pest free area, market access.

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 *MT12052: Co-management of the Greater Sunraysia Pest Free Area for market access* 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

The Australian table grape industry produces approximately 175,900 tonnes of fresh table grapes valued at $530.9 million per year at the farm gate (3 year average 2016 to 2018). Most table grapes are grown in the Sunraysia Region of Victoria. Around 60% of Australian table grapes are exported and major export markets include China, Indonesia, Japan, Hong Kong and the Philippines (Hort Innovation, 2018).

Citrus is grown commercially in all Australian mainland states. There is a large citrus industry in the Murray Valley and Sunraysia. Total production, grapefruit, lemons, limes, mandarins and oranges is approximately 726,250 tonnes valued at $739.4 million per year at the farm gate (3 year average 2016 to 2018). Around 35% of Australian citrus is exported and major markets include China, Japan, Hong Kong, Malaysia and Singapore (Hort Innovation, 2018).

Summerfruit is grown in the Sunraysia, other parts of Victoria, NSW, Queensland and Western Australia. Total production of apricots, nectarines/peaches and plums is approximately 144,800 tonnes valued at $389.6 million per year at the farm gate (3 year average 2016 to 2018). Around 12% of Australian summerfruit production is exported and major markets include China, United Arab Emirates, Singapore, Saudi Arabia and Hong Kong (Hort Innovation, 2018).
Table grape, citrus and summerfruit growers pay a levy on fruit grown in Australia. The levy is managed by Hort Innovation. Levy funds allocated to R&D are matched by the Australian Government.

Rationale

Bactrocera tryoni, Queensland fruit fly (Qfly) is native to subtropical and tropical regions of Australia and infests a limited number of native, European and Asian fruits. In the Sunraysia region citrus, table grapes, summerfruit, chillies, capsicum, strawberry and tomato are especially vulnerable to Qfly, with apples and pears vulnerable to a lesser extent. Qfly damages host fruit, reducing quality so the fruit is not marketable.

Historically, the Department of Primary Industries (DPI) Victoria implemented a state-wide management program based on the eradication of Qfly outbreaks in order to maintain area freedom in accordance with the requirements of the Code of Practice for the Management of Qfly (COP). Qfly area freedom provided fruit producers with the opportunity to access lucrative, Qfly sensitive domestic and export markets without the need for costly treatment and certification.

In 2006, Sunraysia citrus, table grape and summerfruit industries funded a project aimed at establishing a fruit fly Pest Free Area (PFA) in the region in accordance with the requirements of relevant national and international phytosanitary standards. Since that time, the Greater Sunraysia Pest Free Area has attained recognition as a PFA for Qfly in multiple export markets.

With the Sunraysia region attaining PFA status, local fruit industry groups subsequently agreed to accept broader responsibility for the overall management of the region including its strategic direction and delivery of routine Qfly operations and governance arrangements.

MT12052 delivered co-management of the PFA and dealt with a major sustained Qfly outbreak. Additional funds were required from Hort Innovation through a supplementary project (MT13056) and additional in-kind support was required from DPI Victoria to manage the Qfly outbreak and facilitate transition to industry co-management.

Project Details

Summary

Project Code: MT12052

Title: *Co-management of the Greater Sunraysia Pest Free Area for market access*

Research Organisation: Department of Primary Industries Victoria

Principal Investigator: Gary D'Arcy

Period of Funding: June 2013 to May 2016

Objectives

The objective of MT12052 was to enable fruit industries to co-manage Qfly activities in the Greater Sunraysia Pest Free Area and deliver the long-term goal of retaining the area's Qfly-free status.

MT12052 consisted of five critical sub-projects:

1. Project governance including administrative and policy arrangements supporting operational service delivery and setting strategic direction for the PFA.
2. Qfly surveillance, including the delivery of routine and response monitoring programs.
3. Qfly risk management and eradication, including targeting eradication and pest suppression activities.
4. Qfly awareness, to raise awareness of the importance of Qfly to local industry, community groups and the travelling public.
5. Qfly compliance, including targeted enforcement action, market patrols, pest control regulation and the delivery of roadblock activities.

Logical Framework

Table 2 provides a description of MT12052, Co-management of the Greater Sunraysia Pest Free Area, in a logical framework.

