Hort Innovation

Final Report

Project title:

Horticulture Impact Assessment Program:

Appendix 8: Improving the biosecurity preparedness of Australian horticulture for the exotic Spotted Wing Drosophila (Drosophila suzukii) (MT17005 Impact Assessment)

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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 *Improving the biosecurity preparedness of Australian horticulture for the exotic Spotted Wing Drosophila (Drosophila suzukii).* The project was funded by Hort Innovation over the period June 2018 to June 2020.

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 2019/20 dollar terms and were discounted to the year 2019/20 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 MT17005 has improved Australian horticultural industry awareness of the risks and potential impacts of introduction of the spotted wing drosophila (Drosophila suzukii). Further, the project has contributed to the capacity to detect and respond positively to a future incursion of the pest. These outcomes have been achieved by increasing the knowledge and capacity of both industry and government stakeholders.

Consequently, Project MT17005 is likely to have contributed to the future productivity and profitability for some Australian horticultural industries that are susceptible to Drosophila suzukii, should it enter Australia. In addition, the project has identified gaps in knowledge contributing to an increased efficiency of resource allocation for resources invested in addressing further preparedness associated with the pest.

Investment Criteria

Total funding from all sources for the project was $0.70 million (present value terms). The investment produced estimated total expected benefits of $1.59 million (present value terms). This gave a net present value of $0.89 million, an estimated benefit-cost ratio of 2.26 to 1, an internal rate of return of 16.7% and a modified internal rate of return of 7.8%. The valued impact was driven largely by a decreased risk of impact if an incursion occurs.

Conclusions

Several environmental and social impacts identified were not valued as part of the current assessment. Given the impacts not valued, combined with conservative assumptions made for the principal economic impacts that were valued, it is reasonable to conclude that the investment criteria reported may be an underestimate of the actual performance of the MT17005 investment.

Keywords

Impact assessment, cost-benefit analysis, MT17005, biosecurity, Drosophila, Spotted wing drosophila, preparedness, berry fruit, summerfruit, cherry, table grape

Introduction

Horticulture Innovation Australia Limited (Hort Innovation) required a series of impact assessments to be carried out annually on a number of investments in the Hort Innovation research, development and extension (RD&E) portfolio. The assessments were required to meet the following Hort Innovation evaluation reporting requirements:

- Reporting against the Hort Innovation's current Strategic Plan and the Evaluation Framework associated with Hort Innovation's Statutory Funding Agreement with the Commonwealth Government.
- Annual Reporting to Hort Innovation stakeholders.
- Reporting to the Council of Rural Research and Development Corporations (CRRDC).

Under the impact assessment program (Project MT18011) three series of impact assessments were conducted in calendar 2019, 2020 and 2021. Each included 15 randomly selected Hort Innovation RD&E investments (projects). The third series of impact assessments (current series) was selected from an overall population of 56 Hort Innovation investments worth an estimated $38.9 million (nominal Hort Innovation investment) where a final deliverable had been submitted in the 2019/20 financial year.

The 15 investments were selected through a stratified, random sampling process such that investments chosen represented at least 10% of the total Hort Innovation RD&E investment in the overall population (in nominal terms) and was representative of the Hort Innovation investment across six, pre-defined project size classes.

Project *MT17005: Improving the biosecurity preparedness of Australian horticulture for the exotic Spotted Wing Drosophila (Drosophila suzukii)* was randomly selected as one of the 15 investments under MT18011 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 actual and/or potential 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 used 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 Spotted Wing Drosophila (SWD) (*Drosophila suzukii*) is recognised as a relatively new pest of a range of horticultural crops world-wide (e.g. Asia, Europe and USA). Horticultural crops most at risk include soft, thin skinned fruits including a range of berry fruits, cherries, strawberries, summerfruit and table grapes. The fruit damaged by the larvae of the pest is unsuitable for marketing. Losses range from 20-40% of fruit but can be higher.

SWD is not currently present in Australia. However, as the Australian horticultural industry is a large producer of the susceptible crops (see Table 1 below), a significant threat still exists. This is despite the strict biosecurity measures in place in Australia.

Table 1: Statistics for Relevant Australian Horticultural Crops at Risk 2018-2020

Year (ended 30 June)	2017/18		2018/19		2019/20	
	Production (t)	Value of Production ($m)	Production (t)	Value of Production ($m)	Production (t)	Value of Production ($m)
Berries[a]	117,318	929.2	105,090	938.6	113,025	1,040.6
Cherries	15,650	148.7	20,147	189.3	14,720	184.0
Summerfruit[b]	153,148	397.8	161,039	461.0	137,716	413.9
Table grapes	177,416	n.a.	208,277	693.2	214,660	750.4

n.a. not available
(a) Includes strawberries, blueberries and rubus berries (e.g. raspberries, blackberries)
(b) Includes apricots, nectarines, peaches and plums
Source: Australian Horticultural Statistics Handbook, 2019/20

Rationale

Despite strong import biosecurity policies in place, the threat of an incursion by SWD to Australian horticulture remains. Overseas experience has demonstrated that the pest is a successful invader and can cause significant damage rapidly. It was therefore thought prudent to invest in a management and control program should entry occur in order to minimise such impacts as have been evident overseas. Such an investment was needed so that the industry and the Australian government were better prepared in their level of awareness of the pest and their understanding of trapping, surveillance and control, and potential eradication or delimitation options.

Given the potential difficulty of eradication as experienced overseas, the project focused on early detection and identification of delimitation and management control tools. Hence, using data on trade volumes and ecological suitability of different locations, potential incursion pathways and locations were prioritised for surveillance. Also, the strategy was to include modelling of how SWD is likely to behave in Australian conditions and the assembly of information on trapping and control options from overseas experience. Also, gaps in knowledge were to be identified to direct future investment.

To carry out the project, a multi-skilled team was formed including personnel from Plant Health Australia, cesar (an independent private research company), and Plant Food Research New Zealand.

Project Details

Summary

Project Code: MT17005

Title: *Improving the biosecurity preparedness of Australian horticulture for the exotic Spotted Wing Drosophila (Drosophila suzukii)*

Research Organisation: Plant Heath Australia Limited (PHA)

Principal Investigator: Sharyn Taylor, National Manager, PHA

Period of Funding: June 2018 to June 2020

Objectives

The overall objective of the investment was to improve industry awareness of risks posed by SWD (*Drosophila suzukii*) and increase the capacity to detect and respond to any incursions and thus minimise the potential impact of this pest on Australian industries. This included building the knowledge and capacity within industries, government and other stakeholders of:

- the most appropriate surveillance tools and strategies,
- pest management tools for suppression of the pest in Australian environments, and
- options for meeting domestic and international quarantine requirements.

An associated objective was to build capacity for delimitation and containment and also identify potential preparedness gaps requiring further input.

Logical Framework

Table 2 provides a description of MT17005 in a logical framework.

Table 2: Logical Framework for Project MT17005

Activities	**Governance, planning and management** • Establishment of a Steering Committee made up of project partners. • Development of program logic, a monitoring and evaluation plan, and a stakeholder engagement plan. **Identification of potential SWD entry pathways and impacts** • Assessment of potential pathways for SWD entry into Australia. • Understanding of ecological factors (e.g. feeding, survival and reproduction) in order to forecast distribution and population dynamics. • Identification of locations of high risk and where early detection is most likely. **Quantifying impacts to industry** • Estimation of production losses and costs of potential management strategies. • Responses of pest populations to different control measures estimated from past experience reported overseas. **Review of overseas practices, responses to incursions and impacts** • All relevant management practices overseas were identified and reviewed. • Currently, management practices overseas rely on mass trapping and the prophylactic usage of insecticides; however, the chemical treatments are costly, can impact negatively on beneficial communities, can produce