Table 1: Logical Framework for Project MT12052

Activities and Outputs	• Formation of an Industry Development Committee (IDC) to guide the project that included representatives from the table grape, citrus, summerfruit industries and DPI. • Preparation of an annual operating plan that details Surveillance – deployment and maintenance of permanent traps across production, non-production and urban areas; Outbreak management – undertaken in response to detection of 1 gravid female or 5 male Qfly within 1 km over 14 days or the detection of infested fruit; Compliance – accessing refused sites, correct use of control chemicals, liaison with property owners adjacent to suspension zones, compliance with control orders, issuing of permits for movement of Qfly host material, managing applicable roadblocks; Governance and project reporting; Communications; and Project budgeting. • IDC liaison with DPI Victoria to garner information relevant to detection, treatment and eradication of Qfly outbreaks in the PFA. • Dealing with the PFA under pressure, in June 2014 the PFA had 31 declared Qfly outbreaks. The management committee responded to the outbreaks by appointing a technical subcommittee to further develop pest eradication measures. Subsequently the technical subcommittee endorsed the 2014 response plan prepared by DPI Victoria. DPI delivered the program under the guidance of the technical committee. • The response plan's objectives were to deliver COP compliant baiting and treatment programs to ensure citrus and table grape market access, to deliver risk based pest treatment and eradication programs. • Eradication measures included baiting, stripping ripe and semi-ripe fruit from trees, enhanced surveillance, planning, record keeping and reporting. • Treatment with the aim of suppression included use of traps, fruit stripping, limited

	enhanced surveillance, planning, record keeping and reporting. • Completion of an independent mid-term review to ensure project objectives were being delivered (December 2014). • The passing into Vic/NSW law of an Industry Development Order (IDO) to ensure industry funding of the PFA through to December 2018. The IDO facilitates collection of a Qfly control levy paid by growers on cartons sold in the PFA. • Appointment of an Executive Officer to manage operation of the PFA. • Exploration of alternative treatment options to deal with 38 sustained Qfly outbreaks. Qfly numbers at unprecedented levels in the PFA (January 2015). • Management of 100 outbreaks, including 23 pending, in June 2015. Large numbers of Qfly suggest that the species has adapted to survive over winter. • The PFA experiencing unprecedented pest pressure resulting in the loss of Pest Free Area status for market access purposes. • Grower disquiet about lack of Qfly control and resistance of carton manufacturers to the payment of the PFA levy. • Design of new operating plans. Both the October 2015 and February 2016 operating plans focus on mass baiting programs, removal of host plants, awareness raising, and targeted compliance and surveillance. • Management of 124 outbreaks, including 21 pending, in February 2016. Reinstatement of the PFA for market access purposes is unlikely within the duration of the Industry Development Order which expires in December 2018. • MT12052 has delivered governance, surveillance, awareness and compliance with the Code of Practice. • Project outputs included a strategic plan for the Greater Sunraysia PFA program (also contribution to the Managing Fruit Fly in Victoria – Action Plan 2015 – 2020). • Increased capacity within industry to co-manage Qfly operations and provide input into policy directives relating to area wide management and market access programs • Various annual operational plans that address objectives, methods and resourcing requirements for each of the five sub-projects. • Situation reports reflecting seasonal developments and progress against objectives. • Annual reports incorporating evaluation and review of project progress. • Grower skills in preventing Qfly infestations on farm and how to effectively operate certification programs in the event of future emergency situations.
Outcomes	• This project has laid the foundations for Qfly control in the Greater Sunraysia region and restoration of PFA status. With restoration of PFA status growers will not need to use pre and post-harvest chemicals (or disinfestation) to control Qfly. • Development of skills in the management of both PFAs and on-farm biosecurity.
Impacts (potential)	• Cost savings – with PFA restoration, growers will save costs associated with pre and post-harvest Qfly control. Pre-harvest cost savings are relevant to summerfruit and tomato growers. Post-harvest cost savings are applicable to all fruit that host Qfly that are destined for Qfly sensitive markets. • Improved fruit quality – fruit that has not been disinfested with post-harvest chemicals (or disinfestation) has a longer shelf-life. • Integrated pest management – IPM is more viable in the absence of chemical sprays. • Biosecurity capacity – PFA management and growers have new skills in biosecurity applicable to area-wide freedom and on-farm management. • Regional income - increased income in the Sunraysia region associated with more profitable and sustainable fruit industries.