	residues in harvested fruits, and can increase the development of resistance. • Particular attention was given to chemicals and their potential for future use in Australia e.g. efficacy, their current use in Australia, their fit with Integrated Pest Management, potential for gaining permit applications, and data needed for permits required in Australia (residue trials etc.). **Development of a cross commodity contingency plan** • A cross commodity contingency plan was developed based on the information assembled to date (e.g. the plan included information on the biology of SWD, host range, surveillance methods and tools, and control and management options should an incursion occur). **Development and implementation of a communication and awareness program** • A program was developed to raise awareness of the SWD risk, how to identify SWD, and actions to take if the pest is suspected to be present. • The program also collated information from stakeholder workshops in order to inform industries and government of information gaps and other information. • The program was targeted at industry members and their supply chains, as well as government agencies and the wider community. • The communication program included activities in developing a roadshow, factsheets and surveillance guides. • The principal aim of the communication program was to raise awareness of the risk and the biosecurity hygiene activities on farm to both prevent, and to be prepared for, the potential establishment of SWD, and, particularly to encourage early reporting of any suspect incursion. • The program scheduled a number of workshops during the project; the first workshop included technical experts and stakeholders in industry and government and was held early in the project; the workshop addressed risks, knowledge gaps, potential SWD impacts, and challenges in detection and management. • A second workshop was held in the latter period of the project; this workshop was for key stakeholders including industry and government biosecurity and surveillance personnel and provided information and discussion of project outputs. • Other communication activities during the project included project updates being delivered at regional grower meetings and via various industry publications.
Outputs	• Management committee meetings were held that maintained the purposeful objectives of the project investment. • After an initial workshop attended by industry and government personnel, a roadshow around Australia was undertaken to raise awareness and knowledge of growers and supply chain personnel of SWD susceptible industries. • The initial workshop identified gaps in knowledge and management that subsequently assisted in direction for some later project activities. • A review and report on management and impacts of SWD overseas was produced. • A report on modelling of the potential spread and establishment of SWD in Australia to improve forecast of future incursions was produced; this

	was later extended to include surveillance, quarantine and economic cost processes of SWD management.
	• A review and report was produced on potential pest entry pathways and impacts to assist with assessing current preparedness and response capabilities as well as to assist with communication and extension efforts.
	• While eradication and quarantine strategies generally exhibited low cost-effectiveness, increased pest awareness showed large returns to investment due to enhanced early detection and reduced crop losses due to pest management approaches.
	• A review was effected on chemical and other control methods taking into account overseas and Australian use patterns; the review produced a set of recommendations regarding possible applications for emergency permits for specific chemicals for particular horticultural industries.
	• A SWD preparedness plan was developed to assist in forming an initial response to detection and management of any future incursion.
	• A set of recommendations has been included in the preparedness plan including action areas and their priority in:
	  ○ prevention
	  ○ diagnostics,
	  ○ surveillance,
	  ○ preparedness for management and control, and
	  ○ engagement and awareness

Outcomes	• A higher level of knowledge about, and preparedness for, an SWD incursion by potentially affected industries and State and Commonwealth governments. • The work undertaken is unlikely to reduce any residual risk of SWD entering Australia (i.e. residual risk of escapes that may occur despite strict border controls systems) (Sharyn Taylor, pers. comm., 2021). • However, by improving awareness about SWD, providing information on what to look for and how important it is to undertake surveillance, it is expected that there will be an increased chance of people detecting any potential establishments as early as possible (i.e. reducing the risk of spread) (Sharyn Taylor, pers. comm., 2021). • Hence, the project is likely to result in a higher probability of an SWD incursion being detected, delimited and contained, should an incursion occur.
Impacts	• Reduced potential losses of susceptible fruit in Australia due to a lower risk of entry and spread of SWD in Australia. • Reduced potential losses of susceptible fruit in Australia due to an increased probability of containment. • Potentially, some contribution to improved environmental outcomes through increased adoption of best chemical management practices (e.g. integrated pest and disease management, increased protection of beneficials) in the event of an incursion occurring. • Increased efficiency of use of resources in minimising the potential initial area of infestation should an incursion occur. • Reduction of negative regional spillover impacts from future fruit production losses in the event of an incursion occurring. • Increased efficiency of use of government and industry resources in reducing risk of entry and in addressing curtailment/delimitation of spread should an incursion occur.

Project Investment

Nominal Investment

Table 3 shows the annual investment (cash and in-kind) in project MT17005 by Hort Innovation and others. Other investors included PHA, Cesar Australia (cesar), and Plant and Food Research New Zealand (PFRNZ).

Table 3: Annual Investment in the Project MT17005 (nominal $)

Year ended 30 June	Hort Innovation ($)	Plant Health Aust. ($)	Cesar Australia ($)	PFRNZ ($)	Total ($)
2019	239,216	18,850	15,840	30,000	303,906
2020	233,824	18,850	15,840	30,000	298,514
Totals	473,040	37,700	31,680	60,000	602,420

Source: MT17005 Project Research Agreement supplied by Hort Innovation 2021

Program Management Costs

For the Hort Innovation investment the cost of managing and administrating 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, various years). This multiplier was then applied to the nominal investment by Hort Innovation shown in Table 3.

For the investment by other funders, it was assumed that the management and administration costs were already included in the nominal values reported in Table 3.

Real Investment and Extension Costs

For the purposes of the investment analysis, investment costs of all parties were expressed in 2019/20 dollar terms using the Gross Domestic Product deflator index (ABS, 2021). No additional costs associated with project extension were incorporated as the project included a high level of industry participation and a number of communication and awareness activities throughout the duration of the project. These activities informed the relevant horticulture growers and other industry stakeholders (e.g. consultants, researchers and investors) as part of the project, as well as government stakeholders.

Impacts

Table 4 provides a summary of the principal types of impacts delivered by the project. Impacts have been categorised into economic, environmental and social impacts.

Table 4: Triple Bottom Line Categories of Principal Impacts from Project MT175005

Economic	• Reduced potential losses of susceptible fruit in Australia and New Zealand due to an increased probability of containment and reduced area of impact. • Increased efficiency of use of resources in reducing risk of entry and resources in addressing curtailment of spread should an incursion occur.
Environmental	• Potentially, some contribution to improved environmental outcomes through increased adoption of best management practices (e.g. integrated pest and disease management, protection of beneficials).
Social	• Increased capacity and skills by industry and others in recognising and managing an incursion of SWD. • Potentially, improved regional community well-being from spillover benefits from the reduced negative impacts on the production of susceptible horticultural industries.

Public versus Private Impacts

Impacts identified in this evaluation are both private and public in nature. Private benefits are likely to be realised by Australian growers of susceptible fruits where the risks of a SWD incursion spreading will have been reduced by the project and the potential area and speed of spread reduced, given a future incursion does occur. Public benefits may include an increased efficiency of public resources targeted at prevention of entry and curtailment of spread due to the increased awareness and knowledge held by government departments and agencies. Also, there may be some positive environmental impacts derived from the increased knowledge of potential chemical control options and impacts.

Distribution of Private Impacts

The impacts on the Australian horticultural industries that may benefit from the project will be shared with businesses involved in the various fruit supply chains including input suppliers, growers, fruit pickers, processors, transporters, exporters, wholesalers, retailers, and consumers. The share of impact realised by each link in the supply chain will depend on both short- and long-term supply and demand elasticities in the various fruit supply chains.

Impacts on Other Australian Industries

Outputs from the project are specific to the SWD-susceptible Australian fruit industries. However, depending on the likelihood and spread of an incursion, other horticultural industries may benefit from the inability of some areas to continue to grow SWD-susceptible fruit with them growing non-susceptible fruits as alternatives.

Impacts Overseas

No significant or direct overseas impacts were identified. However,

- The knowledge created by the project and shared with New Zealand interests, will undoubtedly assist susceptible fruit industries in that country.
- The SWD susceptible Australian horticultural industries will benefit through any lowered impact on the ability to export (e.g. table grapes).
- Some overseas SWD-susceptible horticultural industries may be able to benefit from the project findings and strategies developed.

Match with National Priorities

The Australian Government's Science and Research Priorities and Rural RD&E priorities are reproduced in Table 5. The project findings and related impacts will contribute to Rural RD&E Priority 2, with some potential contribution to Priority 4, and to Science and Research Priority 1.