Project Investment

Nominal Investment

Table 2 shows the annual investment (cash and in-kind) in project MT12052 by Hort Innovation and others. 'Other' investors were the Murray Valley Citrus Board and the Swan Hill Summerfruit Development Association.

Table 2: Annual Investment in the Project MT12052 (nominal $)

Year ended 30 June	Hort Innovation ($)	Other ($)	Total ($)
2013	100,000	0	100,000
2014	242,000	263,735	505,735
2015	280,000	125,956	405,956
2016	582,514	130,401	712,915
Totals	1,204,514	520,092	1,724,606

NB: Total table grape industry contribution to the project was $794,514

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.

For the Murray Valley Citrus Board and the Swan Hill Summerfruit Development Association investment (other), it was assumed that program management and administration costs were already included in the nominal amounts shown in Table 2.

Real Investment and Extension Costs

For the purposes of the investment analysis, investment costs of all parties were expressed in 2017/18 dollar terms using the GDP deflator index. There were no additional costs associated with project extension. MT12052 included a comprehensive communication program.

Impacts

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

Table 3: Triple Bottom Line Categories of Principal Impacts from Project MT12052

Economic	• Cost savings – with PFA restoration, growers will save costs associated with pre and post-harvest Qfly control. Pre-harvest cost savings are relevant to summerfruit and tomato growers. Post-harvest cost savings are applicable to all fruit that host Qfly that are destined for Qfly sensitive markets. • Improved fruit quality – fruit that has not been disinfested with post-harvest chemicals (or disinfestation) has a longer shelf-life, is more in demand and may achieve higher farm-gate prices.
Environmental	• Integrated pest management – IPM is more viable in the absence of chemical sprays and IPM contributes to a reduction in the overall chemical load in the farm environment.
Social	• Biosecurity capacity – PFA management and growers have new skills in biosecurity applicable to area-wide freedom and on-farm management. • Regional income - increased income in the Sunraysia region associated with more profitable and sustainable fruit industries.

Public versus Private Impacts

Impacts identified in this evaluation are mostly private in nature. Private benefits will be realised by fruit growers that currently incur pre and post-harvest Qfly control costs. Additional private benefits will include improved fruit quality with the potential for higher farm-gate prices. Public benefits will include fewer chemicals in the environment with more effective IPM, increased capacity (PFA management and on-farm biosecurity) as well as increased income in the Sunraysia region associated with more profitable and sustainable fruit industries.

Distribution of Private Impacts

The impacts on the Sunraysia fruit growing industries from investment in this project will be shared along the supply chain with input suppliers, growers, transporters, wholesalers, retailers and exporters all sharing impacts produced by the project.

Impacts on Other Australian Industries

Impacts from this project will be relevant to fruit industries whose crops are susceptible to Qfly. These include citrus, summerfruit, table grapes, wine grapes, dried grapes, apples, pears, tomato, avocado, banana, blueberry, capsicum, strawberry and eggplant.

Impacts Overseas

Impacts overseas will include a reduced risk of a Qfly incursion as a result of accepting Australian fresh fruit exports.

Match with National Priorities

The Australian Government's Science and Research Priorities and Rural RD&E priorities are reproduced in Table 4. The project findings and related impacts will contribute to Rural DR&E Priority 2 and 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 Table Grape Strategic Investment Plan 2017-2021

The strategic outcomes and strategies of the table grape industry are outlined in the Table Grape Strategic Investment Plan 2017-2021[1] (Hort Innovation, 2016). Project MT12052 addressed Table Grape SIP Outcome 1, Strategies 1.1 and 1.2 as well as Outcome 3, Strategies 3.1 and 3.2.

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

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 – avoided pre-harvest treatment costs and avoided market access costs.

Impacts Not Valued

Not all of the impacts identified in Table 3 could be valued in the assessment. Four impacts were hard to value due to a lack of data, difficulty in quantifying the causal relationship and pathway between M12052 and the impact and the complexity of assigning monetary values to the impact.