Table 5: 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 6. Resources 7. Advanced Manufacturing 8. Environmental Change 9. Health

Sources: DAWR (2015); Australian Government, Office of the Chief Scientist (2015)

Alignment with the Strategic Investment Plans for the SWD-Susceptible Industries 2017-2021

The strategic outcomes and strategies of the Australian Strawberry, cherry, summerfruit, and table grape described in the Hort Innovation Industry Strategic Investment Plans (SIPs)[1] all include some reference to productivity increases, as well as highlighting biosecurity and/or pest and diseases challenges.

The SWD project addresses Outcome 3 in the current Table Grape Industry SIP through Strategy 3.2: Safeguard the Australian table grape industry from future biosecurity risks .

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

Valuation of Impacts

Impact 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.

Only one impact was valued. The impact valued was, given an incursion of SWD occurring sometime in the future, the area impacted could be delimited more successfully.

Impacts Not Valued

Not all of the impacts identified in Table 4 could be valued in the assessment. Specifically, within the scope of the current Hort Innovation impact assessment program, environmental and social impacts were hard to value due to lack of evidence/data on which to base credible assumptions, difficulty in quantifying the causal relationship and pathway between MT17003 and the impact and the complexity of assigning magnitudes and monetary values to the impact.

The environmental impact identified but not valued was:

- Potentially, some contribution to improved environmental outcomes through increased adoption of best management practices and lowered expected negative impacts on beneficials (e.g. integrated pest and disease management, appropriate chemical use), should a SWD incursion occur.

The social impacts identified but not valued were:

- Increased capacity and skills by industry and others in recognising and managing an incursion of SWD.
- Potentially, improved regional community well-being from spillover benefits from the reduced negative impacts on the production of susceptible horticultural industries.

The increased capacity and skills of growers and supply chains were captured, at least in part, by the impact valued. The community spillover benefits from reduced losses to growers should an incursion occur, were not valued largely due to a lack of data and its complexity to support credible assumptions (e.g. the number of industries involved and their multiple geographic locations).

Valuation of Impact: Reduction in the value of financial losses by SWD-susceptible horticultural industries

The impact valued was a reduction in the value of financial losses by growers due to the project investment. Specific assumptions for valuation are described in Table 7.

Attribution

The implementation of the findings of project MT17005 associated with the risk and area of spread is not likely to be without some additional costs. Such costs, for example, could include any additional surveillance inputs, additional management costs such as trapping and chemical use, and assessing the validity of potential detections. Hence, an attribution factor of 90% was applied to the benefits estimated to accommodate such cost items that potentially will be incurred in capturing the benefits from the reduction in fruit losses.

Counterfactual

It was assumed that, in the absence of the investment in MT17005, the benefits identified would not have occurred.

Summary of Assumptions

A summary of the key assumptions made for valuation of the impact is shown in Table 6.

Table 6: Summary of Assumptions

Variable	Assumption	Source/Comment
Year of assumed entry and outbreak	2025	Analyst assumption
Total expected value of loss	$37.6m per annum	Project documentation
Period over which major losses incurred	Six years	
Probability of entry without project	10%	Analyst assumption
Probability of entry with project	10%	
Expected production value losses saved with project	20%	Analyst assumption
Attribution		
Attribution of benefits to Project MT17005	90%	Allows for other cost items that potentially will be incurred in capturing the impacts valued
Risk factors		
Probability of outputs	100%	Project outputs already delivered
Probability of outcome	75%	Analyst assumptions
Probability of impact given a successful outcome	75%	

Results

All costs and benefits were discounted to 2019/20 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 (2019/20) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

Table 7 shows the investment criteria estimated for different periods of benefit for the total investment. Table 8 shows the investment criteria estimated for different periods for the Hort Innovation only. The present value of benefits (PVB) for Hort Innovation was estimated by multiplying the total PVB by the proportion of Hort Innovation investment in project MT17005 (81%).