The impacts identified but not valued were:

- Improved fruit quality when post-harvest disinfestation is no longer required.
- More effective IPM when pre-harvest sprays are no longer needed.
- Increased biosecurity capacity including PFA management and on-farm pest management skills.
- Increased income in regional Australia associated with more profitable and sustainable fruit industries.

Valuation of Impact 1: Avoided Pre-Harvest Treatment Costs

Summerfruit and tomatoes are the only host fruit that require pre-harvest treatment to avoid Qfly damage (DPI Victoria, 2010). Production estimates for these two crops in the Greater Sunraysia PFA were sourced and updated from a previous analysis of the benefits of the PFA i.e. BDA Group (2010). Production area data spanned the Victorian Mallee and NSW Murray ABS statistical subdivisions. The cost of pre-harvest treatment was estimated at $0.01/kg of fruit produced and was sourced from DPI Victoria (2010). This analysis assumes that PFA status is regained for the Greater Sunraysia 5 years after MT12052 completion.

Valuation of Impact 2: Avoided Market Access Costs

Post-harvest chemical costs (or disinfestation costs) are incurred when fruit is treated for Qfly larvae to prevent transportation of Qfly to fruit fly sensitive domestic and export markets (DPI Victoria, 2010). Avoided market access costs are applicable to a large number of crops grown in the Greater Sunraysia PFA including citrus, summerfruit, grapes (table, wine, dried), apples, pears, tomato, avocado, blueberry, capsicum, strawberry and eggplant. Once again, production estimates and share of production destined for Qfly sensitive domestic and export markets was sourced and updated from an analysis prepared by BDA Group (2010). Production area data spanned the Victorian Mallee and NSW Murray ABS statistical subdivisions. The cost of post-harvest treatment was estimated at $0.05/kg of fruit produced and was sourced from DPI Victoria (2010).

Attribution

MT12052 delivered co-management of the PFA and dealt with a major sustained Qfly outbreak in the Greater Sunraysia. Additional funds were required from HAL (now Hort Innovation) through a supplementary project, MT13056 ($900,000), and additional in-kind support was required from DPI Victoria ($172,460) to manage the Qfly outbreak. Further funding to support transition to industry management, $780,000 was provided February 2015 and $309,000 in August 2015. As a consequence of these and other investments required to restore PFA status, a modest attribution factor of 33% has been assumed.

Counterfactual

Under the counterfactual it is assumed that in the absence of co-management arrangements, the Victorian Government discontinues PFA funding and growers are forced to rely on pre and post-harvest chemicals to maintain market access. This assumed counterfactual is consistent with DPI Victoria (2010) and BDA Group (2010).

Summary of Assumptions

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

Table 5: Summary of Assumptions

Variable	Assumption	Source/Comment
Impact 1: Avoided Pre-Harvest Treatment Costs		
Summerfruit and tomato production in the Greater Sunraysia PFA.	354,000,000 kg/year	Data includes the Victorian Mallee and NSW Murray ABS statistical subdivisions and was updated from estimates prepared by DBA Group 2010.
Cost of pre-harvest treatment.	$0.01kg of fruit	DPI Victoria, 2010.
Annual probability of a Qfly outbreak once PFA status has been regained.	30%	Analyst assumption after review of BDA Group 2010.
Attribution of benefits to this project.	33%	Analyst assumption after review of BDA Group 2010.
Probability of PFA restoration	50%	Analyst assumption based on severity and extent of current Qfly outbreaks.
Counterfactual	100%	In the absence of MT12052 investment it is assumed that the Victorian Government discontinues PFA funding.
Year of first impact.	2021/22	Five years after MT12053 completion it is assumed that PFA status is regained for the Greater Sunraysia.
Impact 2: Avoided Market Access Costs		
Fruit produced in the Greater Sunraysia PFA destined for Qfly sensitive domestic and export markets.	110,900,000 kg/year	Data includes the Victorian Mallee and NSW Murray ABS statistical subdivisions and was updated from estimates prepared by DBA Group 2010.
Cost of post-harvest treatment.	$0.05kg of fruit	DPI Victoria, 2010.

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 (2015/16) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

Tables 6 and 7 show the investment criteria estimated for different periods of benefit for the total investment and the Hort Innovation investment respectively. The present value of benefits (PVB) attributable to Hort Innovation investment only, shown in Table 7, has been estimated by multiplying the total PVB by the Hort Innovation proportion of real investment (73.0%).