Table 7: Investment Criteria for Total Investment in Project MT17005

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits ($m)	0.00	0.30	1.59	1.59	1.59	1.59	1.59
Present Value of Costs ($m)	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Net Present Value ($m)	-0.70	-0.41	0.89	0.89	0.89	0.89	0.89
Benefit-Cost Ratio	0.00	0.42	2.26	2.26	2.26	2.26	2.26
Internal Rate of Return (%)	negative	negative	16.7	16.7	16.7	16.7	16.7
MIRR (%)	n.s.	n.s.	13.5	10.7	9.3	8.4	7.8

n.s. no solution

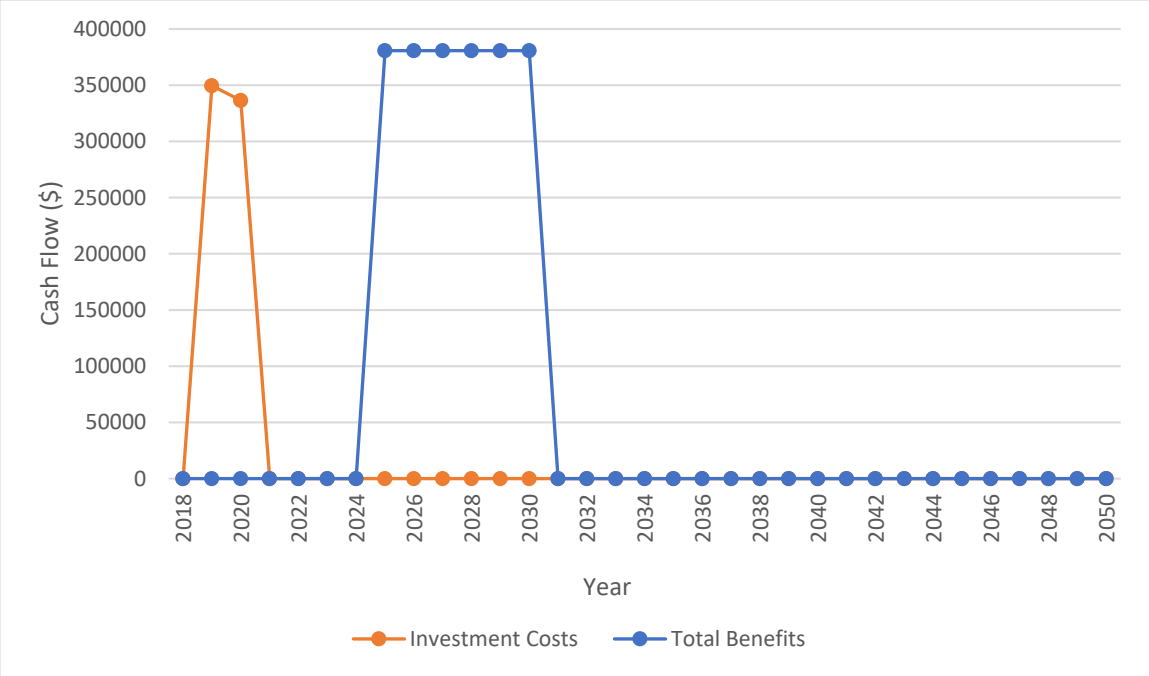
Table 8: Investment Criteria for Hort Innovation Investment in Project MT17005

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits ($m)	0.00	0.24	1.29	1.29	1.29	1.29	1.29
Present Value of Costs ($m)	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Net Present Value ($m)	-0.57	-0.33	0.72	0.72	0.72	0.72	0.72
Benefit-Cost Ratio	0.00	0.42	2.26	2.26	2.26	2.26	2.26
Internal Rate of Return (%)	negative	negative	16.7	16.7	16.7	16.7	16.7
MIRR (%)	n.s.	n.s.	13.9	10.9	9.4	8.5	7.9

n.s. no solution

The annual undiscounted benefit and cost cash flows for the total investment for the duration of MT17005 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 9 presents the results. The results show only a moderate sensitivity to the discount rate. This is largely due to the limited period of benefits assumed.