Table 6: Investment Criteria for Total Investment in Project MT12052

Investment Criteria	Years after Last Year of Investment						
	0	**5**	**10**	**15**	**20**	**25**	**30**
Present Value of Benefits ($m)	0	0	1.77	3.15	4.23	5.08	5.75
Present Value of Costs ($m)	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Net Present Value ($m)	-2.45	-2.45	-0.69	0.70	1.78	2.63	3.30
Benefit-Cost Ratio	0	0	0.72	1.28	1.73	2.07	2.34
Internal Rate of Return (%)	negative	negative	negative	6.8	9.5	10.6	11.2
MIRR (%)	negative	negative	0.1	6.1	7.5	7.8	7.8

Table 7: Investment Criteria for Hort Innovation Investment in Project MT12052

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits ($m)	0	0	1.29	2.30	3.09	3.71	4.20
Present Value of Costs ($m)	1.78	1.78	1.78	1.78	1.78	1.78	1.78
Net Present Value ($m)	-1.78	-1.78	-0.49	0.52	1.31	1.93	2.41
Benefit-Cost Ratio	0	0	0.72	1.29	1.73	2.08	2.35
Internal Rate of Return (%)	negative	negative	negative	6.8	9.5	10.7	11.2
MIRR (%)	negative	negative	0.2	6.2	7.5	7.8	7.8

The annual undiscounted benefit and cost cash flows for the total investment for the duration of MT12052 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

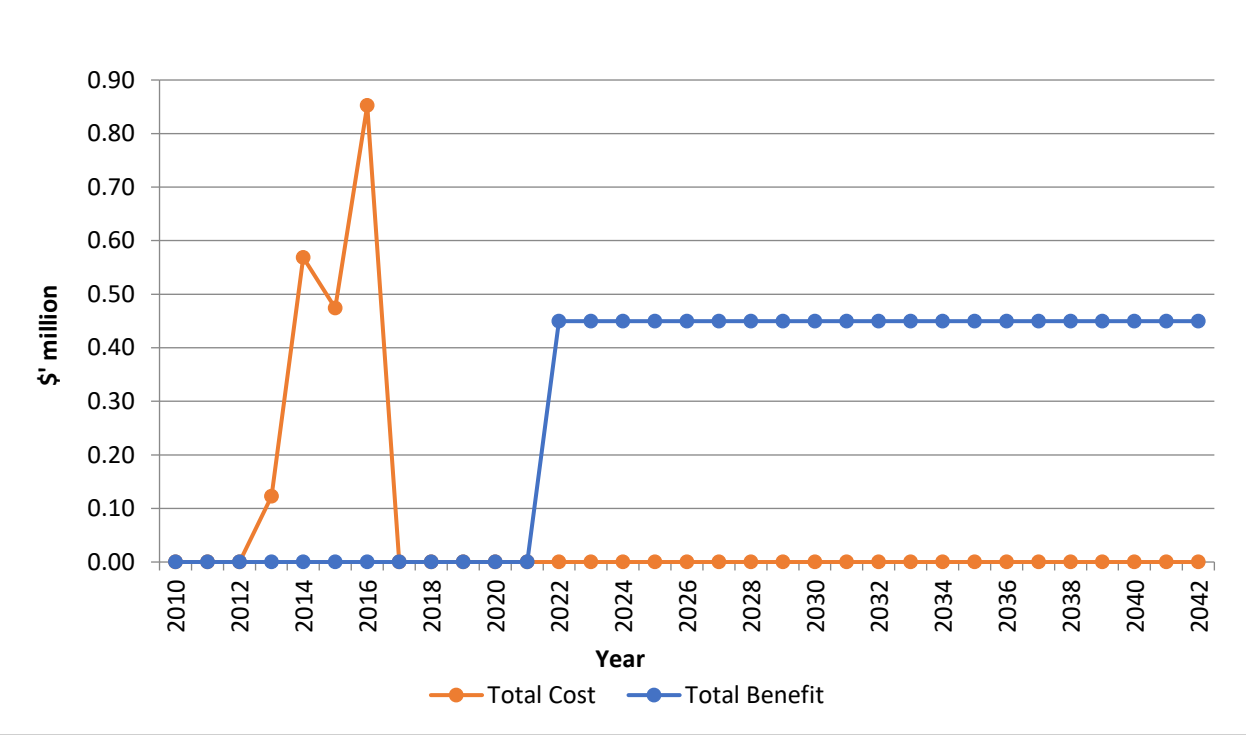

Table 8 shows the contribution of each impact to the total PVB.