Table 9: Sensitivity to Discount Rate

Investment Criteria	**Discount rate**		
	0%	**5% (base)**	**10%**
Present Value of Benefits ($m)	2.28	1.59	1.13
Present Value of Costs ($m)	0.69	0.70	0.72
Net Present Value ($m)	1.60	0.89	0.41
Benefit-cost ratio	3.33	2.26	1.57

A sensitivity analysis was then undertaken for the assumed proportion of losses saved due to the project, assuming it enters Australia. The results are presented in Table 10 and show a moderate sensitivity to the proportion of losses saved. The breakeven reduction in losses saved due to the project is 10.9%.

Table 10: Sensitivity to Assumed Change in Losses Saved Due to the Project

Investment Criteria	**Assumed Crop Losses Saved due to the Project**		
	10%	**20% (base)**	**30%**
Present Value of Benefits ($m)	0.79	1.59	2.38
Present Value of Costs ($m)	0.70	0.70	0.70
Net Present Value ($m)	0.09	0.89	1.68
Benefit-cost ratio	1.13	2.26	3.39

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 11). 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 11: Confidence in Analysis of Project

Coverage of Benefits	Confidence in Assumptions
High-Medium	Medium

Coverage of benefits was assessed as High–Medium as the impact valued represented the key benefit from the project investment. However, confidence in assumptions was rated as Medium. Some of the assumptions were made with a high degree of uncertainty associated with the incursion year of entry and the extent of the reduction of impact due to the project.

Conclusion

The investment in MT17005 has contributed to a higher level of knowledge about, and preparedness for, an SWD incursion into Australia in the future. As a result, MT17005 is likely to have contributed to a reduction in any future potential impact on a range of Australian industries that are susceptible to significant damage from SWD.

Total funding from all sources for the project was $0.70 million (present value terms). The investment produced estimated total expected benefits of $1.59 million (present value terms). This gave a net present value of $0.89 million, an estimated benefit-cost ratio of 2.26 to 1, an internal rate of return of 16.7% and a modified internal rate of return of 7.8%. The valued impact was driven largely by a decreased risk of impact if an incursion occurs.

Several environmental and social impacts were also identified but not valued as part of the current assessment. Given the impacts not valued, combined with conservative assumptions made for the principal economic impacts valued, it is reasonable to conclude that the investment criteria reported may be an underestimate of the actual performance of the MT17005 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.

References

Australian Bureau of Statistics. (2021, February 15). 5206.0 - Australian National Accounts: National Income, Expenditure and Product, Dec 2019. Retrieved June 2020, from Australian Bureau of Statistics: https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5206.0Dec%202019?OpenDocument

Australian Government (2015). Science and Research Priorities. Canberra: Commonwealth of Australia.

Australian Horticultural Statistics Handbook (2019/20), Hort Innovation. Latest issue retrieved from https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/

Department of Agriculture and Water Resources (DAWR). (2015). Agricultural Competitiveness White Paper. Canberra: Commonwealth of Australia. Retrieved from http://agwhitepaper.agriculture.gov.au/SiteCollectionDocuments/ag-competitiveness-white-paper.pdf

Hort Innovation (2017) Table Grape Strategic Investment Plan 2017-2021. Retrieved from: https://www.horticulture.com.au/hort-innovation/funding-consultation-and-investing/investment-documents/strategic-investment-plans/

Office of the Chief Scientist (OCS) (2016) Strategic Science and Research Priorities, Canberra: Commonwealth of Australia. Retrieved from http://www.chiefscientist.gov.au/wp-content/uploads/STRATEGIC-SCIENCE-AND-RESEARCH-PRIORITIES_181214web.pdf

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Abbreviations

ABS	Australian Bureau of Statistics
CRRDC	Council of Rural Research and Development Corporations
DAWR	Department of Agriculture and Water Resources
Hort Innovation	Horticulture Innovation Australia Ltd
MIRR	Modified Internal Rate of Return
PFRNZ	Plant and Food Research New Zealand
PHA	Plant Health Australia
PVB	Present Value of Benefits
R&D	Research and Development
RD&E	Research, Development and Extension