Table 8: Contribution of Benefits

Impact	PVB ($M)	% of Total PVB
Impact 1: Avoided pre-harvest treatment costs	2.24	39.0
Impact 2: Market access costs	3.51	61.0
Total	5.75	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 are moderately sensitive to the discount rate.

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

Investment Criteria	**Discount rate**		
	0%	**5%**	**10%**
Present Value of Benefits ($m)	11.24	5.75	3.37
Present Value of Costs ($m)	2.02	2.45	2.96
Net Present Value ($m)	9.22	3.30	0.41
Benefit-cost ratio	5.57	2.34	1.14

A sensitivity analysis was then undertaken for the assumed cost of post-harvest fruit treatment. Even if the assumed saving in post-harvest treatment costs is as low as $0.01/kg, the project produces a positive return on investment – Table 10.

Table 10: Sensitivity to the Cost of Post-Harvest Fruit Treatment
(Total investment, 30 years)

Investment Criteria	**Post-Harvest Fruit Treatment Cost**		
	$0.01/kg	**$0.05/kg (base)**	**$0.10/kg**
Present Value of Benefits ($m)	2.94	5.75	9.26
Present Value of Costs ($m)	2.45	2.45	2.45
Net Present Value ($m)	0.49	3.30	6.80
Benefit-cost ratio	1.20	2.34	3.77

A final sensitivity test examined the assumed probability of PFA restoration. Halving assumed probability continues to deliver benefits that exceed investment cost – Table 11.

Table 11: Sensitivity to Probability of PFA Restoration
(Total investment, 30 years)

Investment Criteria	**Probability of PFA Restoration**		
	25%	**50% (base)**	**75%**
Present Value of Benefits ($m)	2.87	5.75	8.62
Present Value of Costs ($m)	2.45	2.45	2.45
Net Present Value ($m)	0.42	3.30	6.17
Benefit-cost ratio	1.17	2.34	3.51

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	High

Coverage of benefits was assessed as medium-high – the major benefits, avoided pre and post-harvest treatment costs were quantified. Other secondary benefits were not quantified.

Confidence in assumptions was rated as high. Data were mostly drawn from previous independent and comprehensive benefit cost analyses.

Conclusion

The investment has enabled fruit industries to co-manage Qfly control and eradication activities in the Greater Sunraysia Pest Free Area and make a contribution to regaining and retaining the area's Qfly-free status. Consequently MT12052 is likely to have contributed to future pre-harvest treatment cost savings and post-harvest market access cost savings. Other potential impacts include improved fruit quality, more effective IPM systems, additional industry biosecurity capacity and increased income in the Sunraysia region.

Four impacts were not valued. When inability to value all impacts is combined with conservative assumptions for the principal economic impacts valued, it is reasonable to conclude that the valuation may be an underestimate 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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Acknowledgements

with Horticulture Innovation Australia Limited that were involved in the evaluation process. Their cooperation and feedback throughout the evaluation process contributed significantly to this report.

Specific acknowledgements:
Gary D'Arcy, Manager Product Integrity, DPI Victoria

Abbreviations

ATGA	Australian Table Grape Association
COP	Code of Practice
CRRDC	Council of Research and Development Corporations
DAWR	Department of Agriculture and Water Resources (Australian Government)
DFAT	Department of Foreign Affairs and Trade
DPI	Victorian Department of Primary Industries
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GVP	Gross Value of Production
IDC	Industry Development Committee
IDO	Industry Development Order
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
OCS	Office of Chief Scientist Queensland
OHMA	Office of Horticultural Market Access
PFA	Pest Free Area
PHA	Plant Health Australia
PVB	Present Value of Benefits
RDC	Research and Development Corporation
R&D	Research and Development
RD&E	Research, Development and Extension
SIP	Strategic Investment Plan
US	United States of America